

CASHEW HANDBOOK 2014

GLOBAL PERSPECTIVE

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Zusammenarbeit (GIZ) GmbH



Promoting the Competitiveness of small scale Cashew Farmers in Africa

African Cashew initiative (ACi)

Producing and processing cashews is a promising business in Africa. Through a combination of interventions, ACi together with private and public partners focusses on organizing and building a sustainable African cashew sector to reduce poverty in the five project countries Benin, Burkina Faso, Côte d'Ivoire, Ghana and Mozambique.

The African Cashew initiative aims to:

- 1) Sustainably increase raw cashew nut production and quality
- 2) Increase quantity and quality of African cashew kernel and cashew by-product processing
- 3) Create stable business relationships between farmer groups, processors, buyers and retailers
- 4) Organize key stakeholders of the sector at national and regional levels around shared goals and advocate policies that favor cashew production and processing.



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The 3F group is a 55 year old conglomerate of multifarious businesses which include manufacturing and trading of Edible oils, Bakery fats, Confectionary fats, Oil palm plantations, Garments and International Commodity Trading.

3F has its presence in West Africa through commodity trading operations in countries like Ghana, Burkina Faso, Mali, Ivory Coast, Benin, Nigeria, Senegal, Guinea Bissau and Gambia and in the South Asian countries like Vietnam, Indonesia, Singapore and India.

3F's key commodities are Raw Cashewnuts, Cashew Kernels of various grades, Sheanuts, Sesame Seeds, Soyabean, De-oiled meals, Groundnuts and similar agri commodities. 3F also distributes rice from India under various brand names to countries like Benin, Nigeria and Niger.

The year 2012 marked a successful decade of operations at Africa. The past ten years have been productive in building a brand, creating goodwill and establishing quality practices both in business and within the community. At Africa, 3F as a brand is associated with quality agri products and ethical business practices.

3F's competitive advantage in Africa would be undoubtedly the topographical knowledge of the land, logistical advantages due to the volumes and a loyal, prolific and committed employee base.

In closing, it would be fitting to quote what is our clarion call – *"In Africa today, we recognize that trade and investment, and not aid, are pillars of development"*

To know more about us please visit www.3fg.co or www.3fg.in

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Mali Exim (ME) Sarl is a trading company located in Mali and our main business is concentrated on export of raw cashew and sesame from the country which represent 70% of annual turnover. We are the member of Association Malienne des Exportateurs de Cajou (AMEC) and we plan in next five years as the first exporters of raw nuts from Mali to India, Vietnam markets through our connection tied to Singapore.

In near future, Mali Exim (ME) Sarl in through AMEC will initiate some training programmes with local producers and will tie relation with Indian and Vietnamese organizations to know about the new techniques of growing the big size of raw cashew nuts that can increase the quantity and the quality of kernels.

Mali Exim (ME) Sarl plans to invest or make joint venture locally with one processing company to export the raw kernels on the international market according to the contracts we will negotiate. In summary, our main activity will be focused on export of raw nuts.

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The African Cashew initiative (ACi) recognizes the potential of achieving higher yields, better quality cashew nuts, a flourishing in-country processing industry and the need to build adequate business skills and to increase incomes of along the cashew value chain. ACi, through a combination of interventions, aims at supporting at least 330,000 cashew farmers in the five project countries, namely Benin, Burkina Faso, Côte d'Ivoire, Ghana and Mozambique to increase their family income by US\$ 600 annually from cashew production alone. By 2015, this will be equal to an annual income of US\$ 30 million, benefitting 2.2 Million members of rural households.

The African Cashew initiative is a broad-based multi-stakeholder partnership in Development Cooperation. The initiative is mainly financed by the German Ministry for Economic Development and Cooperation (BMZ) and the Bill & Melinda Gates Foundation. The Deutsche Gesellschaft fuer Internationale Zusammenarbeit GmbH (GIZ) is the lead implementer in collaboration with Fairmatch Support and Technoserve, as well as private companies and national institutions to build and structure a sustainable African cashew sector.

ACi is currently supporting CCA, the Cotton and Cashew Council of Côte d'Ivoire in the organization of SIETTA 2014, The International Cashew Processing Equipment & Technology Show, from 26th to 28th November at Palais des Sports Treichville in Abidjan, Côte d'Ivoire. SIETTA 2014 offers an opportunity for manufacturers of food and agro processing equipment to access the high potential of the cashew sector in Côte d'Ivoire and Africa as a whole. By demonstrating equipment, or exhibiting at a multi-media brochure stand, manufacturers can do business with and learn about the African cashew sector. The Government of Côte d'Ivoire is dedicated to facilitate the processing of 400,000 tons of cashew per annum by 2020. To meet this goal, the Government of Côte d'Ivoire has launched an Agri Investment Program, and is allocating USD \$4.5 billion to be invested between 2012 and 2016.



OLTREMARE is an Italian company specialized in the design and manufacture of turnkey plants and machinery for the cashew nut processing industry. In 1960 OLTREMARE established the first mechanical cashew nut processing plant ever, in Italy. Since then, as of today, OLTREMARE has realized almost 150 industrial projects in the cashew nut industry, selling thousands of machines for the various processing operations in INDIA, VIETNAM, INDONESIA, BRAZIL, TANZANIA, MOZAMBIQUE, KENYA, IVORY COAST and NIGERIA.

Some of the original processing solutions introduced and then developed by OLTREMARE: the RCN Calibration concept prior to shelling, the Continuous Oil Bath Roasting and Centrifuge, the Continuous Steam Roasting, the Semi Automatic first and then the Automatic Shelling, the Pneumatic Shell/Kernel Separation, the Continuous Drying and Re-Humidification, the Low Energy Impact Static Dryer with continuous air re-circulation for small and medium capacities (NEW!) the Mechanical Peeling with the combined action of mechanical and compressed air systems, the Split/Pieces Automatic Separation, the Automatic Grading of the Kernels, the Flexi Pouches Vacuum Packing (dating back in 1986).

Today OLTREMARE has brought cashew processing into the next generation of solutions that, through a 360° integrated approach, allows to combine previously separated processing operations, further increasing efficiency, reducing space requirement, increasing productivity of labor, reducing power consumption, reducing the environmental impact, increasing finished product sanitation levels. Such an approach includes the value addition for all the by-products of the RCN such as the CNSL up to Cardanol and its derivatives, as the shell's cake up to the production of electric and thermal power.

OLTREMARE Services to customers include the design and engineering of all the plant needs such as space requirement (for factory and warehouse), machinery and equipment requirement, the utilities requirement, the ancillary equipment requirement, the labor requirements, the power consumption, following with the assembling and commissioning of the machinery supplied, the technical training of the customer personnel, the maintenance and after sales service (even from remote). OLTREMARE is stably present in INDIA, VIETNAM, BRAZIL, WEST AFRICA, EAST AFRICA.

Associate Sponsors



St John Freight Systems Ltd have been present in WEST AFRICA for the last five years and have been closely associated with various Commodity business with particular emphasis on handling of Raw Cashew business.

Our presence at the moment is in the markets of Nigeria, Ivory Coast, Ghana, Benin, Guinea Bissau but, have long term plans to enlarge our coverage in this region. We have well trained man power who are experienced enough to meet the demands of these markets in terms of handling the Statutory requirements, Infrastructure needs, setting up new operations / activity, warehousing and distribution etc.,

Our current activities cover International Freight Forwarding, Consolidation services, Warehousing and Distribution, Haulage services, Commodity specialization etc., We have strong relationship / working agreements with Shipping Companies and Vendors in the market and in view of the biz volumes that we handle, we are able to procure Competitive pricing backed by dependable service levels.

The Group has over 50 Offices across 4 Continents and this gives us enormous flexibility in handling our Customers documentation/payment requirements with flexibility across our network. Our goal is to establish St John as a one stop service provider in the West Africa market and offer our Customers a reliable product for all their needs in the near future. Our long term interests are to extend our Service Network to other parts of Africa and play a vital role in the development of this Continent.



Buddhi Industries (Pvt) Ltd started as a private limited liability company on 2007 and is the pioneer manufacturer of cashew based machines production in Sri Lanka. It is also ISO 9001:2008 standard certified company. The company produces high quality natural iron based machines with its modern state of the art technology; the capital has increased over hundred folds since its inception. Machines are manufactured under the trade mark of "BI" which was registered in Sri Lanka & India.

The founder & the present managing director was awarded as the best inventor of the year in the presidential award ceremony in 1999 & the gold medal in 29th international exhibitions, New techniques and products of Geneva in Switzerland in 2001 for inventing this product. The product is covered & renewed by the patents locally as per its new technological improvements & was its PCT (in world intellectual property organization) Filing in 2009 & the PCT publishing in 2010. The company is now in the process of covering its product by the patents in other countries. The company maintains stringent quality control measures to ensure that the products are in high standards, which have made machines, the number 1 choice all over the world.



Gayathri Industries find its existence with a passion to excel coupled with in-house R&D, up-graded process technology to suit varying needs of the Cashew processors by introducing Automation in Cashew processing and has set a benchmark in this industry.

The excellent performance of our machines has made cashew processing industry around the globe to look upto us for Technology upgradation. Our product-design department consists of highly talented and experienced mechanical engineers who design rigid and technically advanced machineries that assure ease of maintenance and lower operating cost. Our expertise in machinery design & manufacturing are well-known among our customers that make us a leader in this industry. Besides producing Cashew Processing Machinery, we offer Cashew Kernel Dry Roasting & Salt /Spice Coating Machinery, Bulk & Retail Pouch Packing Machinery.

For large scale Cashew processors, we offer Bucket Elevator, Feeder and Conveyor Material Handling System to integrate the entire Cashew Processing line thereby reducing considerably reliance on labour requirement.

Associate Sponsors



Vink corporation DMCC, a fast growing commodity trading company in Dubai, UAE, is a part of tropical general investment group (TGI) operating mainly out of west africa and owned by european investors. TGI is a multinational group involved in manufacturing and trading of food products, agricultural products, pharmaceuticals, oil field services, fisheries, poultries and so on. Vink Corporation DMCC is the trading arm of the group in agricultural commodities trading in raw cashew nuts, cocoa beans, rice, sesame seeds, and other agri produces. It has offices in Nigeria, Benin, Ghana, Togo,

Ivory Coast, Guinea Bissau and Liberia from where it procures the agricultural produce and exports it to different parts of the world and imports rice, fertilizers and chemicals into the african nations, creating value for its customers and suppliers and the african region as a whole. All this is handled in a cost effective manner maintaining high degree of quality control to the satisfaction of our valued customers. Our mission is to grow our market share in a sustainable, responsible and profitable manner to fulfill our customer's needs with an innovative and value driven approach.

Vink Corporation DMCC, through its sister units in West Africa, has been trading in raw cashew nuts for the past 15 years and is now venturing into raw cashew nut processing in Aafrica, building on its experience and creating job opportunities for thousands across West Africa. The first of such partially mechanised, state of art processing unit is coming up in Benin followed by other african countries. We plan to empower the women in Africa as cashew processing units employs women labour in large number, thereby bringing additional revenue to families and improving their living standards.



By owning and managing the supply chain from start to finish, ETG is able to move agricultural commodities between regions, strategically matching one area's market origination capabilities with market consumption patterns in another. Combined with the capacity to store commodities close to their point of origin for extended periods of time along with control over transport and logistics, the Group maximizes synergies and efficiencies at every stage of the value chain continuum.

In FY 2012, almost 1.4 million metric tons of 25 different commodities – including maize, pulses, wheat, rice, sugar, oilseeds, edible nuts, coffee, tea, fertiliser and farm implements – moved along the ETG supply chain between 30 countries.

ETG increases local employment and adds value to local economies by investing in mid- and downstream agriculture processing, cleaning and packaging businesses. ETG currently has 26 such plants operating in Africa and Asia, transforming maize, rice, cashew nuts, wheat, pulses, soybeans, sesame seeds, coffee and fertiliser into marketable products for regional and international distribution.

Executive Summary

Key Trends Shaping Global Cashew Industry

1. This decade belongs to Africa

Africa produces 42% of the estimated 2.6 million tonnes of raw cashews every year. Of this, it exports 90% to the rest of the world, retaining the rest for domestic produce. In the recent past, while most of the efforts were aimed at improving farm level productivity through seed programmes, replantation and rejuvenation, training and capacity building on farm management practises etc., a lot has also been done on reforming markets and revitalising institutional infrastructure too. Tanzania, through the Cashew Board of Tanzania, has put in place a robust warehouse receipt based auction system to ensure quality nuts get fair price and small-holder farmers are not discriminated against. This has been working very well. Further, the Cashew Board of Tanzania is going ahead with establishment of three processing plants under public-private partnership model with the involvement of producer cooperative and government. Like-wise, Cote d'Ivoire, through its regulatory body, the Cotton and Cashew Council (CCC), sealed raw cashew movement through the land route and restricted raw cashew exports only through Abidjan and San Pedro ports to bring in accountability. Besides, it fixed a minimum price for raw cashew for 2014 season and ensured farmers do not sell below it. Cote d'Ivoire with its significant production volume thus brought in necessary discipline in the raw cashew trade and exports. Simultaneously, CCC have started engaging with Vietnam at government to government level to get access to Vietnam cashew processing technology into Cote d'Ivoire in exchange for assured supply of raw cashews to Vietnam. Cote d'Ivoire is largely replicating its successful model of cocoa in cashew. These are just two examples. The gist is every major raw cashew producer is evolving its own model to add value to raw cashew and in the process generate employment and wealth for the nation. Organisations such as ACA and ACi along with its partners are enabling and hastening this transition. Africa, undoubtedly is the most happening place for cashew and rightfully, this decade belongs to African cashew industry.

2. Vietnam consolidates its leadership

Vietnam became the largest cashew kernel exporter in 2006 and has been successfully holding on to its position for eight consecutive years. It is indeed remarkable! With over 250,000+tonnes of annual kernel exports, Vietnam is way ahead of India, the second largest kernel exporter. To begin with, Vietnam consciously invested in improving productivity of its farms way back in the 90s. High-density planting, commercial farming and seed programmes ensured the yield levels are one of the highest in the world. Secondly, it invested heavily in mechanising the entire cashew processing to save on labour, bring in consistency and cost competitiveness. Vietnam has been investing significantly in developing its relationship with the end-consumers too. Vinacas trade delegation to Australia in 2013 is a case in point. In the last 8 years, Vietnam has increased its presence to over 85 countries. It is the largest supplier of kernel to the USA, China, Australia, Canada and New Zealand today. To ensure raw material security, Vietnam has tied up with Cote d'Ivoire. Thus, Vietnam has grown from strength to strength over the years and has consolidated their position in the last 8 years. It is expected that Vietnam would dominate the global cashew sector for the foreseeable future.

3. India shows the potential of 'brokens & pieces'

Growth momentum in global cashew industry is unsustainable, if market distortions are not corrected. One the major distortions of the cashew market has been pricing of kernel. It is ironical that the

broken cashew, which has identical nutritional value as that of whole kernel, is sold at deep discount to whole kernel. Indian cashew industry never accepted this as given and has been continuously engaged with the user industry for the past two decades. The result- broken and splits have organised markets in India now and the demand for these are as good as the demand for wholes. In fact, Indian market offers one of the highest prices for brokens and splits anywhere in the world. It would not have been possible without the efforts of the Indian cashew processors to educate the consumers. A similar marketing campaign around the world would ensure that new opportunities are created for brokens and splits, benefiting all cashew producers. It is much needed as the global cashew industry aspires to grow above 4% pa maintaining price stability. We believe India would succeed in bringing better value for splits and brokens produced anywhere in the world soon.

4. What was known gets established clinically –‘Cashews are good for health’

As obesity, diabetes and other life-style oriented diseases threaten the world, ‘health’ aspects start dominating food. Given that, it is indeed very relieving to note that at last there is documented evidence to show that Cashew consumption is good for health. Although it was known intuitively in traditional markets, such clinically backed research findings, help bring in new customers and also dispelling misconception among traditional consumers. So, it is indeed a very good development for cashew and hopefully, it would help sustain demand for cashew kernels.

5. Food safety requirements increase across the world- Is it an opportunity?

Food Safety Management Act (FSMA) of US FDA becomes mandatory for all exporters of food to US. The new Act gives sweeping powers to US FDA including inspection of the suppliers facility located outside the US. Similar new food safety laws have come in place EU, Canada, India and other countries. Is it a show stopper? No. We believe that food safety considerations are genuine and countries are well within their powers to implement them as a safeguard. However, it would only assist those processors who are prepared and proactive. Emerging processors in Africa must take cognizance of it.

6. Market grows when prices are stable

One of the reasons for growth in consumption of cashew kernel in recent times has been stability of kernel prices. There are many challenges to achieving stable prices in cashew- small and dispersed production, production susceptibility to weather, transportation intensiveness, varying labour costs, government policies and preferences and balancing equity amongst the supply chain partners. While many of the constraints may not go soon, the industry is progressing in the right direction. Market reforms such as the ones mentioned above in point (1), efficiency gains in processing and innovation should help industry move towards stable price regime with equitable distribution of value across supply chain partners.

7. Sustainability is the weak link for cashew

Sustainability is a weak link in cashew. Two important aspects of sustainability are equitable distribution of wealth across the supply chain and reduction in carbon footprint. In the current supply chain, we believe disproportionate value accrues to retailer, followed by middlemen involved in transacting raw cashew in unregulated market and then to intermediaries in regulated markets and then to processors and lastly to small-farmers. There is a need to rebalance the value accrual, more in favour of producers and processors. Secondly, carbon footprint consideration will bring changes in the industry in the medium term (5 to 8 years), with processors located more closer to raw cashew producers and energy intensity is reduced through creative use of by-product and waste.

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Global Perspective

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About www.cashewinformation.com

www.cashewinformation.com is a unique effort to bring together all stakeholders of the cashew industry- producers of raw cashew, processors, kernel buyers, value-adders, by-product users, technology suppliers, logistics companies, quality systems firms, supplier of capital, government agencies, NGOs, intermediaries and the retail consumers.

The key to the effort is the role of information and knowledge, which we intend to build through your cooperation and our in-house research. After years of extensive research, we are glad to bring out

“Cashew Handbook 2014- Global Perspective”, which will provide you with rich and exhaustive information about the global cashew industry.

Newsletter- Cashew Week

Our weekly newsletter ‘Cashew Week’ is well circulated among the corporate and trading circles and in has been in circulation since 2003. The weekly newsletter contains a good combination of trade related information, RCN/Kernel market information from across the globe and articles/experts view.

Recently, we have added a French edition of the weekly newsletter.

Email your request for a complimentary copy at cashew@eventellglobal.com

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List of Acronyms/ Symbols

<	Lower than
>	Greater than
20's	2001-2013
≥	Greater than or equal to
60's	1961-1970
70's	1971-1980
80's	1981-1990
90's	1991-2000
ACA	African Cashew Alliance
ACi	African Cashew initiative
AFI	Association of Food Industries of New York
B	Butts
BB	Baby Bits
CAGR	Compound Annual Growth Rate
CEPC	Cashew Export Promotion Council of India
CNSL	Cashew Nut Shell Liquid
CO ₂	Carbon di Oxide
CP	Certificate of pledge
CT	Certificate of title
DCCD	Directorate of Cashew and Cocoa Development
DGCI&S	Directorate General of Commercial Intelligence and Statistics
DP	Dessert Pieces
DPPQ&S	Directorate of Plant Protection, Quarantine and Storage
DW	Dessert Wholes
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FOB	Freight on board, or free on board
Fig	Figure
ha	Hectare
HACCP	Hazard Analysis Critical Control Point
IBGE	Brazilian Statistical and Geographic Foundation
ICAR	Indian Council of Agricultural Research
INR	Indian Rupee

ISO	International Organization for Standardization
kg	Kilo gram
Kg/ha	Kilogram per hectare
lb	Pound
LWP	Large White Pieces
MARD	Ministry of Agricultural and Rural Development Vietnam
NHM	National Horticulture Mission
NLG	Next Lower Grade
NLSG	Next Lower Size Grade
NSPM	National Standards for Phytosanitary Measures
O ₂	Oxygen
Qty	Quantity
RCN	Raw Cashew Nut
S	Splits
SB	Scorched Butts
SHM	State Horticulture Mission
SP	Scorched Pieces
SPS	Scorched Pieces Seconds
SS	Scorched Splits
SSP	Scorched Small Pieces
SSW	Scorched Whole Seconds
SW	Scorched Wholes
SWP	Small White Pieces
UAE	United Republic of Emirates
UNECE	United Nations Economic Commission for Europe
USA	United States of America
USD	US Dollar
USDA	United States Department of Agriculture
Val	Value
VINACAS	Vietnam Cashew Association
Vol	Volume
vs.	Verses
W	Wholes

SECTION 1
Global Perspective

Chapter 1: Trends in World Raw Cashew Nut (RCN) Area and Production

Cashew (*Anacardium occidentale*), a native of Brazil, was introduced in other parts of the world starting from the 16th century mainly with the intention of afforestation and soil conservation. From its humble beginning as a crop intended to check soil erosion, cashew has come out as a major foreign exchange earner in most of the countries.

Cashew is primarily grown in the continents of Asia, Africa and South America. Asiatic zones mainly include India, Vietnam and Indonesia as the major cashew producing countries followed by Philippines, Malaysia, Thailand and Sri-Lanka. African countries producing cashew are Côte d'Ivoire, Nigeria, Tanzania,

Mozambique, Kenya, Benin, Guinea-Bissau, Mozambique, Ghana, Senegal and Madagascar. Latin American countries producing cashew consist of Brazil, Columbia, Costa Rica, Honduras and Salvador.

Though cashew is originally from Brazil, it gained greater popularity in India, Vietnam and other African countries than Brazil itself. In 60's India had a major contribution to the world production along with Mozambique and Tanzania. From 1961 to 2013, area under world cashew nut production has increased at a rate of 4.25 per cent (CAGR).

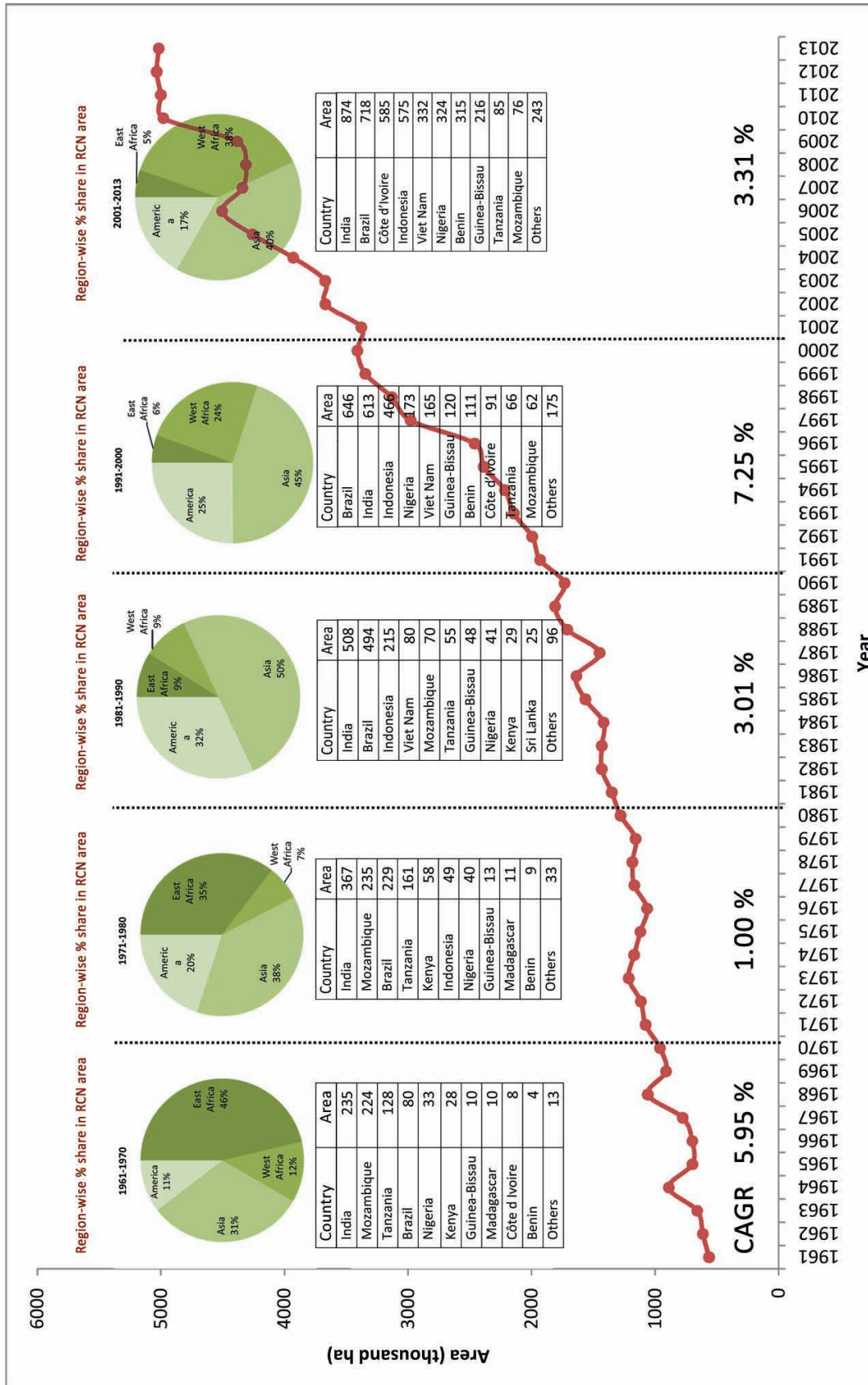
East African countries like Tanzania, Mozambique, and Kenya introduced

cashew. But in 70's Mozambique left the race due to political issues and civil war in the country. In other Asian countries like Indonesia, Malaysia, Cambodia, etc cashew cultivation became popular.

Till 80's, raw cashew nut production witnessed slow and steady growth. From 90's, global RCN production has seen a tremendous growth. The huge production increase has been mainly contributed by Vietnam, the newly emerged RCN producer during the period. Since 1990, Vietnam cashew industry has seen massive growth with respect to domestic cashew nut production and processing.

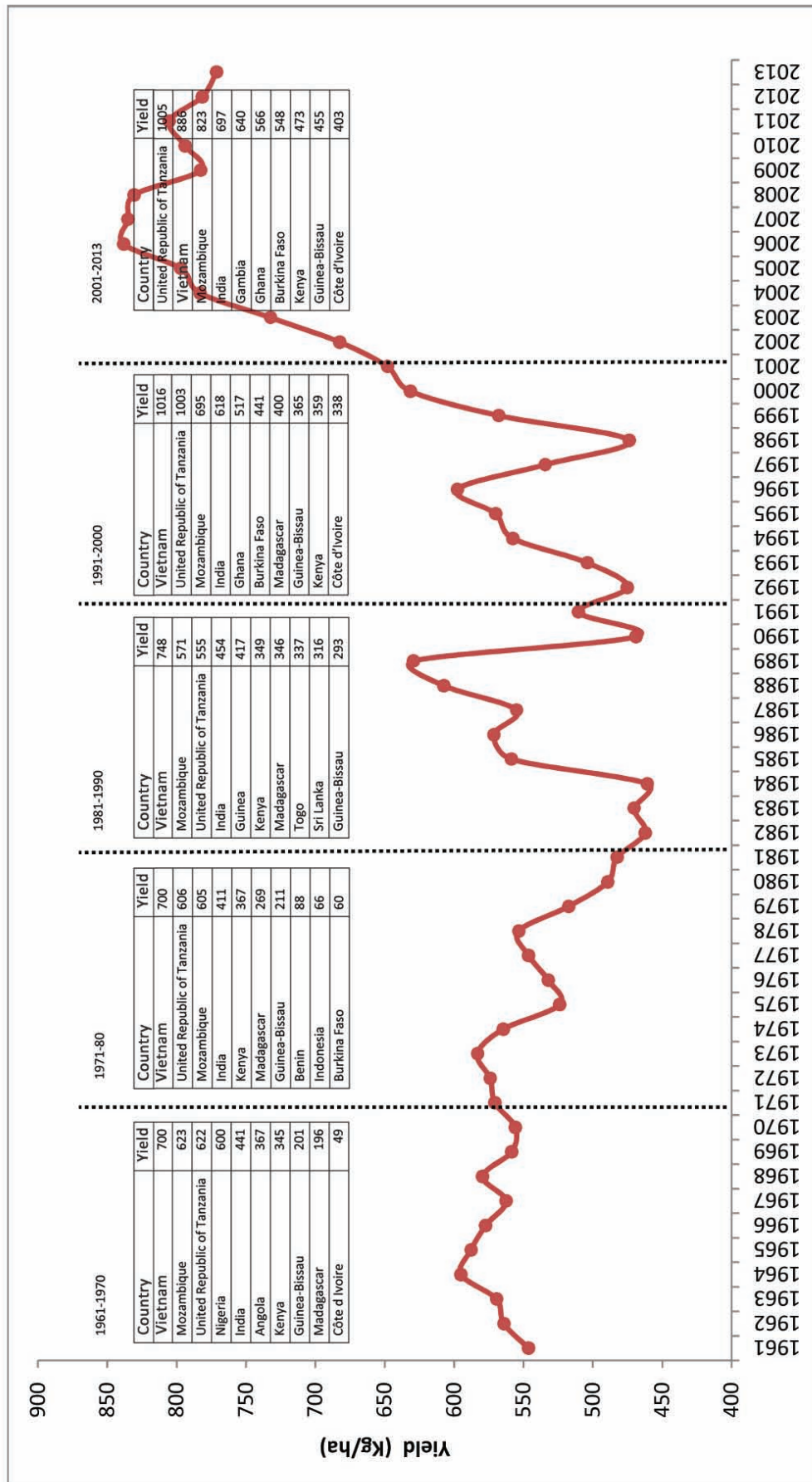


Fig 1.1 Trend in RCN area: global area, region-wise share and list of top countries with highest average area (in thousand ha)



Source: FAO Stat, International Nut Council (INC), Directorate of Cashew Nut and Cocoa Development Cochin (DCCD), Ministry of Agriculture and Rural Development Vietnam (MARD), Brazilian Statistical and Geographic Foundation (IBGE), Ministry of Agriculture Republic of Indonesia and various News Sources

Fig 1.3 Trend in RCN Yield: Global yield and top 10 countries (Kg/ha)



(* "We have not segregated yielding areas from total area. This is due to non-availability of such data for all countries").

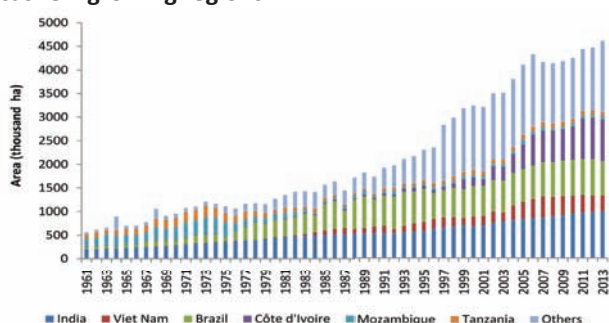
Major Happenings in Cashew Industry

Year	Events
1906	Establishment of Association of Food Industries (AFI), New Jersey
1955	Establishment of Cashew Export Promotion Council of India, India
1955	Establishment of Karnataka Cashew Manufacturers Association, India
1977	Establishment of Nigerian Export Promotion Council (NEPC), Nigeria
1978	Mozambique Government banned RCN export
1978	Formation of Karnataka Cashew Development Corporation Ltd, India
1982-1992	Mozambique performance in cashew sector has tailed off as a result of the civil war
1983	Establishment of International Nut and Dried Fruit Council
1990	Establishment of Vietnam Cashew Association (VINACAS), Vietnam
1991-92	Mozambique Government removed RCN ban and imposed 60 per cent export tax and quota
1993	Establishment of Cashewnut Board of Tanzania
1996	Establishment of Cashew Association of Nigeria (CASHTAN), Nigeria
1999	CASHTAN renamed as The National Cashew Association of Nigeria (NCAN), Nigeria
1998-99	Mozambique removes export quota and export tax reduced to 14 per cent
2002	Establishment of ARECA (the Regulatory Authority for Cotton and Cashew Nuts) in Cote d'Ivoire and starts operation in 2003.
2005	Establishment of African Cashew Alliance (ACA), Ghana
2007	Introduction of warehouse receipt system for marketing of RCN, Tanzania
2009	Formation of Ghana Cashew Association, Ghana
2011	Formation of Global Cashew Council
2014	ARECA in Cote d'Ivoire, changed to Council of Cotton and Cashew Nuts (CCA)
2014	CCA imposed a strict regulatory ban on movement of cashew nuts through road.

Chapter 2: Trends in Country-wise RCN Area and Production

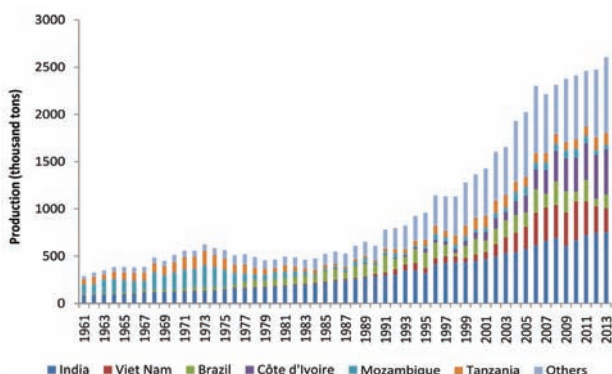
During 60's, India, Mozambique, Tanzania, Brazil and Cote d'Ivoire were the only producers of RCN. Till mid of 70's, the same trend continued with some new entrants in the market. In 70's, Indonesia and in 80's Vietnam became one among the new entrants of RCN in the world.

Fig 2.1: Trend in RCN acreage over the years in major cashew growing regions



Source: FAO Stat, DCCD Cochin, MARD Vietnam, IBGE Brazil and VariousNews

Fig 2.2: Trend in RCN production over the years in major cashew growing regions



Source: FAO Stat, DCCD Cochin, MARD Vietnam, IBGE Brazil and Various News

Fig 2.3: Country-wise % share of RCN area in 2013

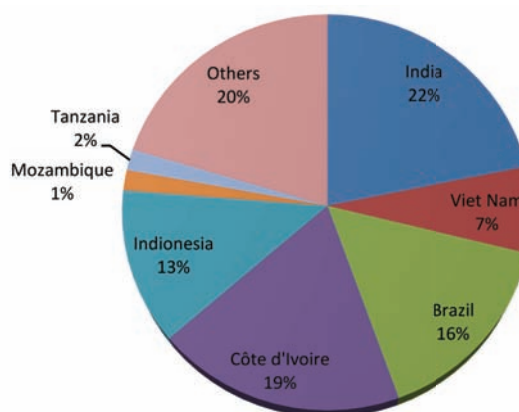
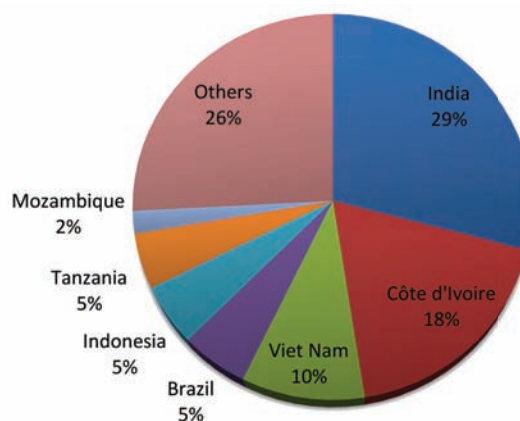


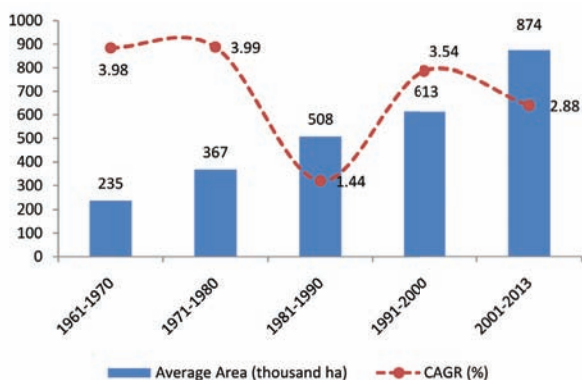
Fig 2.4: Country-wise % share of RCN production in 2013



India:

India is the largest producer of raw cashew nut in the world with 1.01 million ha area under cultivation and 0.75 million tons production in 2013. The area under RCN has been increasing consistently year-after-year. From 1961, cashew cultivation area in India has increased at a growth rate of 3.04 per cent (CAGR).

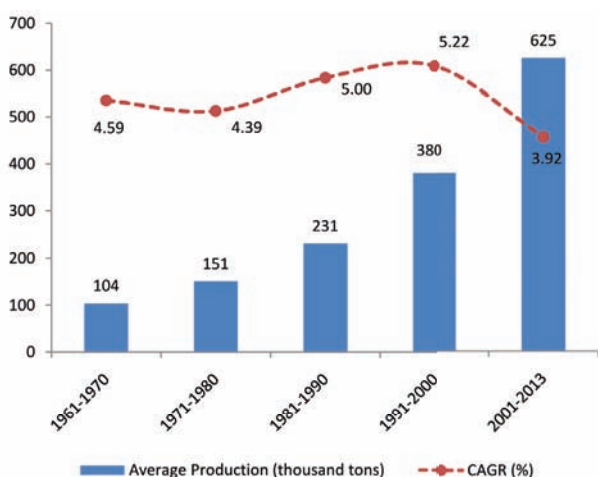
Fig 2.5: Decadal Area and growth of RCN in India



Though the area under cashew cultivation is increasing, the growth rate for area is declining over the decades. In 60's and 70's, the CAGR was nearly about 4 per cent which declined to 1.44 per cent in 80's. In 90's, the growth rate increased again to 3.54 per cent, but was lower than the previous echelons. In last decade, the area has grown by only 2.88 per cent which was again lower than its previous decade.

Indian cashew nut production has also grown steadily in past five decades at a rate of 4.44 per cent (from 1961 to 2013).

Fig 2.6: Decadal production and growth of RCN in India



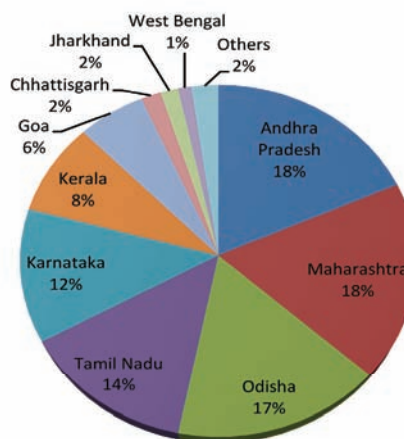
Over the past years cashew nut production in India has been increasing steadily with the release of new high yielding grafts and adoption of good agronomical practices. Recently many farmers in India started to adopt High Density Planting (HDP) which accommodates 625 plants in a hectare with spacing of 4m X 4m which definitely reflects on production in near future.

Kerala, Goa and Karnataka states are the traditional RCN producers and processors for a long time in India. Later the RCN cultivation expanded towards other states like Maharashtra, Andhra Pradesh, Odisha and Tamil Nadu.

Commencement of National Horticulture Mission (NHM) Schemes in India during 2005-06 has become a boon for development of cashew sector. NHM is a centrally sponsored scheme which has been launched to promote holistic growth of the horticulture sector through strategies like ensuring an end-to-end holistic approach covering production, post-harvest management, processing and marketing of horticultural produce. Before the introduction of NHM, INR 100 or 150 million (about 2 to 3 million US dollars) in a year were allocated for cashew development by the Government. But after 2005-06 India is spending about INR 600 to 700 million (about 10 to 12 million US dollar) a year for the development of cashew sector. About 145,000 ha of new cashew plantation and 68,000 ha replantation of senile plantation with high yielding varieties were brought under cashew plantation after 2005-06. Soft-wood grafting technique has revolutionized the availability of elite planting material of cashew in the country. There are about 100 regional cashew nurseries under public and private sector catering to the needs of graft requirement in addition to large number of small to medium cashew nurseries.

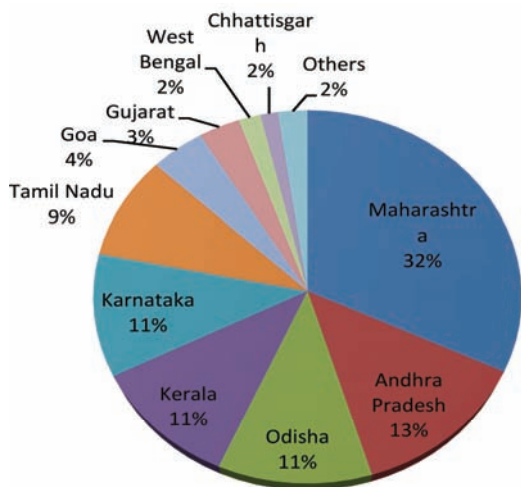
At present, RCN production is gaining momentum across the country. From being south centric, RCN production and processing is now expanding to the central India and is further expected to expand to the other parts of the country. The recent non-traditional entrants into RCN production include Assam, West Bengal, Tripura, Gujarat, Jharkhand, Andaman Nicobar, Chattisgarh, etc.

Fig 2.7: State-wise % share of RCN area in 2013



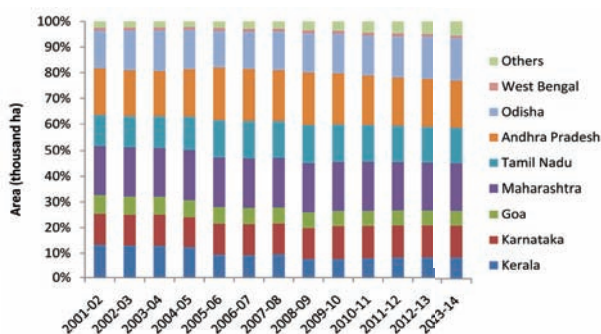
Source: DCCD, Cochin

Fig 2.8: State-wise % share to the total RCN production in 2013



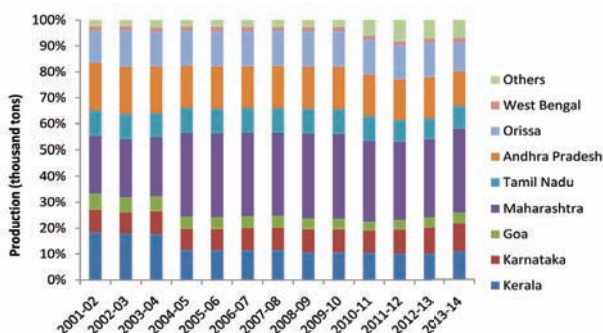
Source: DCCD, Cochin

Fig 2.9: State-wise % share in RCN area over the last decade



Source: DCCD, Cochin

Fig 2.10: State-wise % share in RCN production over the last decade



Source: DCCD, Cochin

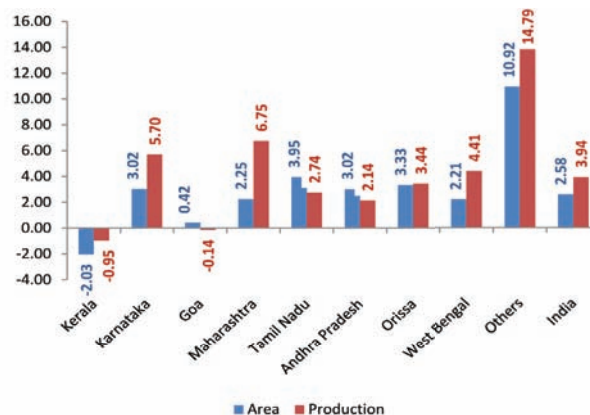
The above figures clearly indicates that the area and production of cashew nut in Kerala is being decreased

at a rate of 2.03 per cent and 0.95 per cent respectively since 2001. Kerala farmers are replacing cashew plantation with rubber.

Table 2.1: Major cashew nut growing belts in India

States	Regions
Andhra Pradesh	Srikakulam, Visakhapatnam, East Godavari, West Godavari, Khammam, Vizianagaram
Chhattisgarh	Bastar region, Raigarh
Goa	North and South Goa
Gujarat	Valsad
Jharkhand	East and West Singhbhum, Saraikela, Jamtara, Pakur, Dumka, Deoghar
Karnataka	Kolar, Uttara and Dakshina Kannada, Shimoga, Bidar, Udupi, Belgaum, Chikkbal-lapur
Kerala	Kasargod, Kannur, Malap-puram, Kozhikode, Palakkad, Thiruvanthapuram
Maharashtra	Ratnagiri, Sindhudurg, Raigad, Kolhapur, Thane
Meghalaya	East Garo hills, West Garo hills
Pondicherry	Poducherry, Karaikal
Odisha	Dhenkna, Cuttak, Nayagarh, Ganjam, Kendujhar, Koraput, Jaipur, Mayurbanj, Khurda
Tamil Nadu	Cuddalore, Pudukkottai, Tiruchirapalli, Villupuram, Perambalur, Ariyalur, South Tripura
West Bengal	Midnapur (East and West), Purulia

Fig 2.11: State-wise growth rate in area and Production of RCN in India (2001-02 to 2013-14)



Kerala was the leading producer of cashew nut in India during 90's with a share of 27.56 per cent followed by Tamil Nadu, Andhra Pradesh, Maharashtra, etc. Since

last decade, the scenario of raw cashew nut cultivation has changed in India. Maharashtra overtook Kerala and became the largest producer of cashew nut in India. Currently Maharashtra, Andhra Pradesh, Odisha, Kerala, Karnataka and Tamil Nadu are the major producers of cashew nut with a share of 32.03 %, 13.26%, 11.32 %, 10.97 %, 10.64 % and 8.90 % respectively (2013).

The non-traditional RCN area like Gujarat, West Bengal, Chhattisgarh, Meghalaya, Tripura, Manipur, Nagaland, Jharkhand, etc has good potential to grow RCN. In all new regions, cashew is cultivated as commercial crop.

Table 2.2: Cashew cultivars developed in different regions of India

States	Cultivars
TAMIL NADU	Vridhachalam-1,Vridhachalam-2-,Vridhachalam-3,VRI 4,VRI (CW) H1, etc.
KERALA	Akshaya (H-7-6),Amrutha (H1597-),Anagha (H-8-1),Anakkayam-1 (BLA-139-1),Dhana (H-1608),Dharasree (H-3-17),K-22-1,Kanaka (H-1598),Madakkathara -1 (BLA-39-4),Madakkathara-2(NDR-2-1),Priyanka (H-1591),Sulabha (K-10-2), etc.
ANDHRA PRADESH	BPP-1,BPP-2,BPP-3,BPP-4,BPP-5,BPP-6-,BPP-8(H2/16), etc.
KARNATAKA	CHINTAMANI-1,NRCC-1,NRCC-2,ULLAL-1-,ULLAL-2,ULLAL-3,ULLAL-4,UN-50, etc.
MAHARASTRA	Vengurla-1,Vengurla-2,Vengurla-3-,Vengurla-4,Vengurla-5,Vengurla-6-,Vengurla-7, etc.
GOA	GOA-1
ORISSA	Bhubaneswar-1
WEST BENGAL	Jhargram-1

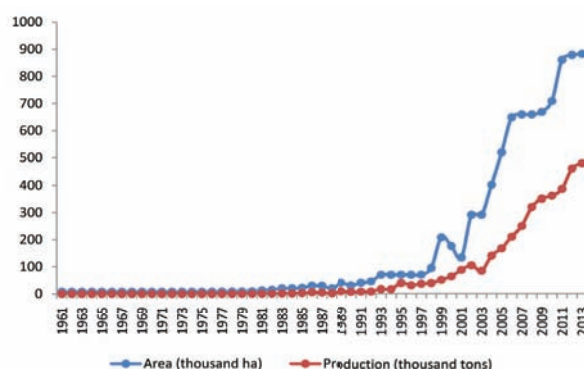
Cote d’Ivoire

Since 2009, Cote d’Ivoire is the second largest producer of cashew nut in the world after India. In Cote d’Ivoire cashew is cultivated in three major zones.

Table 2.3: Major cashew growing regions in Cote d’Ivoire

Zone	Regions
The Guinean zone	Sipilou, Biankouma, Bouaké and Agnibilekro
The intermediate zone	Katiola, DabakalaandAgnibilekro
The Sudanese zone	Bako, Sirasso, Kong and-Bouna

Fig 2.12: Trend in area and production of RCN in Cote d’Ivoire (1961 – 2013)



Source: FAO Stat and Various News Sources

Fig 2.13: Decadal area and growth of RCN in Cote d’Ivoire

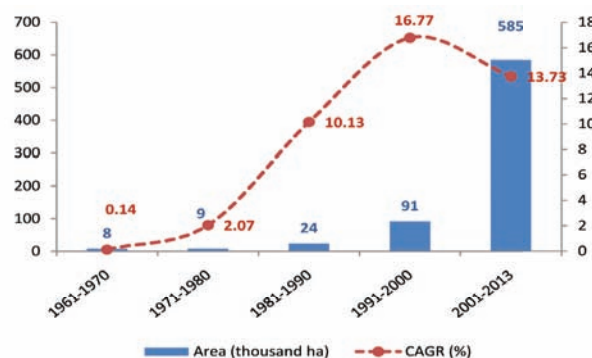
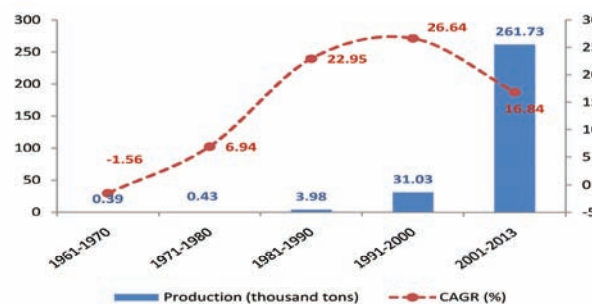


Fig 2.14: Decadal production and growth of RCN in Cote d’Ivoire



Both with respect to cashew nut area and production Cote d'Ivoire has seen a rapid growth over the past five decades. From last five decades area and production has steadily grown at an annual growth rate of 11.09 and 17.83 per cent respectively. When the Indian traders started buying RCN (around 80's), Ivorian farmers started showing interest in growing cashews. In 2013, Cote d'Ivoire produced 0.48 million tons of RCN from an area of around 0.88 million ha and contributed 18.43 per cent to the global cashew nut production.

From 1991 to 2013, Ivorian RCN production has grown significantly with a growth rate of 20.67 per cent. This growth is due to the historical dynamic of plantations which has been strong between 1995 and 2001. Most of the cashew acreage is still relatively young and increasing yields. Furthermore, there is a still new acreage planted each year, and around 10 percent of the total acreage is still less than 10 years old (Rongead, 2013).

During 2014, ARECA, the government agency which regulates the cotton and cashew industries in the country was rechristened as le Conseil du Cotonnet de l'Anacarde (CCA). The body developed a new mission to develop the productivity of the entire value chain from production to the processing sector in Cote d'Ivoire.

The Government published a new regulatory law which prohibits cashew exports by road, in accordance with the Directorate General of the Ivorian Customs and Regulations.

The objectives of the CCA are

- To optimize the production
- Improve the quality of the cashew nut
- Ensure a remunerative price to producers
- Ensure the transparency and reliability of the marketing system
- Increase the value added by processing and improve the framework and living conditions of the producers
- Establish a multi-stakeholder body which will bring together representatives of producers, cooperatives, exporters, buyers, and processors
- To identify and approve all of the primary operators and shops involved in the cashew sector within Cote d'Ivoire
- The new regulations mandates are,
- Export of cashew is done only through the ports of Abidjan and San Pedro
- The export of raw cashew nuts operations are carried out only by approved operators as the exporter
- The export of cashew must be submitted to the new agency and authorized prior to shipment

- The CCA also handles price control for the cashew sector, basing minimum prices on a variety of factors. This year cashew season in Cote d'Ivoire with new regulations, fully closed borders has provided more visible reasons to bring investors in favor of Cote d'Ivoire. Also there are now around 20-50 new trading companies approximately being registered for cashew trade during the year.

Vietnamese Cashew Industry is also strengthening their cashew business relations with Cote d'Ivoire due to their increasing dependency of RCN. In resume, Ivorian government has been showing strong visible interest to consider cashew as their priority commodity which need protection and promotion of domestic industrialization.

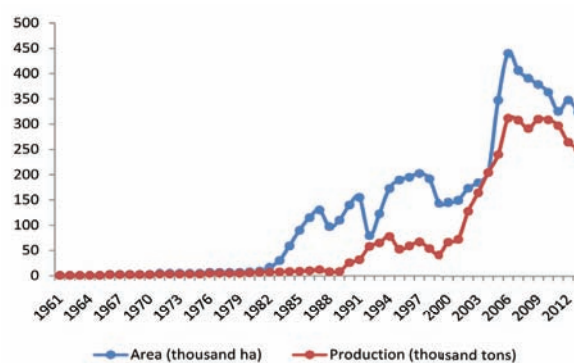
Vietnam

Vietnam is one of the largest producers of cashew nut in the world and is the world's largest exporter of cashew kernels. During 1990s, Vietnam emerged as an important cashew nut producer within Asia.

DakNong, DakLak, Binh Duong, BinhPhuoc, TayNinh, Laong An, KienGiang, Kon Tum, Gia Lai, Quang Nam, Quang Ngai, BinhDinh, Phu Yen, KhanhHoa, NinhThuan, Lam Dong, BinhThuan and Dong Nai are the major cashew growing regions in Vietnam. Among these, Bin Phouc contributes nearly 50 per cent to the nation's production.

In Vietnam cashew was introduced in the 20th century as a soil erosion control and shade tree. In 80's, Vietnamese started fostering cashew plants as the major economical crop. During 90's cashew cultivation has taken up in many provinces as an export earning crop. Vietnam Cashew Association (VINACAS), established in 1990, acts as a catalyst to facilitate growth of the cashew sector in Vietnam.

Fig 2.15: Trend in area and production of RCN in Vietnam (1961 – 2013)



Source: FAO stat and MARD (Ministry of Agriculture and Rural Development) Vietnam

Vietnam Cashew Industry: A Snapshot

Vietnam Raw Cashew Sector: Cashew is grown in 300,000 ha in Vietnam with an average productivity of 1000 kg/ha. Moving plantations from mountains, better seed programme, choosing proper seasons for seeding and harvesting and use of Integrated Pest Management (IPM), Vietnam aims to increase productivity to 1700 – 2000 kg/ha. Vietnam has a challenge of not being able to allocate more land to cashew. Thus, productivity improvement is the option. In 2013, Vietnam had an excellent crop estimated at 400,000 tons. The target for 2014 is set at 425,000 tons. With Cambodia production of 70,000 tons, the total availability in 2013 was about 470,000 tons. In 2014, the availability is expected to be over 525,000 tons.

Vietnam Cashew Kernel Market: Vietnam cashew industry in 1980s was similar to the cashew industry in Africa today. Processing started in 1990. In three decades, Vietnam has raised itself into becoming the second largest processor of Raw Cashew and the largest exporter of cashew kernel (for the 8th consecutive year since 2006). In 2013, Vietnam exported 257,000 tons of kernels valued at USD 1.8 billion, imported Raw nuts worth USD 0.52 billion and achieved a total export turnover of USD 2.2 billion from cashew kernel, CNSL and other by-products. The target for 2014 has been set at USD 2.2 billion. In 2013, Vietnam exported about 90000 tons to US, 55000 tons to China, 50000 tons to Europe, 50000 tons to Middle East and 14000 tons of cashew kernels to Australia. Vietnam enjoys a 92% market share of Australian market estimated at 15058 tons and 90% of the New Zealand market of 2536 tons. Vietnam today exports its kernel to more than 90 countries.

Vietnam Cashew processing sector: Current processing capacity is in excess of 1.2 million tons. About 500 large and medium scale processing units co-exists with 500 other small scale units. All large scale units are GMP, ISO and HACCP certified. Vietnam has also developed processing capability to value-add in form of roasted, roasted and salted and coated (honey or chocolate). Factories are designed to optimise on manpower and machinery capabilities to maximize returns for the processors. Cost of financing is about 5- 7% for the large processors, while it is about 10 -12% for medium scale processors.

Challenges to Vietnam cashew processing industry:

Sustainability of growth momentum: Vietnam is addressing it through a combination of cost control, customer engagement and partnerships with suppliers. In the last one year, VINACAS has been engaging with The Cotton and Cashew Council of Cote D'Ivoire to strike a win-win partnership. MoU has been signed between the countries whereby, Cote D'Ivoire would strive to provide quality raw nuts to Vietnam so as to ensure smooth supply. In turn, Vietnam would enable Cote D'Ivoire to process about 20 – 30% of its raw nuts through transfer of technology, setting up of processing units and other related assistance. Both countries agreed to resolve several origin-specific and market specific challenges in a win-win proposition. Vietnam is also assisting neighbouring countries such as Cambodia to increase its raw nut production, so as to have supply continuity. The machinery manufacturers are working on bringing down labour involvement, reducing quality damages and improving product consistency. Vietnam had sent a delegation to Australia in 2013 and is pursuing that market opportunities aggressively. In the same manner, efforts are to build relationships with the Middle East markets. Vietnam has identified the importance of domestic demand and is keen on improving the domestic demand for kernels.



**MEMORANDUM OF UNDERSTANDING
Between the Cotton and Cashew Council and the Vietnam Cashew Association
in Vung Tau city, Vietnam
May 16th, 2014**



The Council for the regulation, the monitoring and the development of cotton and cashew sector's, "Cotton and Cashew Council", located in Abidjan, Cote d'Ivoire, represented by Mr. Sanogo Malamine – General Director.

and,
The Vietnam Cashew Association, "VINACAS", located in Ho Chi Minh City, Vietnam represented by **Mr. Nguyen Duc Thanh – President of VINACAS**

Below collectively appointed the "Parties" and individually a "Party",
Considering that the Vietnam Cashew Association VINACAS is an organization established since 1990 under the laws of Vietnam, with approximately 200 members operating in all fields of cashew sectors including cashew growers, processors, traders, importers and exporters and which objective is to boost processing capacities of the Vietnam cashew industry, giving supports to cashew agriculture and relaxation the policies in the cashew sector for the sustainable development of Vietnamese cashew industry

Considering that the Cotton and Cashew Council is a body with the legal entity and with the financial autonomy, governed by the Ivory Coast laws, which has for objectives to strengthen the competitiveness of cotton and cashew sector's and to contribute to the development of co-operatives, trading companies of processing and export of cotton and cashew products;

Recognizing the mutual interests which will arouse the present Memorandum of Understanding,

Suited what follows:

VI-Purpose

The present Memorandum of Understanding establishes a frame of collaboration and exchanges between the Parties in the field of cashew.

VII- Objectives et contains

The parties to this MoU agree to establish a short-term and long-term collaboration with each other to further the business development of two countries. The collaboration would include the followings:

1. Sharing of information on various parts of cashew sector including cashew-related regulatory, cultivation, post harvest technology, processing, import and export, quality, standardizations, reliable cashew exporters/importers.
2. Settling and minimizing business problems (if any) arising during the business transactions between the members of the two organizations.
3. VINACAS and the Cotton and Cashew Council of Côte d'Ivoire create periodical visits and B2B meetings between their members in Vietnam and Côte d'Ivoire for effective business relationship exchange.

4. The Party will assist each other to set up a representative office or appoint a representative individual (ambassador) of each other in respective country to assist its members on trading raw cashew and processing equipments.

VIII- Implementation

In order to reach the objectives of this MoU, the Parties:

1. Expect to meet periodically to further develop the above objectives.
2. Shall meet to review the performed works and develop a specific framework for collaboration within a period of 12 months.
3. Agree to provide bi-monthly updates to each other on their works via email.

IX-Dispute settlement

The Parties suit that any dispute arisen from the interpretation or from the implementation of the present MoU, has to be resolved amicably, by means of consultations or of negotiations between the Parties.

X- Coming into force and Termination

The present MoU shall be in effect as of the date of signing for a period of 12 months, renewable thereon as may be agreed by the parties concerned.

If a Party decides to end the present MoU, this Party has to notify it in writing to the other Party with an advance notice of two months and obtain the agreement of the other Party.

The termination of the present MoU does not affect the current projects of cooperation, except agreement of concerned the Parties.



Vung Tau, Vietnam, May 16th, 2014

In duplicate, in French and English languages, both texts being also valid.

For The Cotton and Cashew Council

Conseil du Coton et de l'Anacarde
27 BP.604 ABIDJAN

Tel: 22 52 75 80
Fax: 22 52 75 85

Mr. Sanogo Malamine



Mr. Nguyen Duc Thanh

Fig 2.16: Decadal area and growth of RCN in Vietnam

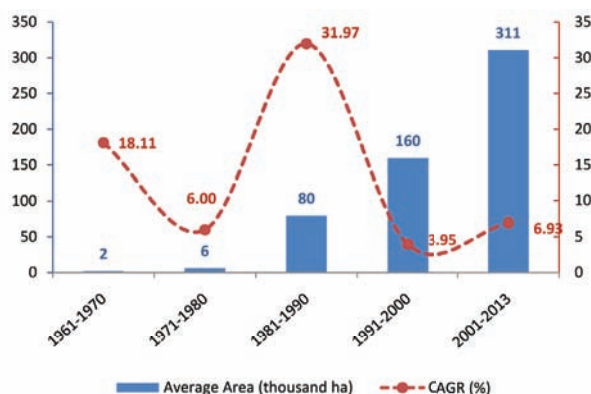
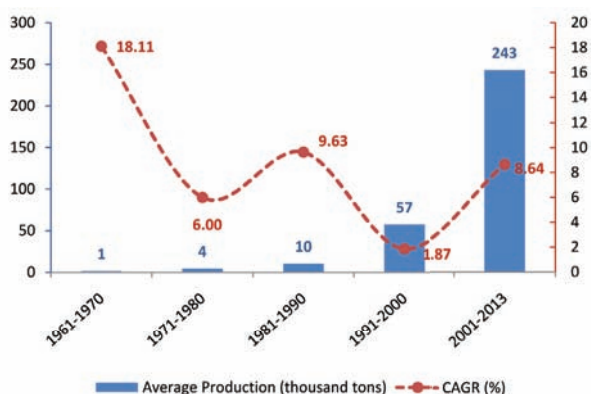


Fig 2.17: Decadal production and growth of RCN in Vietnam



Though Vietnam has lesser area under cashew cultivation as compared to India, the higher productivity has pushed up its production.

The Vietnam cashew industry has shown a significant growth in the last decade (2001-2010) with respect to production. The annual growth rate recorded during the period was nearly 15.31 per cent. However, over the past five years, cashew nut production in Vietnam has been declining. During the period between 2009-2013, the RCN area and production has declined by 3.51 per cent and 5.56 percent (CAGR) respectively. The competition from other crops viz., rubber, pepper, etc has resulted in narrowing of cashew cultivation area.

To increase the supply of RCN for processing, during 2010 within the framework of the Golden Cashew Festival in BinhPhuoc province, Vietnam initiated the programme to develop the cashew plantation in Cambodia and Laos. This way Vietnam is trying to increase RCN supplies from neighbourhood to meet the country’s processing demand. Many research institutes and agricultural universities in Vietnam are working in collaboration with VINACAS to increase the cashew output in the country.

In May 2014, the Vietnamese Cashew Association (VINA-CAS) signed a MOU with the General Council of Cotton and Cashew of Cote d’Ivoire (CCA). The objectives of MoU are,

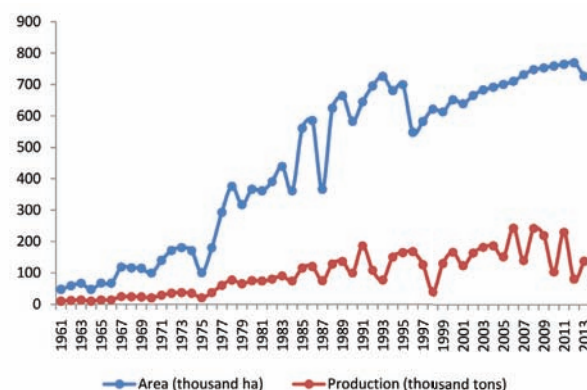
- Support for the mentoring and training of Ivorian cashew producers on farming techniques and post-harvest operations;
- The exchange of information;
- Securing commercial transactions between traders of the two countries;
- Support for the installation of representation of each structure in the respective countries.

Major changes that improved yield – shifts from hilly areas to plains, shift from soil conservation oriented cashew plantation to commercial high density plantation, improved seedlings, proper planting and harvesting schedules and fertilizer and pesticide management. Goal by 2020 is to push the yield from the current average of 1000 kg/ha to 1500 – 1700 kg/ha.

Brazil

Though cashew originated from North Eastern part of Brazil, it was not cultivated as commercial crop in Brazil until 80’s. The commercial cultivation of cashew was started from 1990 and shown an enormous growth area-wise.

Fig 2.18: Trend in Area and production of RCN in Brazil (1961 – 2013)



Source: FAO Stat, IBGE (Instituto Brasileiro de Geografia e Estatística)

Area and production of cashew nut in Brazil has significantly grown from 1961 onwards at annual rate of 5.35 per cent and 5.45 per cent respectively up to 2013. With the expansion of area, production has increased steadily over the years. However, from past 10 years (from 2004

onwards), Brazilian cashew production has started declining at a rate of 4.96 per cent due to adverse climatic conditions (mainly continuous drought year and scarcity of farm labour). The area in this period has also grown very slowly at a rate of just 0.97 per cent.

Fig 2.19: Decadal area and growth of RCN in Brazil

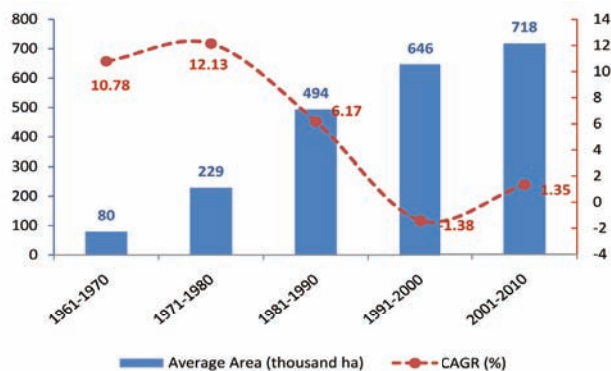
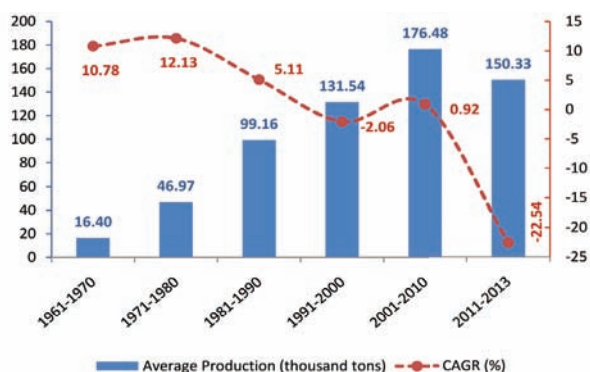
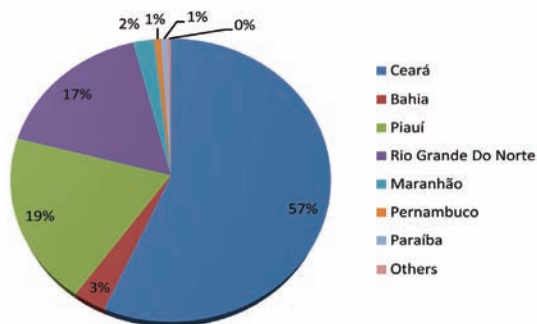


Fig 2.20: Decadal production and growth of RCN in Brazil



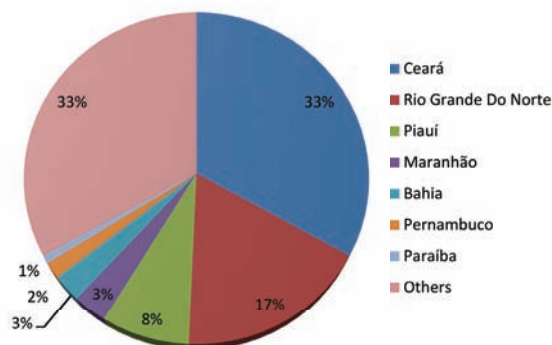
Northeast region of Brazil accounts for over 95% of the total Brazilian cashew production, with the largest orchards located in coastal and transition zones of Ceará, Rio Grande do Norte and Piauí states. The state of Ceará constitutes over 50% of cashew plantations in Brazil.

Fig 2.21: Trend in State-wise share to RCN area 2013 in



Source: IBGE

Fig 2.22: State-wise share to RCN production during 2013 in Brazil



Source: IBGE

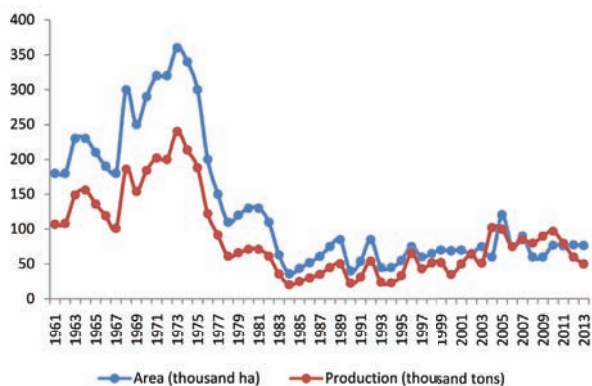
Brazilian Government enacted a law on the set up of a Support Fund for Cashew Cultivation (FUNCAJU). A national Cashew Development Program is being elaborated in this framework, directed to financing the modernization of the sector, the increase of crop productivity and processing performance, strengthening exports and reviving research and development on cashew.

Mozambique

Cashew, one of the major crops of Mozambique, is produced along the entire coastal area. The coastal zone of the provinces Cabo Delgado, Nampula, Zambezia and Inhambane, Gaza and Maputo are the most important areas of production.

After independence in 1975, Mozambique was the world’s leading cashew producer, and processed cashew kernels and exported 240,000 tonnes of raw nut production. But sector’s performance was tailed off as a result of the civil war (1982-1992). The liberalization policy on exports of unprocessed cashews, led to closing down of a few processing factories due to lack of raw materials. With the return of peace to the country, cashew production has gradually increased again but the Naida cyclone in 1994 destroyed 40 per cent of plantations area. In recent times, Mozambique plans to continue to focus on cashew production, by distributing saplings and combating diseases that affect the cashew trees. Mozambique’s cashew production has rebounded substantially in the last ten years but still the production is far lower than those achieved in 70s.

Fig 2.23: Trend in area and production of RCN in Mozambique (1961 – 2013)



Source: FAO Stat and Various News Sources

Fig 2.24: Decadal area and growth of RCN in Mozambique

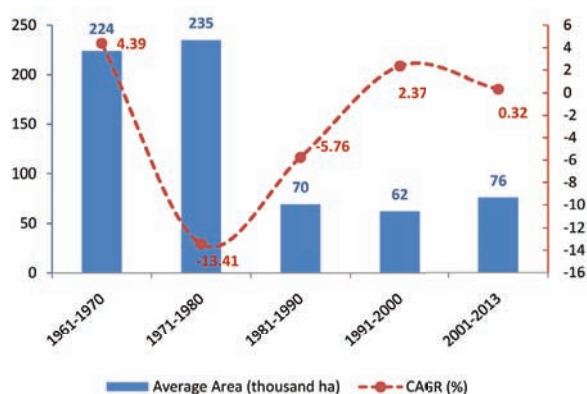
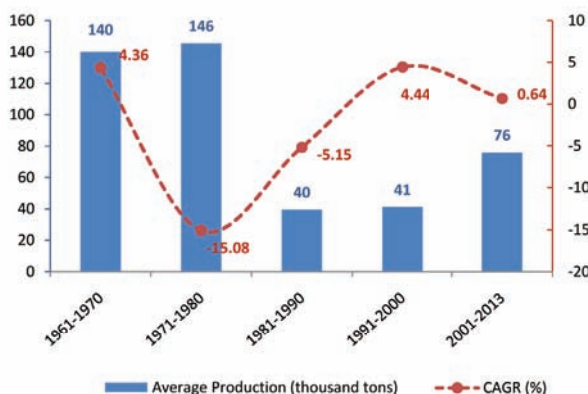


Fig 2.25: Decadal production and growth of RCN in Mozambique



The 80's civil war and ineffective policies made the cashew cultivation area to decline at a rate 13.41 per cent; as a result production also dipped by 15.08 per cent. The new plantings under cashew were restricted due to

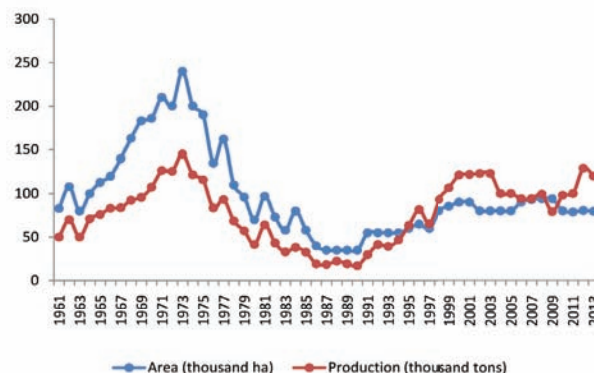
unstable policies that further added to the decline in the production.

With the advice of World Bank, the Mozambique government slowly started removing restrictions from cashew sector by late 80's. The ban on export of RCN was removed by 1991-92 but an export quota and tax was imposed. Mozambique started to regain its position in cashew production; however, the previous highs have not yet met so far.

Tanzania

Tanzania, officially United Republic of Tanzania, is one among the major cashew producing countries in Africa. Major cashew growing area in Tanzania includes Mtwara, Lindi, Ruvuma and Tanga. Among these regions, Mtwara and Lindi regions contributes more than 87% to the national cashew production.

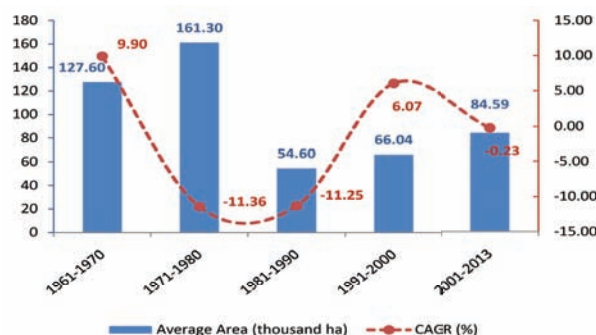
Fig 2.26: Trend in area and production of RCN in Tanzania (1961 – 2013)



Source: FAO Stat and Various News Sources

Area and production of cashew nut in Tanzania is varying decade-on-decade. Neither continuously growing nor decreasing. Senile plantations are resulting in decrease of cashew nut production in the country. Area under cashew cultivation is decreasing year-on-year as some farmers are shifting towards other crops.

Fig 2.27: Decadal area and growth of RCN in Tanzania



Procedures for Warehouse Receipt System in Tanzania

- Individual farmers collect well dried and graded raw cashew nut to the primary cooperative societies and in turn get a receipt indicating the quantity, quality and amount of loan to be secured from bank.
- Primary cooperative societies re-package raw cashew nut into standard jute/sisal bags each of 80 kg. The primary societies then collect the re-packed raw cashew nut bags to the regulated warehouses.
- On presence of Cashewnut Board of Tanzania and respective primary society, before accepting the cashew nut the warehouse operator undertakes quality test called cutting test. On completion the respective primary society is issued with certificate of quality assurance, certificate of title (CT) and certificate of pledge (CP) all these indicate the quantity, quality and lending institution.
- The primary society takes CP to the lending institution (usually the bank). The bank issues loan up to 75% of the estimated value of the warehoused cashew nut. Then the primary society takes loan back to farmer to form what is called first payment.
- The primary society takes CT to the market usually the sealed bid auctions.
- After auction successful buyers (bidders) are given CT and directed to the respective bank to un-pledge the cashew nut. On effecting payments the buyer is issued the CP.
- The buyer takes both CT and CP to the warehouse (warehouse operator).
- Warehouse operator issues the respective cashew nut to the buyer.
- The buyer then exports or process locally.

The conceptual framework for Warehouse Receipt System Operation is attached for your further reference.

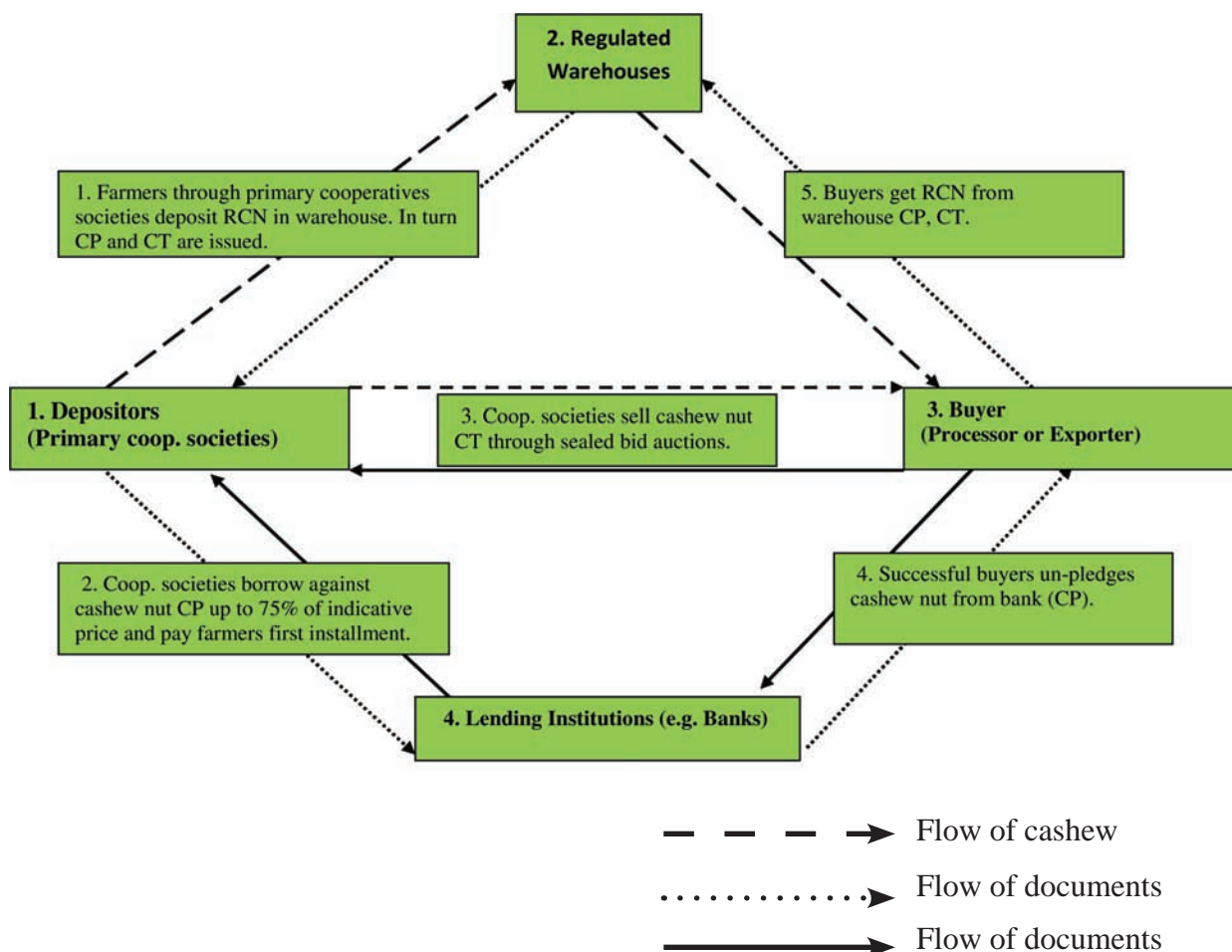
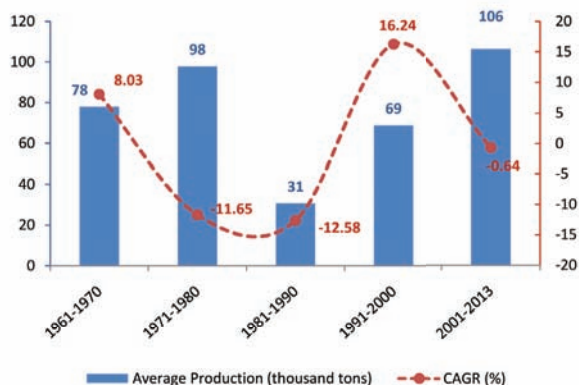


Fig 2.28: Decadal production and growth of RCN in Tanzania



From last three years, cashew growing area is increasing steadily with the government intervention in developing the cashew production and processing in the country.

In recognition of the potential importance of cashew nuts in Tanzania, the Cashewnut Board of Tanzania (CBT) was established by the government in 1993. Many research institutes and agricultural universities in collaboration with CBT are working towards increasing the production capacity of the country. There is a substantial potential to extend the production of cashew nuts by improving productivity of existing farms, engaging in new plantations using improved varieties.

Since 2007 a warehouse receipt system has been put in place which means that all cashew production has to be auctioned via co-operatives at an auction managed by the Cashewnut Board of Tanzania. The warehouse receipt system was introduced to prevent exploitation of farmers and to enhance competitiveness of processors.

Marketing of raw cashew nuts in Tanzania has changed over time and has included direct sales from farmers to traders and delivery of the raw nuts to the Primary Society for marketing. The Primary Societies were the sole marketer of farmer's cashew nuts from independence until 1991 when marketing was liberalized and farmers were allowed to sell to any buyer.

Following the introduction of the warehouse receipt system (WRS) the producers either sell in domestic markets or for export. In WRS, exports of RCN has to go through Primary Cooperatives (Agricultural Marketing Cooperative Society, AMCOS) where the exporters and processors bid for RCN through auction. When selling to AMCOS, farmers receive a first payment which is normally financed by credits undertaken by the AMCOS. The AMCOS in turn sell to buyers via the auction and charge a fee for their services. With the income from the fee in theory AMCOS should build, upgrade and maintain storage facilities and eventually provide additional services.

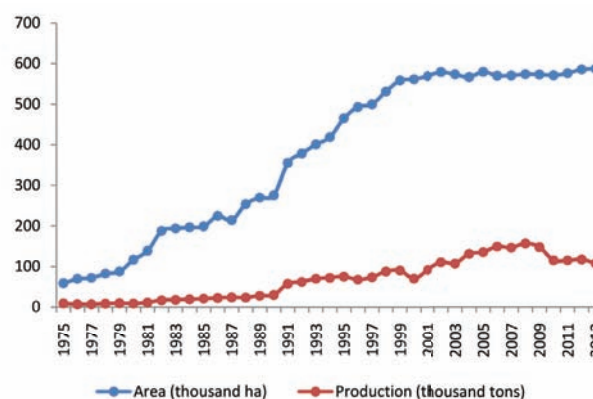
Indonesia

The Asiatic zone includes India, Vietnam and Indonesia as the major producers of cashew nuts, besides Philippines, Malaysia, Thailand and Sri Lanka, produces cashew nuts on a small scale. Among these countries, Indonesia is one of the importance sources of RCN for India and Vietnam.

Cashew cultivation in Indonesia was originally meant for afforestation programme. The commercial cultivation of cashew in Indonesia is quite recent. The first extensive plantings began in the mid-1970s, and exports of commercial quantities began in the 1980s.

Cashew production in Indonesia is mainly confined to the Eastern part of the country, where area is characterized by sparse rainfall and a long dry season which is considered ideal for high productivity of cashew. The main growing regions in Indonesia are the provinces of South East Sulawesi (46%), South Sulawesi (23%), East Java (10%), West and East Nusatenggara (4%), Bali (3%) and other minor areas (14%).

Fig 2.29: Trend in area and production of RCN in Indonesia (1975 – 2013)



Source: FAO Stat, Ministry of Agriculture Republic of Indonesia

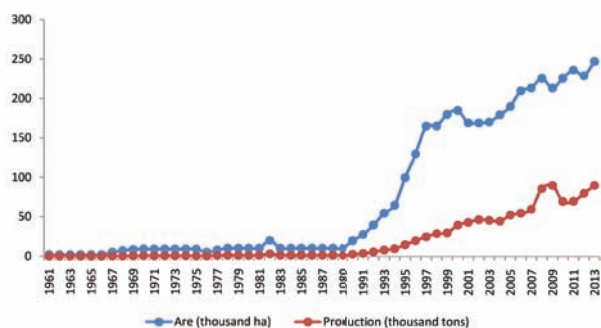
Since 1975, the area and production of cashew nut in Indonesia has grown steadily. However, from past ten years production of cashew has been declining steadily at a rate of 3.0 percent.

Benin

In the cashew world, Benin is known for the quality of its raw product. Benin's cashew nut is very well priced for its quality on the international market. In the agriculture sector, cashew constitutes Benin's second largest source of revenue after cotton. It is produced in the central and northern regions of the country. Collines, Zou, Borgu, Donga, Atacora are the major cashew producing areas in Benin.

Since 2001, the area and production of cashew nut in Benin has increased at an annual growth rate of 3.39 and 6.58 per cent respectively.

Fig 2.30: Trend in area and production of RCN in Benin



Source: FAO Stat, ACA, National Institute of Statistics and Economic Analysis Republic of Benin and Various News

Ghana

Cashew production in Ghana is mainly carried out by small land holding farmers (88 per cent), who are usually organized into associations. About 43 per cent of total family income of farmers is generated through cashew farming (Cashew Development Project, Ghana, 2009).

Major areas of Ghana that produce cashew nut are Coastal Savanna, Brong-Ahafo/Afram Plains, Upper East Region, Northern Region and Upper West Region.

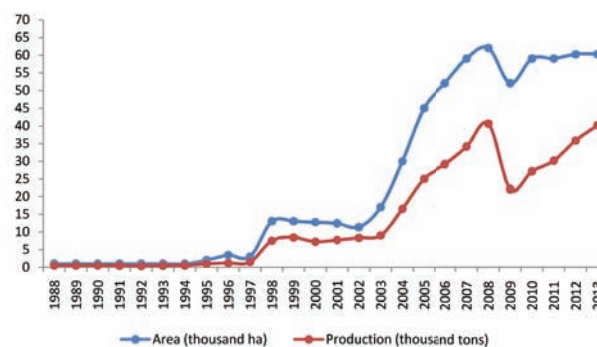
Ghana is one of the important contributors of cashew in African countries. Ghana produces smaller quantity of cashew nuts (2.13 per cent of total African and 0.79 per cent of total world), however, it exports more than its national production which indicates the cross border trading of raw cashew nuts between Ghana and neighboring countries like Cote d'Ivoire, Burkina Faso, Togo and Mali.

With the establishment of ACA in Ghana during 2005, cashew nut production in Ghana as well as in other African nations has seen massive improvement. As well as TechnoServe, GIZ, ACI and such other initiatives also aided in cashew nut sector improvement in Africa. Mim cashews, Rajkumar Impex, Usibras, etc are the large processing factories established recently in Ghana.

This year cashew season in Cote d'Ivoire with new regulations all together has implicated lots of difficulties to all Ghanaian Cashew Value Chain. Ghana processors have been the most victim of this, which resulted in shutting the operations of some of the large processing units till they secure required RCN stocks. Other sizable processors

too are struggling to match to their recently expanded volumes and targets.

Fig 2.31: Trend in area and production of RCN in Ghana



Source: FAO Stat, ACA and Various news

Nigeria

The history of cashew in Nigeria dates back to 15th century. During that time, it was mainly used in afforestation schemes for the control of soil erosion in the former Eastern Nigeria. Commercial cashew plantations started in Nigeria in the early 1950s with the establishment of commercial plantations in different regions of Nigeria. Research on the cultivation, uses and economy of cashew in Nigeria commenced in 1972, by Cocoa Research Institute of Nigeria (CRIN).

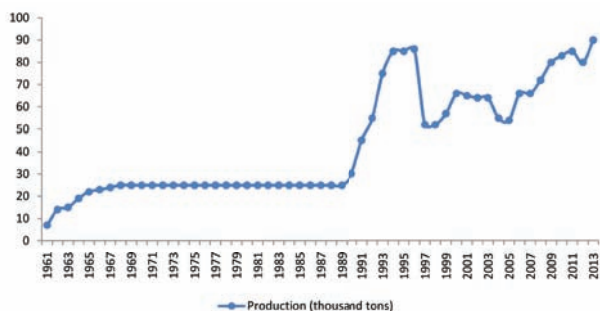
Cashew grows almost everywhere in Nigeria but is concentrated primarily in the southern and middle belt regions by small land holdings farmers. Major cashew growing areas in Nigeria are Enugu, Abia, Imo, Anambra, Ebonyi and Cross River states in the Eastern part of the country; Oyo, Osun, Ondo, Ekiti and Ogun States in the Western part, as well as Kwara, Kogi, Nassarawa, Benue, Taraba, Niger and FCT in the Middle Belt and also Sokoto and Kebbi States in the North West part of the country. The majority of export of quality nuts come from the Western and Eastern parts of the country.

Industrial cashew processing in Nigeria began in the early 80's when the old Eastern Regional Government established the Premier Cashew Processing Factory, located in Oghe in Enugu State, primarily to process the harvest from the government owned 650 ha cashew plantation as well as to serve other small land holding farmers in and around the States of Kogi and Benue.

The National Cashew Association of Nigeria (NCAN) is the

umbrella body for the Nigerian cashew industry. It is actively involved in developing a strategy and action plan to improve the quality of raw nuts, to increase the coordination in the sector, and to improve the business climate for processing.

Fig 2.32: Trend in RCN production in Nigeria



Source: FAO Stat, ACA, NCAN and various News

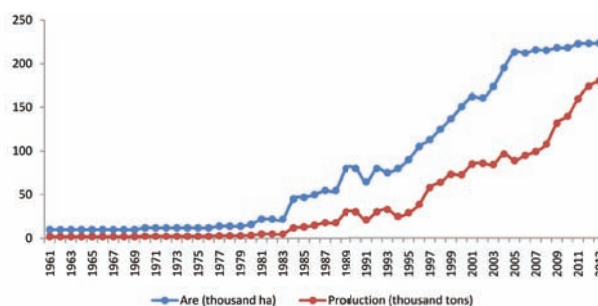
Guinea Bissau

Guinea-Bissau is a small country (about 35,000 km² of geographical area) located on West Africa’s coast between Senegal and Guinea. Guinea-Bissau was the first Portuguese African colony to fight for independence and the last to win it (in 1974, after a protracted civil war). The country is struggling with its evolution from a centralized socialist state to a free market economy.

Agriculture, principally products from rural farmers, drives the economy; and cashews (known as “Guinea-Bissau’s petroleum”), furnish its major fuel.

Cashew planting in Guinea Bissau was first established in the northern regions of Ohio and Biombo, and expanded thereafter rapidly in the east and the south.

Fig 2.33: Trend in area and production of RCN in Guinea Bissau



Source: FAO stat and Various News

During 1981-90, the cashew cultivation area and production have experienced massive growth. More than 85 per cent of cultivation area belongs to the traditional growers of the country. Total cultivated area in this decade was mainly contributed by these traditional growers.



Chapter 3: RCN Production and Area (2017) Projection

Global cashew nut production is growing at a rate of 4.97 per cent since 2001 but the area is growing by only 2.56 percent. Increasing demand for cashews and government initiations in promoting cashew cultivation, etc are helping to increase in cashew nut area and production. However, during last 12 year period (2001-2013) in some of the countries the area and production have experienced slow growth. Brazil has seen negative growth rate due to continuous drought periods.

Table 3.1: Trend in CAGR (%) of area and production of RCN over the decades

Country/Decade		1961-1970	1971-1980	1981-1990	1991-2000	2001-2013
World	Area	5.95	1	3.01	7.25	2.56
	Production	5.71	-2.84	3.53	6.63	4.97
India	Area	3.98	3.99	1.44	3.54	2.88
	Production	4.59	4.31	5	5.22	3.92
Vietnam	Area	18.11	6	31.97	5.63	4.68
	Production	18.11	6	9.63	1.87	9.85
Brazil	Area	10.78	12.13	6.17	-1.38	1.35
	Production	10.78	12.13	5.11	-2.06	-1.8
Cote d'Ivoire	Area	0.14	2.07	10.13	16.77	13.73
	Production	-1.56	6.94	22.95	26.64	16.84

During last decade global area and production have seen lower growth rate compared to 1991-2000. According to forecast, global RCN area is likely to be 4509 thousand ha from the current 4588 thousand ha, a 1.73 per cent decrease. Whereas, global RCN production is projected at 3049 thousand tons by 2017 from the current levels of 2600 thousand tons with an increase of 17.25 per cent.

The projected production for Cote d'Ivoire is significantly high compared to other countries. Projected production in Cote d'Ivoire is likely to touch 644 thousand tons with an increase of 34.13 per cent. Whereas, in Brazil projected production is showing 11.38 reduction from the current level.

In India according to forecast, RCN area likely to be 997 thousand ha decrease by 1.14 per cent and RCN production is likely to touch 851 thousand tons with the increase of 12.34 per cent from the current level. In the major cashew growing regions of India like Kerala farmers are shifting to other plantation crops mainly to rubber on higher returns.

In Vietnam the projected area and production have shown increase by a rate of 4.24 and 56.60 per cent respectively. Uncertainties are more as the farmers are shifting from cashew plantation to other plantations like pepper, rubber on higher returns.

Methodology used for projection:

Yearly area and production data is considered for forecast. Area is projected by taking moving average of latest three year acreage. Production is linearly extrapolated based on the 10-year production between 2003 and 2013. The forecast function which we have used, gives a prediction of future value based on the existing values.

Fig 3.1: Projected global RCN area and production till 2017

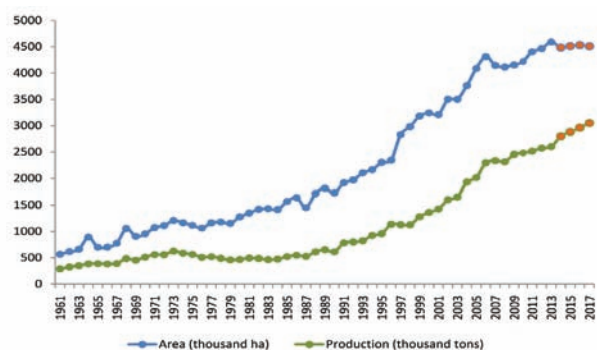


Table 3.2: Projected RCN area and production till 2017 (Area in thousand ha and production in thousand tons)

	World		India		Vietnam		Brazil		Cote d' Ivoire	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
2000	3241	1359	686	450	196	68	651	167.123	176	63.7
2001	3209	1423	700	470	199	73	639	124	133	88.1
2002	3501	1598	750	500	240	129	665	165	292	104.9
2003	3502	1652	780	535	184	164	683	183	292	84.8
2004	3761	1929	820	544	296	205	691	188	400	140.6
2005	4086	2014	843	579	348	232	700	153	520	167.9
2006	4312	2292	854	620	402	340	710	244	650	210.7
2007	4147	2335	868	665	440	350	731	141	660	250.5
2008	4114	2311	893	695	403	349	747	243	660	320
2009	4155	2454	923	613	391	350	753	221	670	350
2010	4218	2481	953	675	373	400	759	104	710	360
2011	4403	2515	979	725	363	350	764	231	860	385
2012	4464	2572	992	753	342	275	769	76	878	460
2013	4588	2600	1009	757	324	252	726	138	882	480
2014	4485	2795	993	784	343	362	753	140	873	526
2015	4513	2879	998	807	336	373	750	134	878	566
2016	4529	2964	1000	829	335	384	743	128	877	605
2017	4509	3049	997	851	338	395	749	123	876	644

Chapter 4: Demand and Supply Trends of Cashew in Major Countries

India

Table 4.1: Demand and supply trend of cashew in India

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CAGR
Production (thousand tons)	544	579	620	665	695	613	675	725	753	757	3.40
Import (thousand tons)	481	523	577	571	655	662	565	798	822	830	6.04
Per cent share of major sources in total RCN import											
Côte d'Ivoire	24	26	34	34	33	32	34	22	30	31	5.95
Guinea Bissau	17	17	10	19	13	14	9	16	11	18	3.96
Benin	10	11	12	10	13	17	14	15	19	14	11.69
Ghana	6	6	8	5	7	7	9	16	10	13	15.20
Nigeria	4	3	4	3	2	2	1	1	3	2	-3.96
Tanzania	16	9	9	1	8	14	17	12	15	16	14.14
Mozambique	9	6	5	4	5	1	5	4	1	2	-11.89
Indonesia	9	15	8	9	9	5	5	4	5	3	-7.89
Others	5	7	11	14	9	7	5	10	7	0.5	-8.60
Average Import price (USD/kg)	0.79	0.91	0.70	0.65	0.98	0.81	1.02	1.43	1.12	0.98	5.05
Total Supply (thousand tons)	1025	1102	1197	1236	1350	1275	1239	1523	1575	1587	4.71
Implied Kernel Production (thousand tons) *	256	276	299	309	338	319	310	381	394	397	4.71
Kernel Export (thousand tons)	111	130	121	111	123	128	113	133	102	126	0.01
Per cent share of major markets in total kernel export											
USA	48	41	37	36	33	31	28	37	33	29	-4.06
Saudi Arabia	12	14	17	13	12	9	10	9	9	9	-6.01
Netherlands	6	6	9	11	13	15	17	10	11	16	9.58
France	5	5	5	3	3	5	3	3	3	2	-8.61
Japan	4	4	3	4	5	5	6	5	6	6	6.20
Spain	2	3	3	3	4	3	3	3	3	3	8.83
UK	2	3	3	4	2	3	4	3	6	5	0.44
UAE	2	2	2	2	2	3	3	3	3	3	2.72
Germany	1	2	2	2	1	1	1	2	2	2	5.00
Others	16	20	20	22	24	25	25	24	26	25	4.24
Average kernel Export price (USD per lb fob)	2.01	2.15	2.04	2.16	2.47	2.04	2.25	3.04	3.41	3.30	6.00
Kernel import (thousand tons)	0.74	1.24	0.93	0.56	1.12	2.24	5.50	2.82	4.35	6.69	28.72
Average kernel import value (USD/lb)	0.55	0.54	0.46	0.45	0.39	0.48	0.61	1.56	1.38	1.53	15.02
Derived Domestic Consumption (thousand tons)**	146	147	179	199	216	193	203	251	296	278	7.76

* Implied kernel production is assumed to be 25 per cent of total RCN supply

** Derived domestic consumption equals implied total kernel production + kernel import - kernel export

Source: Directorate General of Commercial Intelligence and statistics (DGCI&S), UN Comtrade

India is the largest producer of raw cashew nut in the world, with a share of 29 per cent of global raw cashew production during 2013. However, the domestic production is not enough to meet its processing demand. Hence India imports equivalent or even more than its production from other producing countries, mainly African countries.

RCN import into India has been steadily growing over the years. The import has increased at a compounded annual rate of 9.71 per cent from 1990 onwards whereas own production has grown by only 4.45 percent. This indicates country's dependency on other sources for RCN. In 2012, RCN import reached its high with the import volume of 826 thousand tons. Africa is the largest source of RCN to India. African countries like Côte d'Ivoire, Benin, Ghana, Guinea Bissau, Tanzania etc export maximum quantity of their production to India.

Côte d'Ivoire has become the major supplier of RCN to India. RCN import from Côte d'Ivoire since 1995 has increased by 16.56 per cent (CAGR). Fully matured and good quality nuts with average prices have attracted Indian processors/traders to import more from Côte d'Ivoire. The other major source includes Benin, Guinea Bissau, Ghana, Nigeria, etc in West Africa and Tanzania, Mozambique among East African countries. Indonesia also exports fair amount of RCN to India but usually Indonesian nuts prices are at higher level compared to African nuts.

India started export of kernels way back in the early 19th century with a small quantity and grew significantly from 70's. First exports of kernels from India were made during late 1920 from Kollam, Kerala. India used to export more than 50 per cent of total supply of kernels. But with the expansion of domestic market coupled with narrowing price parity between the export and domestic earnings to the exporters, the share started to become narrow. However, with the increase production of kernels, export were also growing but at a lower phase.

Since 1990-91 onwards Indian kernel exports increased only by a 3.7 per cent (CAGR) whereas value increased by 8.2 per cent.

During 1991 to 2000 kernel export growth rate from India were prominent at 6 per cent. During 2011-12, India reached its high in export by exporting 132 thousand tons of kernels to the world.

The major export markets for Indian cashew kernels are USA, UAE, the Netherlands, Japan, UK, Saudi Arabia, France, etc.

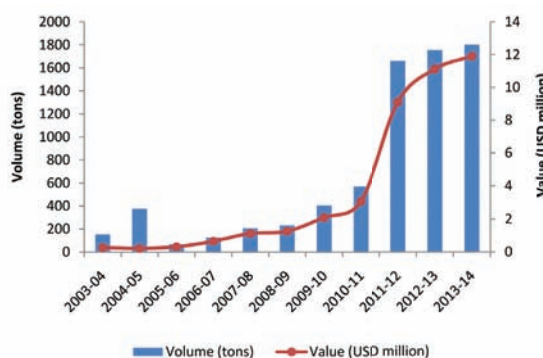
In recent years, the share of USA import in total Indian kernels export is decreasing due to increased competition from Vietnam. Vietnam has overtaken the Indian share in USA and is enjoying the largest player position.

The Netherlands is another traditional market for Indian kernels, whose share is also declining over the years. India's share has reduced from 49 per cent in 2001 to 28.7 per cent in 2013.

Recently UAE, Japan and other markets emerged as a new potential markets for Indian kernels. Kernel exports from India to UAE have increased by 14.41 per cent, to Japan by 5.37 per cent and to Saudi Arabia by 11.12 per cent from past 13 years (CAGR). The share of UAE in total Indian exports has grown from 3.5 per cent in 2001 to 15 per cent in 2013.

Value added cashew kernels (Roasted and Salted) exports have also shown a significant increase over the years.

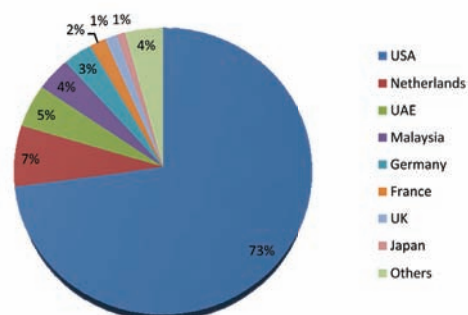
Fig 4.1: Trend in export of Roasted & Salted cashew kernels from India



Source: Export Import Data Bank of India

Export of value added kernels have increased by 33 per cent in terms of volume and 55 per cent in terms of value since 2003-04 to 2013-14.

Fig 4.2: Major importers of Indian value added cashew kernels during 2013-14



Source: Export Import Data Bank of India

USA constitutes of major share (73 per cent) in total value added kernels exported from India followed by the Netherlands, UAE, Malaysia, Germany, France, etc.

Though, India is losing its share in exports, the surging domestic demand is a sign of relief to cashew exporters. Recently with the steady demand in export markets and stable export price trends, most of the Indian processors are looking to expand their business in Indian market.

Vietnam

Table 4.2: Demand and Supply trend of cashew in Vietnam

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CAGR
Production (thousand tons)	205	240	312	309	292	311	309	298	265	252	1.46
Import (thousand tons)	17	26	21	200	250	250	350	395	333	643	50.00
Per cent share of major sources of RCN in total import											
Cambodia	25.8	22.1	25.7	15.8	3.3	2.1	3.4	3.3	19.0	9.6	28.8
Côte d'Ivoire	11.1	14.6	8.9	14.9	7.1	4.5	8.5	6.0	29.4	4.1	42.9
Nigeria	24.0	34.0	23.9	18.5	3.1	1.5	3.2	3.7	20.2	0.0	22.3
Indonesia	25.1	18.3	31.8	23.8	2.3	1.8	6.4	1.0	5.7	4.1	13.7
Ghana	1.2	1.2	1.9	6.3	1.8	1.0	1.1	4.7	9.9	-	80.9
Guinea Bissau	-	-	-	-	2.2	0.5	0.6	1.6	5.1	-	46.2
Others	12.8	9.8	7.7	20.7	80.2	88.5	76.9	79.9	10.7	82.2	83.6
Average Import price (USD/kg)	3.26	3.26	3.26	0.65	0.88	0.62	0.79	1.41	1.00	0.94	-12.42
Total Supply (thousand tons)	222	266	333	509	542	561	659	693	598	895	
Implied Kernel Production (thousand tons)*	56	67	83	127	136	140	165	173	150	224	14.68
Kernel Export (thousand tons)	87	103	115	142	161	176	190	174	218	265	11.73
Per cent share of major markets in total export											
USA	40.28	31.25	32.28	31.75	28.31	29.48	31.59	26.83	27.39	30.67	8.89
China	16.49	20.01	20.88	18.43	19.12	22.46	17.35	21.75	21.78	19.68	13.37
Netherlands	10.82	12.13	10.88	15.28	17.35	13.83	13.08	15.42	11.13	8.85	10.83
Australia	10.70	10.91	11.09	8.11	7.11	6.77	7.24	6.65	6.56	5.32	3.42
UK	5.49	5.46	4.70	5.61	5.24	3.97	3.87	3.25	3.39	3.18	4.25
Canada	4.32	3.71	2.69	2.91	3.36	2.22	2.60	2.30	2.66	3.26	7.51
UAE	0.38	0.48	0.39	0.57	0.74	1.19	1.60	1.53	1.16	1.20	31.62
Russia	1.06	2.45	3.76	3.59	4.15	2.37	3.39	3.67	3.79	3.44	20.77
Others	10.46	13.60	13.32	13.74	14.61	17.71	19.28	18.59	22.14	24.40	21.58
Average kernel Export price (USD per lb fob)	2.22	2.22	1.80	1.94	2.49	2.15	2.65	3.76	3.00	2.83	5.45

* Implied kernel production is assumed to be 25 per cent of total RCN supply. However in some years the exports are more than the kernel production. In these periods production may be underestimated. As per VINACAS, during 2013 Vietnam processed approximately 1.2 million tons of RCN.

Source: Ministry of Rural and Agricultural Development (MARD) Vietnam, UN Comtrade, Vietnam Customs

Vietnam is one among the largest producers of raw cashew nut in the world after India and Côte d'Ivoire. However, to meet the demand of country's processing, huge quantities of RCN are imported into the country. African countries and Cambodia are the major suppliers of RCN to Vietnam.

Import of RCN into Vietnam has been steadily growing over the past 13 years with the installation of many large processing factories. The imported RCN volume and value increased by 45.45 per cent and 32.99 per cent from 2000 to 2013. African countries along with Cambodia are the major supplier of RCN to Vietnam. Hence for smooth trade Vietnam with the help of VINACAS and government has signed a MoU with African RCN supplier countries.

During 2013, Vietnam imported 643.38 thousand tons of RCN worth of 604.59 million USD.

During November 2013, Vietnam Cashew Association (VINACAS) has signed the Memorandum of Understanding with Cashew Importer Association of Ivory Coast (AEC – CI), the Exporters Council of Benin (Benin Conec) and Nigeria Cashew Association (NCAN) mainly to strengthen the relationship between the Vietnam cashew nut importers and exporters of RCN from these countries.

To increase the supply of RCN for processing, during 2010 within the framework of the Golden Cashew Festival in BinhPhuoc province, Vietnam has initiated the programme to develop the cashew plantation in Cambodia and Laos.

Vietnam Kernel Export

Vietnam has achieved a tremendous progress in

cashew export from the last decade. Export of cashew kernels from Vietnam has been increasing consistently. During 1990 Vietnam Cashew Association (VINCAS) is established in order to improve the cashew sector, and from 1992 Vietnam started exporting of kernels seriously. By 2006, Vietnam became the largest exporter of cashew kernels in the world.

Kernel export from 2000 has grown significantly at a rate of 17.7 per cent with respect to volume and 22.6 per cent in value. Middle East countries, European countries, China, Australia, New Zealand, etc are the major export destinations for Vietnam. Vietnam enjoyed a 92 per cent market share of Australian market and 90 per cent of New Zealand market in 2013. Increased processing capacity of RCN, increased food safety standards adoption in Vietnamese processing units, reasonably cheaper prices of kernel compared to India, attracted consuming countries towards Vietnam market.

During 2013, Vietnam reached its high in export of cashew kernels. About 264.86 thousand tons of cashew kernels were exported from Vietnam worth of 1655.45 million USD. Vietnam continues its success journey in cashew kernel export during the current season also. Export volume during first four months of 2014 reached 73 thousand tons worth of 456 million USD, up by 14.5 per cent in volume and 15.7 per cent in value over the same period in 2013.

India is the major importer of broken cashew kernels from Vietnam. Import of broken kernels from Vietnam into India has greatly increased by 61.73 per cent from past seven years (from 2007 to 2013). In 2013, India imported 4265.80 tons of broken kernels from Vietnam worth of 14.61 million USD.



Brazil

Table 4.3: Demand and supply trend of cashew in Brazil

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CAGR
Production (thousand tons)	188	153	244	141	243	221	104	231	82	138	-4.98
Import (thousand tons)					4.5	43.7		44	59	42	-1.76
Per cent share of major sources of RCN in total import											
Côte d'Ivoire								25.10	56.72	31.94	10.83
Ghana								45.86	30.00	68.06	19.68
Others								29.04	13.29	0.00	-
Average Import price (USD/kg)								1.31	0.98	0.70	
Total Supply (thousand tons)	188	153	244	141	248	265	104	275	126	182	-1.24
Implied Kernel Production (thousand tons) *	47	38	61	35	62	66	26	69	31	45	-1.24
Kernel Export (thousand tons)	47	42	43	52	35	48	42	26	25	21	-7.94
Per cent share of major markets in total export											
USA	70.64	64.26	71.28	65.93	61.61	63.84	56.92	62.37	48.69	44.26	-11.88
Netherlands	1.37	2.86	1.93	3.14	5.00	6.72	4.82	10.32	18.34	16.36	21.16
Canada	7.29	7.51	5.04	7.76	6.42	6.28	7.53	6.05	8.55	9.59	-5.58
Lebanon	2.36	3.35	2.34	3.02	3.14	3.56	4.14	2.17	2.86	3.56	-6.08
France	1.58	1.99	1.38	1.36	1.25	1.26	1.02	1.60	2.47	2.64	-4.52
Germany	1.10	1.56	1.24	1.17	1.92	1.16	2.09	1.21	2.01	0.61	-9.29
Italy	3.46	3.49	3.49	3.41	4.14	2.96	3.90	2.31	2.28	3.05	-11.30
Chile	0.15	0.21	0.28	0.28	0.81	0.38	0.68	0.60	1.04	1.12	13.73
UK	1.19	1.95	2.28	2.19	1.59	3.58	4.29	2.04	2.69	2.20	-2.16
Others	10.86	12.83	10.74	11.76	14.13	10.28	14.62	11.34	11.06	16.62	-6.03
Average kernel Export price (USD per lb fob)	1.78	2.03	1.97	1.98	2.51	2.20	2.47	3.91	3.32	2.90	7.42

* Implied kernel production is assumed to be 25 per cent of total RCN supply

Source: UN Comtrade, IBGE

The cashew is native to Brazil but its cashew industry only grew up recently. Previously, the fruits were collected or harvested for juicing. With the development of mechanised processing and government initiatives which prevented the export of raw nuts, the processing industry started to develop.

RCN imports into Brazil were insignificant earlier. From 2008, import of cashew into Brazil started to grow in order to compensate the domestic supplies which were reduced due to consecutive draught years. Imports rose to 9500 tons in 2008, 4500 tons in 2009, 43700 tons in 2011 and 59500 tons in 2012 and dipped to 42193 tons in 2013.

Brazil exports over 70% of the production to all major markets mostly in the form of raw natural cashew kernels (without value addition) of varying different grades and sizes. However, kernel exports from Brazil were decreasing from past several years due to lower production. From past 14 years (2000 to 2013), kernel export volumes were down by 1.99 per cent annually whereas export values were up by just 3.23 per cent annually. From past three year, kernel exports from Brazil drastically declined at a rate of 10.72 per cent per year due to decreased production.

USA is the major destination for Brazil cashew kernels. It constitutes major share in kernel export followed by the Netherlands. However, recently the share is narrowing from 78 per cent in 2000 to 44 per cent in 2013.

Indonesia

Table 4.4: Demand and trend of cashew in Indones

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CAGR
Production (thousand tons)	131	135	149	146	157	147	115	115	117	108	-2.88
RCN Export (thousand tons)	56	66	57	72	57	61	38	42	59	47	-3.43
Per cent share of major markets in total RCN export											
India	71.5	78.1	52.8	52.3	80.1	63.9	32.6	68.6	66.3	41.7	-7.06
Vietnam	27.1	21.4	45.4	47.2	19.4	35.4	67.4	30.6	33.4	57.6	2.34
Others	1.4	0.5	1.8	0.5	0.5	0.7	0.1	0.8	0.3	0.7	-13.39
Average export prices (USD/kg)	0.89	0.84	0.74	0.81	0.90	1.04	1.27	1.34	1.19	1.21	6.02
*Domestic processing of RCN (thousand tons)	75	69	92	74	100	86	77	73	58	61	-2.55
** Implied kernel production (thousand tons)	19	17	23	19	25	22	19	18	15	15	-2.55
Kernel Export (thousand tons)	2.88	3.46	6.85	11.75	10.40	7.63	7.11	4.05	3.67	4.80	0.34
Per cent share of major markets in total cashew kernal export											
USA	23.8	39.0	17.5	18.4	18.1	13.6	13.9	16.5	34.4	41.6	2.02
Canada	9.6	6.9	4.8	1.2	3.1	1.0	0.7	2.8	2.8	6.0	-8.88
Australia	1.8	2.5	0.2	1.1	1.9	3.4	4.0	8.1	7.8	10.9	32.62
India	37.7	8.6	32.0	43.9	58.0	52.3	43.0	32.6	12.1	7.8	-6.59
Germany	3.7	2.6	3.2	2.0	2.9	4.2	7.3	11.8	11.9	8.5	19.47
Malaysia	3.5	1.2	0.5	1.0	2.4	1.6	1.3	3.9	2.1	2.0	6.03
Lebanon	1.0	2.5	2.3	2.2	1.7	2.7	0.2	0.7	5.3	3.7	3.16
Others	19.0	36.7	39.3	30.2	12.0	21.2	29.5	23.6	23.6	19.5	-2.60
Average kernel Export price (USD per lb fob)	1.23	1.75	0.97	0.95	1.16	1.17	1.44	2.52	3.09	3.05	11.60

* Domestic processing of RCN is derived from production-export

** Implied kernel production is derived from taking 25 per cent conversation rate

Source: UN Comtrade, BPS-Statistics Indonesia

During 1990's Indonesia emerged as an important cashew producing country within Asia, helping to boost Asia's position as a prime producer. Indonesia exports about 50 per cent of its raw cashew production. India and Vietnam are the major destination of Indonesian RCN. Cashew processing in Indonesia is limited due to the lack of skill in cashew processing and lack of information on the shelled cashew market. Still some quantity of national RCN production is processed domestically for both local consumption and for export purpose.

Indian and Vietnamese traders converge in the main production centres of Indonesia in November - January every year seeking supplies.

Export of RCN has been decreasing since 2004 at a rate of 3.42 per cent annually due to lowered production. On the other hand, kernel export is increasing at an annual rate of 0.34 per cent. Weather parameters are playing a major role in declining domestic production of RCN.

Major export markets for Indonesian processed kernels are USA, Australia, Canada, Germany, Malaysia, India, Lebanon etc. Among these, the exports of kernels to Australian market increasing significantly over the past years. Australia imports kernels from Indonesia mostly in the forms of raw natural (without value addition) and then kernels are salted/roasted and packed there in Australia.

The major Indonesian ports from where the cashews are exported are Surabaya and Ujung Padang. The other ports are Bau-bau, Maumere, Semarang, and Larantuka.

Côte d'Ivoire

Table 4.5: Demand and supply trend of cashew in Côte d'Ivoire

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CAGR
RCN Production (thousand tons)	141	168	211	251	320	350	360	385	460	480	14.47
RCN Export(thousand tons)	141	168	211	251	312	340	350	278	410	470	12.57
Average Export price (USD/kg)	0.49	0.59	0.43	0.41	0.55	0.50	0.89	0.94	0.80		
Per cent share of major markets in total RCN export											
India	95.94	87.79	92.89	84.89	69.41	71.06	64.38	57.40	64.32	49.94	5.17
Vietnam	3.48	9.82	5.23	14.39	26.29	28.15	35.28	38.48	24.68	49.67	46.22
Others	0.58	2.39	1.87	0.72	4.30	0.80	0.34	4.12	11.00	0.39	17.51
*Domestic processing of RCN	0	0	0	0	8	10	10	107	50	10	
Kernel Export (thousand tons)	0.0	0.1	0.4	0.5	0.8	1.0	1.2	1.5	2.5	N.A	
Average Export price (USD/lb)		1.83	1.52	1.07	2.05	1.60	1.53	1.96	2.69	N.A	
Per cent share of major markets in total kernel export											
USA	-	42.4	18.4	21.7	48.4	60.3	65.8	66.0	55.0	N.A	
Netherlands	-	43.7	73.8	42.6	23.0	13.7	13.7	10.7	14.9	N.A	
South Africa	-	11.2	3.7	3.0	2.1	1.5	1.4	4.6	0.0	N.A	
Others	-	2.8	4.1	32.8	26.5	24.4	19.1	18.7	30.2	N.A	

* Derived domestic processing (RCN production-RCN export)

Source: *FAO Stat, INC, UN Comtrade, ACA*

Côte d'Ivoire's cashew sector plays a major role in meeting the needs and requirements of the processing industries in India and Vietnam.

Major part of produced cashew nut (about 98 per cent) is exported to the foreign countries. The major destinations of IVC's RCN are India and Vietnam. IVC is the largest exporter of RCN in the world with 40.12 per cent share.

Only a small part of the cashew nuts i.e on an average 1.50 to 2.00 per cent of total production, is processed locally. The cashew processing industry in IVC is in its infancy and most factories started operations as recently as 10 years ago.

Recently, ARECA has been changed to new regulatory board as CCA (Cotton and Cashew Board of Côte d'Ivoire). With this new regulatory board, cashew sector in Côte d'Ivoire has become more transparent and organized this year than ever. Ghana border has been closed to cashew trade and strictly controlled. All the cashew traders had to be identified and had to get licenses to be allowed to trade cashew, and a new system of traceability had installed to monitor the whole national trade.

Benin

Table 4.6: Demand and supply trend of cashew in Benin

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CAGR
Production (thousand tons)	45	53	55	60	86	90	70	90	80	90	7.64
RCN Export (thousand ton)	48	55	68	57	86	115	84	125	171	103	12.36
Average export price (USD/kg)	0.73	0.89	0.70	0.69	0.97	0.85	0.99	1.53	1.05	1.00	5.50
Per cent share of major markets in total RCN export											
India	99.88	100.00	99.97	99.99	98.15	98.81	98.13	95.66	91.99	98.99	
Vietnam	0.12	0.00	0.03	0.00	1.55	0.76	1.81	2.91	5.62	0.00	
Others	0.00	0.00	0.00	0.01	0.31	0.43	0.06	1.43	2.40	1.01	

Source: UN Comtrade

Though the cashew production in Benin is lower, it exports more quantity of RCN than what produces domestically, which indicates the cross bordering of RCN. Benin RCN in the world is known for its good quality, hence the neighbouring countries viz., Nigeria, Mali, Burkina Faso, etc. origin RCN gets exported through Benin. There is no exact data on how much of quantity of RCN being processed domestically; however as per ACA, Benin has a capacity of around 13 thousand tons of RCN to process and it processed 1779 tons of RCN in 2012.

India is the main destination for Benin RCN; more than 90 per cent of Benin RCN is exported to India alone. Vietnam imports some quantity of RCN from Benin.

Tanzania

Table 4.7: Demand and supply trend of cashew in Tanzania

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	CAGR
Production (thousand tons)	100	100	94	94	99	79	98	100	129	120	2.23
RCN Export (thousand ton)	67	47	68	43	67	68	89	66	118	123	8.83
Average export price (USD/kg)	1.03	0.93	0.78	0.86	1.09	1.06	1.46	1.74	1.35	1.23	6.13
Per cent share of major markets in total RCN export											
India	99.26	99.77	99.42	93.20	97.72	98.91	97.23	99.38	99.96	99.96	
Others	0.74	0.23	0.58	6.80	2.28	1.09	2.77	0.62	0.04	0.04	

Source: UN Comtrade

Cashew is second only to coffee in importance in Tanzania's export crops with potential to increase foreign exchange earnings and provide employment through processing. Some Coastal regions to the South rely on cashew for 80% of their GDP, making it the main vehicle for poverty reduction on which more than 280,000 growers are directly dependent.

Cashew nut processing sector in Tanzania still remains underdeveloped and insufficiently competitive. Commercial cashew processing in Tanzania began following the independence of that country. African Cashew Processors Company Ltd is the first cashew processing unit established in 1960s with a simple manual processing plant. In 1965, the first mechanical processing factory incorporating Italian technology was installed.

Tanzania exports more than 80 to 90 per cent of its raw cashew nuts. The major destination of Tanzanian RCN is India. Tanzania nut prices are at a higher level as compared to other African nations due to its bigger nuts of 50 to 52 lbs out-turn and the arrival of the crop coinciding with the end of the Indian / West African crop season.

Tanzania also exports processed kernels; as per UN Comtrade during 2013 Tanzania exported around 3821 tons of kernels. The Netherlands, India, USA, UAE, etc. are major destinations for Tanzanian kernels. During 2013, Cashew Nut Board of Tanzania and Cashew nut Industry Development Trust Fund set aside Tsh10 billion (nearly USD 6 million) to boost local processing capacity.

Ghana

Table 4.8: Demand and supply trend of cashew in Ghana

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Production (thousand tons)	16.5	25.0	29.0	34.0	40.5	22.0	27.0	30.0	35.7	40.0
RCN Export (thousand tons)	5	27	22	70	45	32	132	105	170	
Average export price (USD/kg)	0.33	3.05	2.16	0.63	2.65	2.40	0.28	0.03	0.73	
Per cent share of major markets in total RCN export										
India		97.8	92.7	90.9	71.7	68.2	88.6	68.0	69.6	46.8
Vietnam				7.12	23.13	20.02	5.94	15.95	14.01	34.82
Brazil								2.38	9.05	2.65
Others		2.2	7.3	2.0	5.1	11.8	5.5	13.6	7.4	15.8

Source: UN Comtrade, ACA

Though Ghanaian cashew production is low, it exports higher quantity of RCN than it produces annually. The country is considered to be the hub for trading in cashew from neighbouring countries including Côte d'Ivoire and Burkina Faso.

RCN exports from Ghana have increased at a rate of 42.2 per cent, since 2005. India, Vietnam and Brazil are the major destinations for Ghanaian RCN.

The new regulatory mandate of Côte d'Ivoire implicated lots of difficulties to all Ghanaian Cashew Value Chain and Ghana processors have been the most victim of this. As per ACA, during 2012 Ghana processed 13731 tons of RCN.



Chapter 5: Cashew Prices – Analysis and Outlook

Raw cashew (Imported) Tuticorin, India likely to be in the range of 0.95 and 1.25 USD per kg

Raw cashew (imported) price at Tuticorin, India on the weekly chart is currently trading well below the channel support. It may signal room for near term weakness before it could resume uptrend. Raw Cashew (imported) price may hold the support in the region USD 0.95 to 1 per kg. On the higher side resistance is seen at USD 1.15/ kg and then at USD 1.23-1.27 per kg.

Expect raw cashew (imported) price in Tuticorin to recover in the coming months as downside seems to be limited and trade in the broad region of USD 0.95 and USD 1.25 per kg for the rest of the year.

Fig 5.1: Technical view on RCN prices (imported) at Tuticorin port



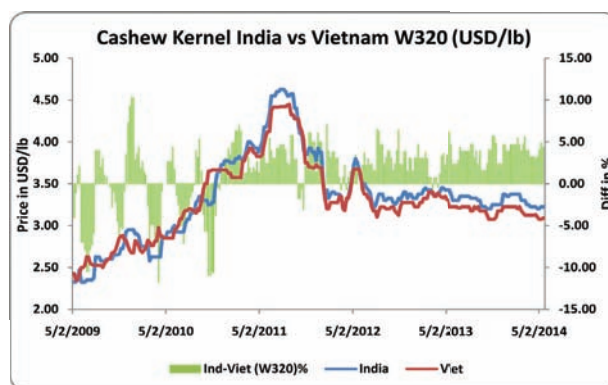
Technical Views on cashew kernel prices

During 90's Vietnam opened its door for kernel importers. Since then kernel exports from Vietnam has grown steadily over the years. In 2006 Vietnam surpassed India's dominance and became the largest exporter of kernels in the world. The reasons may include increased processing capacity, lower domestic demand, adoption of food safety norms, excellence in packaging and last but not the least the price behaviour of kernels in comparison to Indian kernel prices.

If we compare the Indian and Vietnamese kernel export prices over the past five year, most of the time Vietnam-

ese kernel prices were cheaper than the Indian kernel prices. Vietnamese processors/packers sacrificed some price gains to capture export markets share from the Indian processors. Both the premium and lower grades were priced at a lower level.

Fig 5.2: Difference between Indian and Vietnamese W320 grade prices



During first half of 2009 Vietnam W320 prices were higher than the Indian prices; thereafter the prices were lower than the Indian prices. Since April 2013, Vietnam kernel prices were always lower than the Indian prices, at a discount between 1.19 and 6.20 per cent.

Fig 5.3: Comparison between Indian and Vietnam LP prices

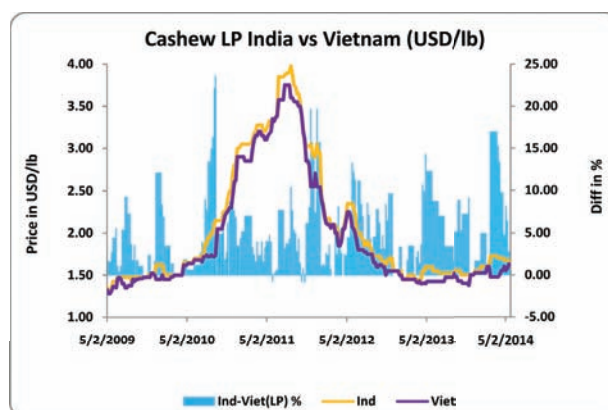


Fig 5.4: Comparison between the Vietnam LWP export prices and Kollam domestic prices

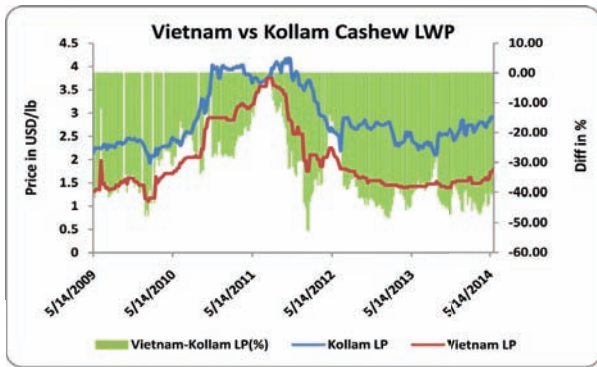
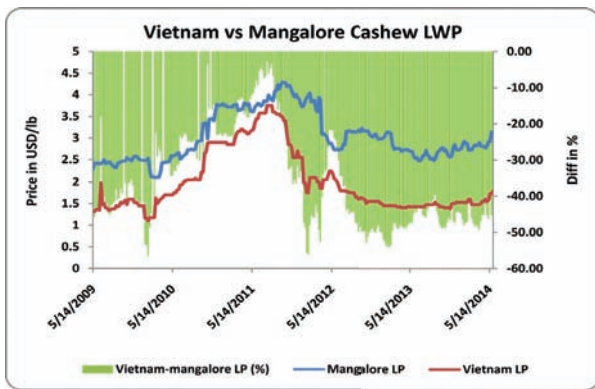


Fig 5.5: Comparison between the Vietnam LWP export prices and Mangalore domestic prices



India is the major importer of broken cashew kernels from Vietnam mainly broken and pieces. Import of broken kernels from Vietnam into India has greatly increased by 61.73 per cent from past seven years (from 2007 to 2013). In 2013, India imported 4265.80 tons of kernels from Vietnam worth of 14.61 million USD. The huge increase in import is mainly due to Vietnam export grades were priced at lower level compared with the Indian grades prices. Lower (up to 50 per cent lower than the Indian domestic prices) Vietnam kernel prices and increase in domestic consumption of kernels are mainly attracting the Indian traders to import more from Vietnam. If we add 45 per cent import duty, then Vietnamese broken kernel prices would be almost at parity with the Indian broken kernel prices.

Increasing volume of brokens as a result of increase in throughput and absence of alternate broken markets is forcing Vietnam processors to sell its brokens at such 'discounts'.



Chapter 6: Currency Outlook for Rest of 2014

Main raw cashew producing countries in Africa such as IVC and Tanzania are likely to witness higher realization for their nuts in their local currency thanks to expected depreciation of their currency against USD going forward in 2014. Currency appreciation is likely to pressurize the export margins for India. Vietnam is expected to continue with a stable currency regime, barring a scenario of escalated tensions with China. Stable Vietnam dong would augur well for the country's export prospects in 2014 as well.

Tanzania Shilling: Gradual depreciation towards 1800 to a USD seen (Range 1625 – 1820)

Tanzania is the fastest growing market in East-Africa and its Gross Domestic Product (GDP) averages around 7% since 2002. Moreover Tanzania and its east African neighbours' (Kenya, Ethiopia and Uganda) are urbanizing faster than BRICS (Brazil, Russia, India, China and South Africa) countries. The International Monetary Fund (IMF) lauds Tanzania for the successful implementation of their economic program supported by the Fund's Standby Credit Facility.

Tanzania's economy has been growing consistently over the years due to investments in natural gas and on increased private consumption. Tanzania's GDP is forecasted to grow further from 7.1% in 2013 to 7.4% in 2014, 7.6% in 2015 and 7.8% in 2016, said World Bank. Tanzania has successfully contained spiraling inflation when it hit 19.8% in December 2011. In particular, inflation averages 6.1% since August 2013.

Tanzania shilling recently (May3rd week) breached well above the long consolidation formation, may signal room for further upward bias going forward. Shilling may retest the 2011 highs of 1810-1820, most probably in Q4 of this year. As long as 1625 holds on a weekly basis, expect shilling to stay higher.

MACD-14 reading is firm well above equilibrium since early February this year, indicating more chance of depreciation against US Dollar in coming days.

Fig 6.1: Tanzania-Inflation

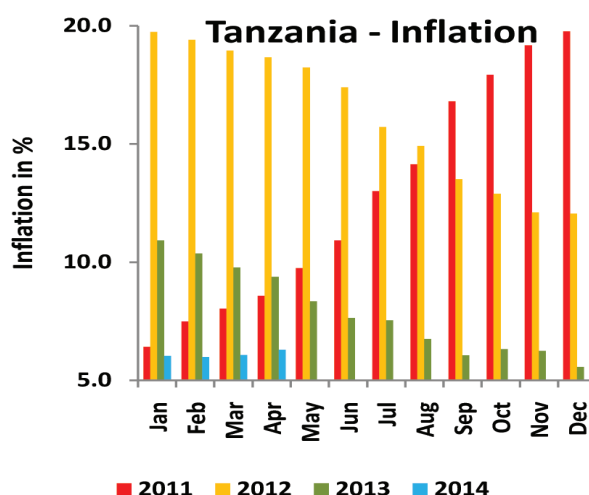
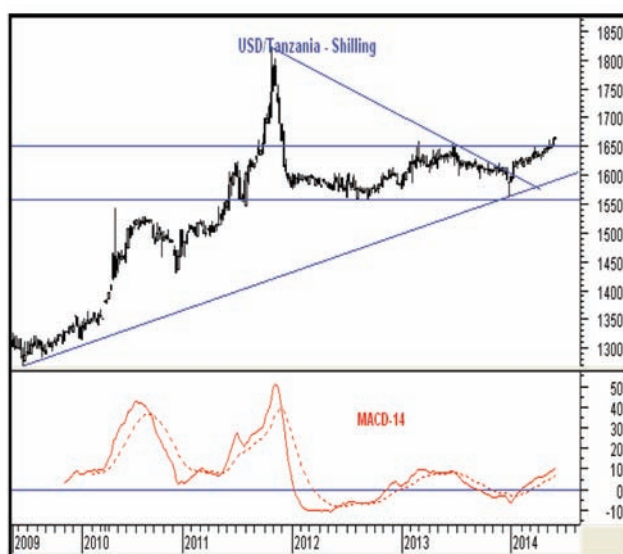


Fig 6.2: USD/Tanzanian Shilling



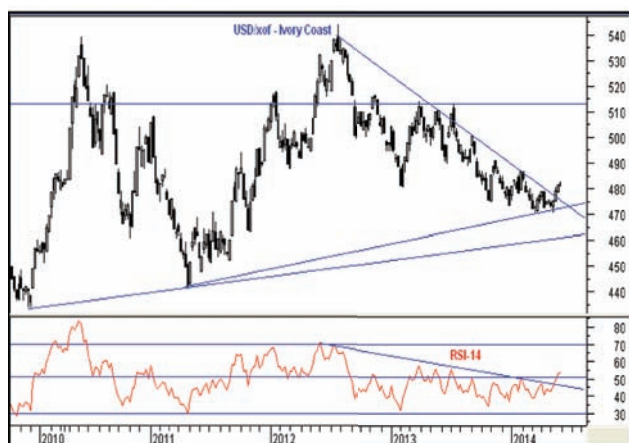
Ivory Coast- CFA franc (XOF): Depreciate gradually towards XOF 510 to a USD (Range 460 – 520)

Ivory Coast, West Africa's largest economy has undergone a rapid economic turnaround since the end of a decade-long political crisis in 2011 and saw economic growth of around 9% 2013.

Ivory Coast currency-CFA franc against the US dollar in the weekly chart is witnessing firm trend in the last few weeks and halted its overall declining trend which began in July 2012. The recent low of 470 is likely to act as a strong support and as long as that support is not violated on weekly basis, expect USD-XOF to move towards the higher resistance of 495-510 levels going forward. RSI-14 reading is well above 50 is also adding further credibility to our view of further depreciation in USD/XOF going forward.

Overall USD-XOF is expected to depreciate further and to trade in the broader region of 470 and 510 levels and this view holds good at the end of 2014.

Fig 6.3: Technical chart of XOF/USD



Vietnamese Dong (VND): Barring political tensions, should be range bound (Range 20330 – 21400)

Vietnam's GDP is forecast to grow in the range of 4.15-4.88% this year as against a growth of 5.42% in 2013,

Tensions between Vietnam and China have risen sharply since China unilaterally announced in May'14 that it would move a deep-water drilling rig into disputed waters.

According to experts, the recent anti-china riots in Vietnam will damage its reputation as a good business environment and have a negative impact on its economic growth.

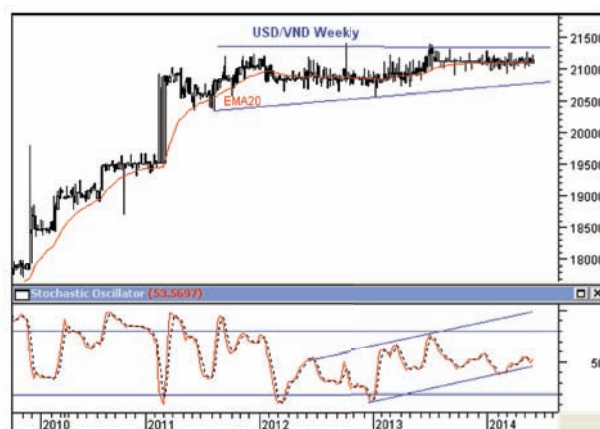
Vietnam GDP rose to 4.96% in Q1 of 2014, according to General Statistics Office.

During third week of June Vietnam's dong was devalued for the first time in a year so as to help exports to grow and to ensure stability of the currency as tension rises over a Chinese oil rig in disputed waters. The State Bank of Vietnam devalued the dong by weakening its reference rate for the currency by 1 percent to 21,246 per dollar.

"After adjusting the dong's exchange rate, the State Bank will take comprehensive measures and use monetary tools to ensure the stability of the foreign currency market," the monetary authority said in the statement.

In the weekly chart Vietnamese dong continues to stay in the broader range of VND20330 and VND21400 to a US dollar since June 2011. Currently, as on May 30, it is quoted at VND21082 against the US dollar. Expect the broader range to continue and only on breach of those levels on either side to confirm further direction. The stated levels may vary if state of Vietnam chose to devalue dong further as and needed going forward.

Fig 6.4: Technical chart of USD/VND weekly



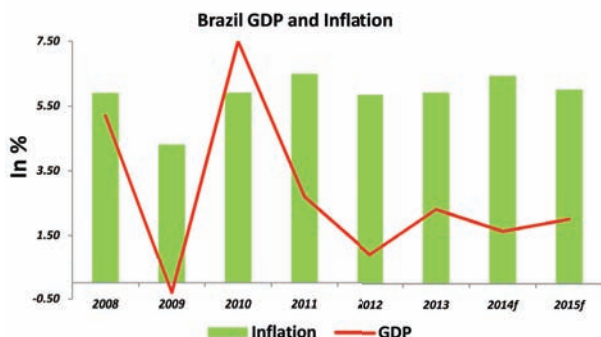
Brazilian Real

Brazil GDP in the first quarter of 2014 expanded by 0.2% on a Q-o-Q seasonally adjusted basis. Investments fell for the third consecutive quarter by 2.1% and exports contracted sharply by 3.3% after registering a growth of 3.6% during previous quarter. In contrast, government spending grew 0.7 percent and imports advanced 1.4 percent.

Brazilian economy is likely to grow only by 1.6% in 2014 as against a growth of 2.3% in 2013. Inflation is forecast at 6.43%, very close to the central bank upper limit target of 6.5%. The Brazilian central bank left interest rates unchanged at 11% in its two-day meeting ended on May-28th. Policymakers have raised the Selic rate nine times

since last April, from a record low of 7.25% to the current level of 11%, aiming to curb persistently high inflation rate.

Fig 6.5: Brazilian GDP and Inflation



Source: *bcb.gov.br*

BRL in 2014 expected to trade between 2 and 2.37 to USD

In the weekly chart, Brazilian Real is trading well below the key trend line resistance of 2.25-2.26 since early April. For the Real to depreciate, it has to settle well above 2.26 on weekly closing basis. In that scenario, expect real to retest the March-2014 highs of 2.35-2.37. On the lower side real may find support in the region of 2.1 and 2.0 and unlikely to gain further.

Overall expect Brazilian real to trade in the broader region of 2 and 2.37 to USD and this strategy holds good till the end of this year.

Fig 6.6: Technical chart of USD/BLR weekly



USD/INR: To gradually appreciate to 56 (Range 56 – 61)

Indian rupee (INR) since the beginning of 2014 has appreciated significantly from the January low of 66.34 to reach the 11-month high of 58.32 against the US dollar during third week of May. INR gained on robust FII inflows

into local debt and equity markets after election results showed BJP storming into power after a gap of a decade, with thumping majority on its own.

Foreign exchange reserves-highest since July-2011

India's foreign exchange reserves improved substantially since February 2014, in anticipation of stable and change in government at the centre. Foreign exchange reserves stood at USD 312.66 bn for the week ended on May 23, 2014, the highest since July-2011.

GDP growth falters below 5%

India's GDP (gross domestic product) for the second successive year registered below 5% growth. In 2013-14 India's GDP grew by 4.7% as against 4.5% growth in 2012-13.

India's growth rate was hit by high inflation, costlier loans, policy paralysis, slowdown in reforms and on poor services and industrial growth.

India's GDP in 2014-15 may grow by 5.4-5.5%, as new government may take steps to boost manufacturing and investment in the coming months.

Fig 6.7: India's GDP Growth Rate

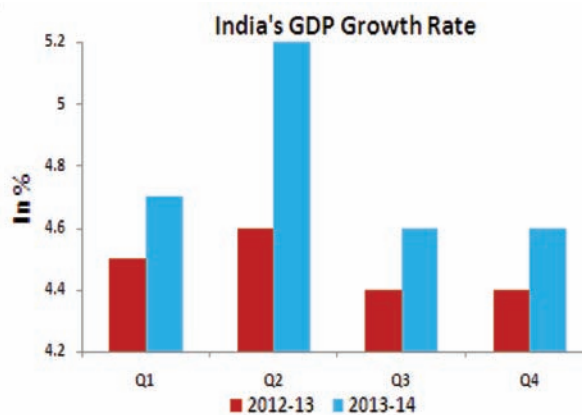


Fig 6.8: India's Foreign Exchange Reserves



CAD contained well below 2% of the GDP

India's current account deficit (CAD) for Q4 of 2013-14 was 0.2% of the GDP (\$1.2 billion) as against 3.6% (\$18.1 billion) during the same period last year. For 2013-14, the CAD was 1.7% (\$32.4 billion), well within the Reserve Bank of India (RBI)'s comfort level of 2.5%, against 4.7% (\$87.8 billion) for 2012-13 as fall in imports was steeper than fall in exports.

In 2013-14 India's gold and silver imports declined by 40% to \$33.46 billion due to restrictions imposed by government on inbound shipments and on steep hike in custom duty to contain the spiraling CAD.

India misses 2013-14 export targets

India missed the 2013-14 export targets of \$325 billion as demand from key markets failed to pick up. Moreover loss of preferential access in Europe and quality issues with drugs has hit exports. Overall exports in 2013-14 increased close to 4% to \$312.35 billion, imports declined by 8.11% to \$450.94 billion. This has narrowed down the trade deficit from \$190.3 billion in 2012-13 to \$138.5 billion in 2013-14.

India's consumer price inflation in April accelerated to three month high of 8.59%, mainly driven by higher food prices.

The Narendra Modi led government is facing daunting task of reviving the economy, controlling inflationary pressures, with the added probable hurdle in form of deficient monsoon as forecasted by IMD, which could affect farm production in 2014-15.

Indian rupee has appreciated substantially after having hit the record low 68.93 against the US dollar in August 2013. During May last week rupee has gained the most in 11-months and reached 58.32 against the dollar.

Rupee may appreciate in the next couple of month towards 56.50-56 levels. Upside is capped in the region of 60 and 61 levels going forward.

Fig 6.9: Technical Chart of USD/INR weekly

**Risk factors**

In case if the recent geo-political events in Iraq escalates further and if Brent crude oil spurt up massively to re-test the March-2012 high in the region of \$125-\$128 per barrel, then rupee may come under pressure. In that scenario one can't rule out rupee depreciating towards 63 levels against the dollar. Moreover, domestic factors notably the presentation of union budget in the first half of July to determine further road map on economy, subsidy cuts, tax sops, etc., will also weigh the sentiments on rupee.



SECTION 2

Cashew Nut Processing

Chapter 7: Cashew Nut Processing Scenario in India

The raw cashew nut processing sector has seen many technological interventions and breakthrough in the various processing stages. In earlier days, cashew processing was mainly manual as it was a work of the artisan whose art of processing was the key to realize maximum value (whole kernel- W grade) from the raw material. Careful roasting of RCN for easy shelling but without having burning or breaking impact on kernel, peeling off the testa (skin) without using sharp tool to avoid the scratch on the kernel and grading the kernel based on the color and size are the key processing steps, where minimum mistake committed by the labour would gain higher return.

What is driving mechanization and automation in cashew processing?

Primarily, the following three factors are driving mechanization and automation trend in cashew processing.

1. Availability and affordability of quality manpower with increasing education and aspiration levels of rural people and better job prospects in urban areas.
2. As the markets develop, there is an increasing emphasis on adherence to stringent quality control standards and food safety norms from customers.
3. Health and safety issues related with the labour involved in the cashew processing and environmental concerns (pollution).

As said well, "***Necessity is the mother of all inventions***", technological interventions have changed the cashew sector.

Mechanization has brought both, favorable as well unfavorable changes in the cashew processing sector. Until then, the sector was manually operated and the recovery of whole and broken cashew ratio used to be 85:15 and this level was processor's maximum tolerance limit. However, with the use of machines in the processing, this ratio has change to a great extent (70:30). Still, processors are able to manage their business with this recovery ratio because there is a great labour scarcity and also increasing demand of broken nuts in the countries like India.

Vietnam, the leader in mechanization

Brazil has been having automated plant for cashew processing for ages. Most of the cashew processed in those plants goes for in-house use or captive consumption. The process followed in those plants is slightly different. However, those plant designs are not suited for India and Vietnam, as they produce unacceptable level of broken kernels. In recent times, Vietnam, the world's largest exporter of cashew kernel, has lead mechanization effort in the cashew processing sector, with focus on maximizing whole kernels. Many large scale fully automatic cashew processing units are successfully operating in the country. India, which is one of the world's largest processors of cashew, is just a step behind to Vietnam; however, most of the cashew processing units in India are operated as semi-automatic units.

A summary of the equipment study done by www.cashewinformation.com on practices and technologies adopted by the Indian cashew processors is presented in the next page.

Fig 7.1: cashew processing flow diagram- mechanical processing

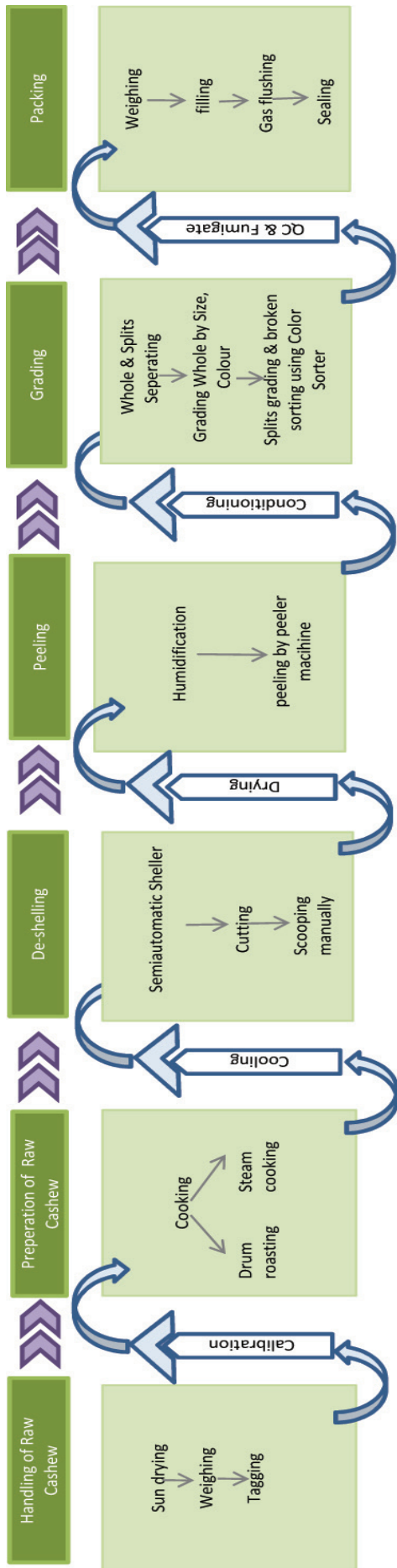
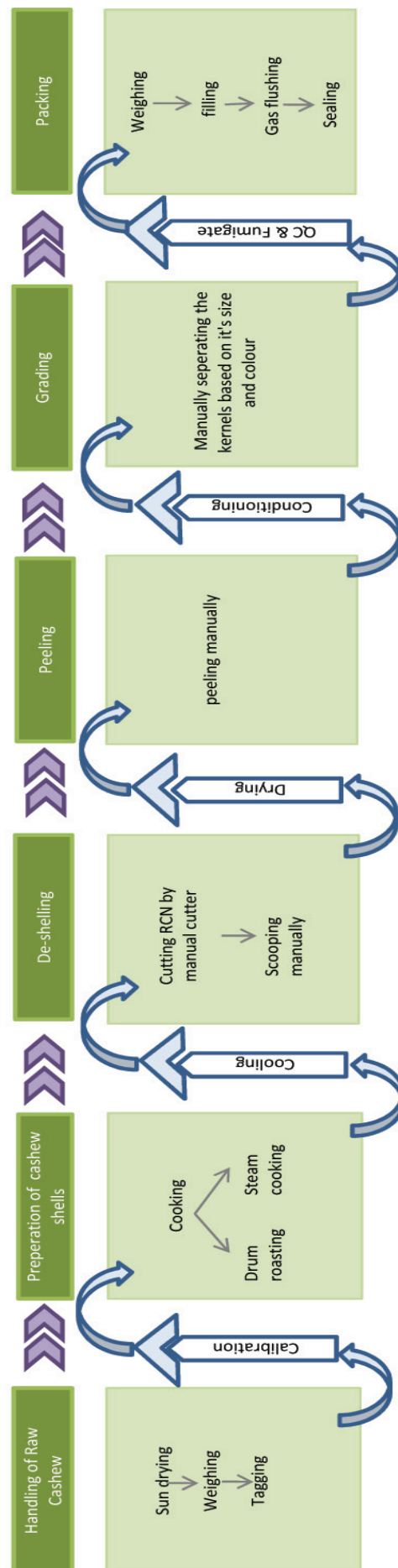


Fig 7.2: cashew processing flow diagram- manual processing



1) Raw Material Handling and Storage

India is a producer as well as large importer of raw Cashew Nuts (RCN) in the world. During the harvesting season (Jan-April) most of the processors stock the local RCN for their future requirement. As the new RCN contains lot of moisture, it needs to be dried to prevent quality loss of the nuts during warehousing. Drying and Calibration of RCN are the key processes done at this stage.

Drying of RCN- The freshly harvested RCN are dried by spreading it on the drying yard under the sun for the period of 1-3 days depending on the moisture content. The nut making rattling sound is the symbol that the raw nuts have been dried properly. However, it is necessary to monitor the drying process as over drying of RCN may cause scorched kernel which may lead to higher breakage during shelling. On the other hand, improper drying of RCN may again cause lower yield of wholes and de-coloring of kernel.

Preparation/Construction of Drying Yard- In general, for drying 100 bags (8000 kg) of RCN around 700 sq. feet of drying yard area is required. The size may differ from processor to processors depending on the total area they possess within their processing premise. The drying yard should be constructed with 1.5-2 inch (4 – 5 cm) thick cement concrete floor over flat solid brick or bolder stones.

Drying Process: Once RCN is received at the drying premises, the processors will check the moisture level by using moisture meter or some traditional method like poking pointed pin or nails and based on which days of drying is decided. Processors will avoid buying the RCN having more than 17-18% moisture as it may be immature. The RCN is spread on the drying yard throughout the day and kept in covered place during the night. Once the RCN is dried, it is calibrated, bagged, weighted and tagged with details before sending it to warehouse. In general, during the warehousing or storage, the RCN will be carrying 6-9% moisture level.

Plate 7.1: Cashew Drying Yard



Calibration Process: It is also called size grading and pre-cleaning of the nuts. At this stage, the dried RCN is separated as per the nut size as well as impurities like dust, plant stalks, mud/stones etc are removed. This practice is newly adopted by the processors as it is not only very useful in efficient utilization of shelling machine but enhancing the manual cutting/shelling rate also. In this process a calibrator/grader machine is used, the machine will have cylinder shaped sieves having whole of various dimensions/size and RCN passed through different wholes will be segregated and collected separately. The size of the whole varies from 17-18 mm to 23-24 mm which may yield 3-5 grades of RCN. However, as per the requirement of the customer the number of grads can vary. In general, in India, the processors would grade the RCN mainly into the three sizes, i.e. small, medium and big.

Plate 7.2: RCN Calibrating in India



Plate 7.3 : RCN calibration process in Vietnam



Plate 7.4: pre-cleaning the calibrated rcn before feeding for steam cooking through elevator



Equipment/machines Used- Calibrator/grader machine of various capacities and sizes are available in the market. The capacity ranges from 1000 kg/hr to 2000 kg/hr and dimensions from 5 feet (length) to 20 feet based to the number of grades sorted by the machine. Some large machines would have attached elevator for feeding and screw conveyor for separating the nuts. A simple grader machine with manual feeding options of 1000 kg/hr capacity would require 1 HP (horse power) motor and based on the additional attachments, it may increase up to 4-5 HP. Selecting the capacity of machine is irrespective of plant capacity as the raw nut is stored after calibrating, in general the size or capacity of this equipment is 3-5 times higher of the processing capacity.

Storage/warehousing- Dried, cleaned, calibrated, bagged and tagged/marked RCN is stored in warehouses for future use. Jute bags are used for bagging RCN and 80kg is the standard quantity stuffed in a bag. Based on the origin, grade, purchase date etc; different lots are created, bagged and stacked accordingly. Warehousing is an important activity not only from the safe storage point of view but also from the traceability of the nuts point of view.

Construction of Warehouses- A lot of guidelines are available on the civil construction of the warehouse. Processors will follow the guideline as per their convenience. In general, the floor of the ware house should be 1.2-1.5 meter above the ground level, flooring should be done using solid bricks and cement plaster above, structure height of 4.6m from plinth level of the building and single span of tubular truss with color-coated dyna sheet roofing.

2) Preparation for Processing- Steam cooking or Roasting of Raw Cashew Nut (RCN)

The raw cashew nut processing starts with cooking process. It helps in softening the outer cashew shell so that cutting or shelling becomes easy. There are three methods of cooking available in the cashew sectors, i.e. fire roasting, steam cooking and oil bath roasting.

Roasting is a traditional method and mostly abandoned now. In this technique raw cashew nuts (RCN) is roasted on the steel/iron tray directly heated by the firewood where the shell gets burnt.

Plate 7.5: Boiler & Steam Generation- Vietnam



Steam cooking is the most adopted method as of now. Here the raw nuts are cooked in a GI/steel vessel for 20-30 minutes using steam generated through the boiler (mini or large). Thereafter, it is cooled down at the room temperature for 18-24 hr. The steam cooking also has two different sub-methods, where the static or fixed cooking vessels or rotating drum steaming process is used. The static method is more common in India whereas the second one is popular in Vietnam where large quantity is cooked and operation is mechanized. The static steam cooker generally comes in sizes of 100 kg to 320 kg RCN per batch and bigger; in India minimum 320 kg capacity cookers are more popular. Based on the batch processing quantity, the number of cooking vessels is determined. The rotated steam cookers come in bigger size which may have capacity of carrying equivalent or more than 640 kg RCN per batch.

The additional attachments like feed elevator, screw conveyor to transport the cooked RCN and another elevator to feed at the cooling tank are used by the processors depending on the batch size, extent of mechanization and space availability. Boiler is used as source of steam to cook the RCN. As per the steam requirement, various size of boilers is available. The steam generation capacity of boilers ranges from 60 kg per hour (hr) to 2000 kg per hr and more. This technology has given great flexibility to the processors of different processing capacity; even a small processor with 8-10 bags/day (640 – 800 kg per day) processing capacity can adopt two cookers with mini boiler for this clean operation. This mini/baby boiler is a hand stoked fire tube boiler that generates steam at 7.0 –8.5 kg/cm². Fuels like roasted cashew shell or de-oiled cake and/ or other firewood etc are fed manually (about 2 to 3 kg fuel once in 15 to 20 minutes) at the bottom of the boiler.

Plate 7.6: Cashew steam cooking plant



Plate 7.7: Mini boiler for steam generation



Plate 7.8: Unloading the steamed RCN



Plate 7.9: manual checking of cooked RCN



Plate 7.10: unloading the cooked RCN for cooling



Oil bath method is mainly used in Vietnam and Brazil also, where raw cashew nuts are passed through the heated Cashew Nuts Shell Liquid (CNSL) oil at the level of 190-200° C for the period between 1-2.5 minutes. During the process, the RCN gets heated and shell releases the oil into bath. Later, the roasted nuts are brought to the centrifuge to remove/recover the oils from the nuts. Once it is cooled and dried the nuts may directly go for shelling as it is or mixed with saw dust. This is also an automated process. Both rotating steam cooking and oil bath method are adopted where large scale processing is done.

Plate 7.11: Automated RNC cooking plant



Plate 7.12: Automated RCN cutting/shelling- Type 1



Plate 7.13: Automated RCN cutting/shelling- Type 2



Plate 7.14: Automated RCN cutting/shelling- Type 3



Initially there were high percentage of un-cuts 25-30% and broken nut 8-12% recovery reported but equipment manufacturers have overcome these by modifying/altering the machine.

Some of the major improvements in shelling in recent times are (1) Calibration of nuts into 3 or 4 size ranges prior to feeding into the sheller; (2) feeding mechanism; (3) easy dissembling and maintenance of the machines/blades; (4) improvements to reduce oil contamination on the nut through automatic suction of shells; (5) scooping mechanism and (6) optimization of power consumption.

Plate 7.15: Manual cutting/shelling of RCN by hand and leg operated tool



At present, all three types of shelling methods are operational world-wide; however, shift to mechanical from manual is now taking place at good pace. Availability trend of labour, plant capacity, investment capability and business models are the key factors determining the extent of shifting from manual to mechanical. For example, a labor can cut 45-50 kg of RCN in a shift (8 hr) whereas, the similar amount of cutting can be done in an hr with the help of machine; average cost of single shelling machine of 30 kg/hr capacity would be around INR 150,000 (USD 2500). The mechanical shelling machines are operated using electricity. So availability of electricity is also a key issue.

In India, shelling machine has become fast moving equipment among the cashew processors. The large capacity operators are now shifting and new entrants are necessarily adding shelling machine in their plant. Some organic cashew processors are now completely using shelling machine. However, the un-cut RCN from the shelling system and scooping are still processed manually. Areas like Odisha and West Bengal in India use more labour than machine due to availability of labour. Large processors are now using manual and mechanical shelling to the average ratio of 40:60.

Plate 7.16: Auto-shelling process in Vietnam



Plate 7.17: Horizontal RCN Cutter- Vietnam



Plate 7.18: RCN manual scooping



4) Drying/heat treatment of shelled cashew- pre-peeling treatment

The de-shelled nuts will have high level of moisture which makes testa/skin to hold tightly to the kernel. This layer/skin needs to be loosened to ease the process of removing it in further steps. At this stage, shelled cashew is dried or roasted in the oven/hot house to reduce the moisture level so that the testa/skin can be peeled out easily. This is also a crucial stage where efficiency could determine the breakage of kernels.

Plate 7.19: Cashew kernel drying tray



Three types of systems are available for drying the nuts before peeling. The dryers are like large chamber or metal box in which perforated metal trays are placed, hence these are also called tray dryers. These systems or methods differ based on source of fuel used.

- (i) Heat exchanger
- (ii) Steam hot house and
- (iii) Electric hot house

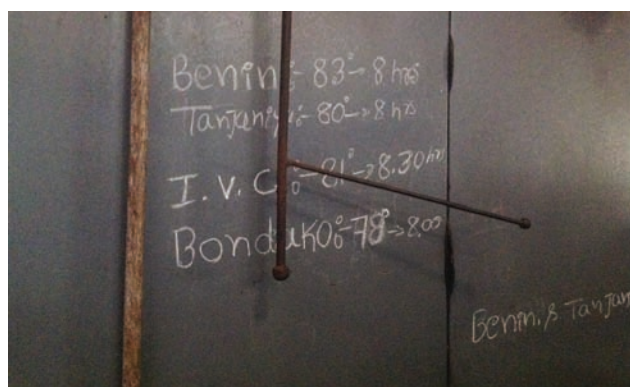
Heat exchanger: Heat exchanger basically has five parts namely, insulated chamber, heat exchanger, ignition chamber/furnace and insulated pipes and a chimney. Cashew kernels are kept in aluminum trays stacked in a portable trolley in an insulated hot chamber. The Blower maintains a uniform circulation of air at desired temperature 75-85 ° C inside the hot chamber. Heat Exchanger is fired by Cashew Shell cake in furnace heats up the air.

Steam hot house: Steam cooking of cashew shells has an advantage, as the same hot steam can be used for heating up the hot chamber.

Plate 7.20: Cashew kernel drying/roasting –borma dryer



Plate 7.21: Cashew kernel drying/roasting –borma dryer (with instruction for operator)



Electric hot house: In this method, electric power is used to heat up the hot chamber which holds the aluminum trays fed with cashew kernels.

Fuels used for the purpose are firewood, cashew shell cakes and power/electricity. Earlier there has been separate chamber for the drying kernel as firewood and other burning materials were used to generate heat. Now a days, mostly electrical and steam based dryers are used. Processors who have higher capacity boiler utilize

the excess steam to be circulated in the dryers. Electrical dryers are also popular but mostly used by the small size processors or those who could not install large capacity boiler at their premises or those processors who could not alter/upgrade their existing set-up to steam due to various reasons.

Currently, batch dryers are in use; however, experiments are going on to move to continuous dryers. Such continuous dryers are useful only to the large capacity/size processors. Per batch drying process takes six to nine hours, depending on the moisture level present in the kernel during shelling process. The kernels are maintained at the temperature of 75-80°C; during this period the trolleys placed inside are shuffled for uniform drying. Once, hot treatment is done, the kernels are allowed to cool for a day or for a lesser time if humidity is higher.

The key features of the dryer are: control panel fitted with electronic digital indicator controller, Timer, indicator lamps, main on/off switch, motor on/off push buttons and mode selector switch, HRC fuses motor and heater contactors. The inside wall of the dryer is usually made of 18 SWG thick Mild Steel (MS). In the dryer mainly four number of trolleys are used and number of trays placed will depend on the size/capacity of the dryer, also the trolleys will have wheels made of heat/fire proof material.

Humidification

Humidification (Moisturized by water-mist) as a separate process is a new concept in the cashew processing. It has become more popular after introduction of auto peeler or peeling equipment. In this process, the moisture level in the kernel is enhanced up to 5-6% which is helpful in reducing the breakage of nuts during mechanical peeling process. In this process (Humidification) which is also called thermal shock treatment, the kernel expands by absorbing the moisture and skin/testa loosen further. There may be re-heating treatment (for short duration of 20-30 minutes) in case the kernels have got more moisture. In the earlier days, processors used to cool the kernel for a day or so which was sufficient to enhance the moisture level for manual peeling. There are traditional as well as modern methods available with processors to humidify the kernels at the desired level. Traditionally, in place of humidification, the kernels kept in trays are spread in a room so that it absorb the moisture present in environment. Now-a-days, humidifier chamber has been developed which again uses steam to increase the

moisture content in the kernel. Swiveling type humidifier and float valve mounted on the caster wheel of various capacities are the key technologies available for modern humidification process.

5) Peeling of Cashew Kernel

Peeling is the last process from where cashew kernel appears in Ready-to-Eat form. At this stage, all the inedible parts/layers are removed from the kernel, the price enhancing value addition processes like grading, sorting, packaging etc start from here. Peeling is the process by which the testa or outer skin attached to the cashew kernel is removed. The process looks simpler but a lot of care needs to be taken at this stage as around 60-75% of the processing cost is added up in the output recovered from here. Peeling is done through two processes, viz. manual and mechanical. In the manual process, the roasted/heat treated kernel is rubbed softly between the finger or palm of the hands to remove the testa. In the mechanical process, the humidified kernel is fed in the machine in which it passes through the rotating cylinder fitted with brush where the testa comes out. The testa is then separated by blowing air flow generated through the compressor.

Plate 7.22: Machine peeling of cashew kernel



Vietnam is believed to be the inventor of cashew peeling machine in the world. Now almost all major cashew processing equipments manufacturers in the world have developed their own competency in cashew peeling machine. This machine is the most selling cashew processing equipment after shelling machine. As stated in the shelling section, the mechanization of this segment has also emerged due to the unavailability of labour and increasing quality standard norms from the buyer's side. High level of broken (11-20%) compared to the manual peeling

(5-10%) and yield of 20-30% un-peeled nut are major drawbacks of this machine.

Most of the cashew Peeling Machine works on pneumatic principle. These machines are usually of higher capacity above 100 kg/hr, but some Indian manufacturers also provide small capacity peelers of 60-70 kg/hr. These small capacity peelers yield higher broken nuts (25-30%) as well as unpeeled nut (55-65%) compared to the higher capacity machine. Variable speed compressor is a new addition in the auto peeler as it can control the power consumption by adjusting the speed according to the peeling needs. Auto peelers come in one, two and three feeding head system. It can also be fed using conveyors to minimise the human interference. Now, the peeling process is driven by the conveyor system (for both feeding and receiving). At the receiving end, the conveyor will be partitioned with 0.5 or 1.0 inch high rubber walls in two sides where the unpeeled kernels are placed and it will fall in the separate collection bins. This system is helpful to continuously sort unpeeled or partially peeled nuts.

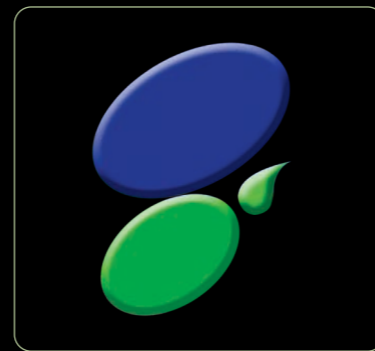
Plate 7.23: Compressor of peeling machine



In India, the peeling machine is definitely getting adopted by the cashew processors at a fast pace. However, the small size processors who have sufficient labour are still peeling manually; on the other hand, some processors who do not have labour prefer to get peeling done through job work. The un-peeled nuts are usually processed manually by the labour rather than reloading it to peeling machine which yield higher percent broken of nuts. Small processing units, mainly the cooperative societies or self help group (SHGs), outsource peeling work to group of ladies from nearby places. Here the ladies collect the un-peeled kernel from the processing units, do the peeling at their home and bring back the peeled nuts along with all by products like broken, dust, husk etc. This has also been practised in the "Satellite Cashew Processing Unit" concept in Vietnam, although with slight



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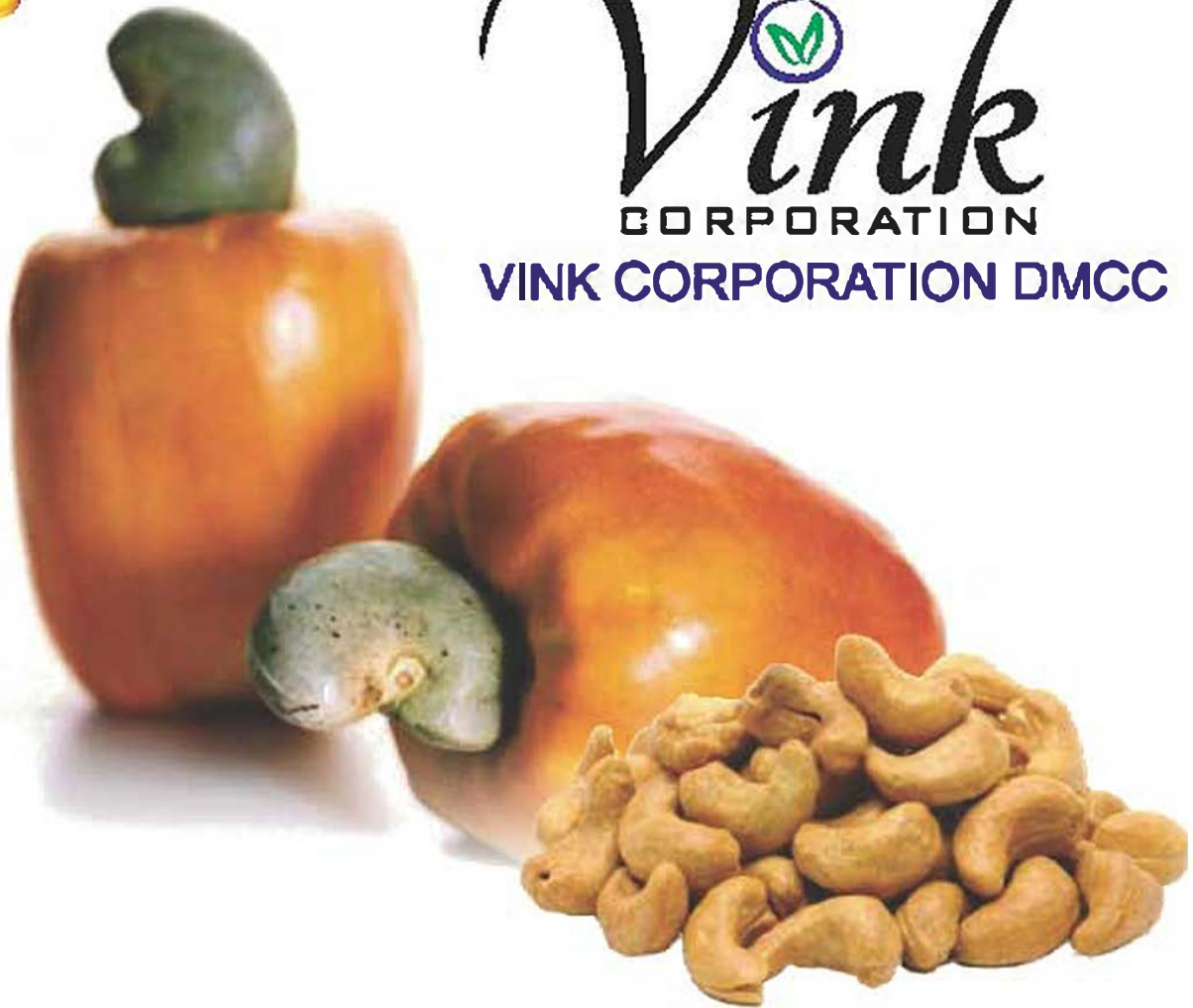
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M-171-1 CASHEW SHELLING MACHINE

TECHNICAL DETAILS OF THE MACHINE

Height	-141cm
Width	-46cm
Length	-50cm
Net Weight	-110kg
Drive	- Motor Driven mechanically operated unit with automatic nut feeder
Motor	- 220v, 0.5HP, Single phase AC motor
Drive belt	- A-58-V belt
No of Feeders	- 02 Nos

Out Put

Processing rate (Raw Cashews)	-15kg -25kg/ Hour
Full Kernels	-95%
Splitting & Breakages	-5%

Other Details

Number of operators	-01
Noise	-Very low
Required skills	- None
Process management	- Easy
Manufacturing Practice	- Easy to maintain
Contamination with cashew nut Shell liquid	- Very low

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Benefits:

- ★ First-hand experience of successful business models in operations in cashew sector
- ★ Provides perspective on various technologies used, their benefits and limitations
- ★ Helps understand the various policies and programmes of the government along with their effectiveness
- ★ Provides a first-hand feel of by-product utilisation and opportunities therefore
- ★ Get an 'experience' of benefits of developing domestic market for cashew kernel

Details:

A typical study tour may be for 7 to 10 days duration with visits to progressive farms, processing factories (small as well as large), by-product utilisation factories, visit to markets, meeting with importers of raw cashew and exporters of kernels and meeting with associations. Recommended team size for effective learning is under 10.

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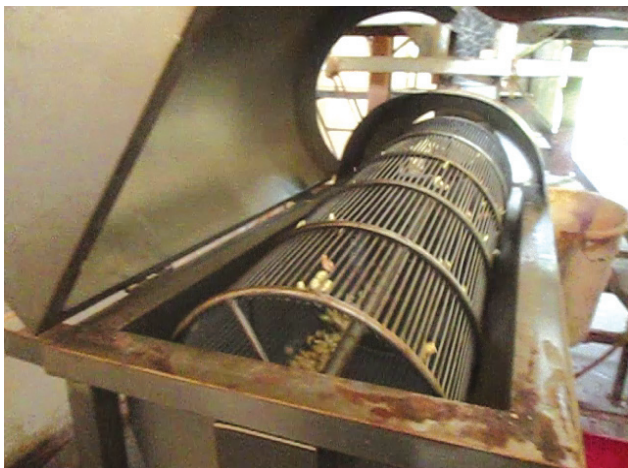
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modifications (In Vietnam the workers come to a satellite centre and perform operations such as manual shelling and manual peeling).

Plate 7.24: Cashew kernel separator cylinder of peeling machine



6) Conditioning the Peeled Nuts/Kernel

As stated in the above process, the cashew kernel is treated through the humidification process to enhance the moisture content (4-5%) for peeling in the machine. The moisture level above 4% at the time of final packing is not preferred as it may cause fungi infestation; low moisture level below 2% is undesirable as it causes breakage of kernel during processing and shipment. It is desirable that the moisture level in the kernel at the time of packing should be 3%. Once the kernel is peeled, it again goes for drying/roasting process to maintain the standard level of moisture content (the moisture content in kernels need to be reduced to three percent as per the export standard norm), this process is called 'Conditioning of the kernel'. Hot drying machine called 'Dryer' is used for this purpose. The processors have choice to either use the same 'Borma Dryer' earlier used for un-peeled nut or may go for separate dryers (electric). The processors use electric dryers for drying the kernel up to 400-450 kg per batch for five to six hours. These dryers would have heater of, on an average, 1 KW in various numbers as per the capacity or size of the dryers. In general, machine peeled kernels are dried in the drier at 40-5 ° C for about four to five hours, however the duration varies based on the moisture content present in the kernel. But, those processors who do manual peeling of kernels will not raise the moisture instead retain three percent moisture only. Thus, manual peeling usually does not require drying of kernels.

7) Grading/Sorting/Cleaning the Cashew Kernel

Cashew kernel prices are based on the various grades specified by the market. These grades are defined as per the size, color and body texture etc. At present more than 24 grades of cashew kernel are traded in the markets. Women employees are largely used in grading/sorting/cleaning section. These skilled ladies have all expertise to correctly select the kernel for specific grades. Technology providers are still experimenting with the grading machine; to a certain extent they have succeeded also (grading the kernel for 5-8 grades based on the size, color and texture) but still incomparable to the human grading methods.

Plate 7.25: Manual Grading of the Cashew Kernel



At first step, splits, broken and whole are separated, this is mostly done using vibrator separator machine. Once the wholes are separated from others, they are graded using the grading machine. The grader could grade the kernel as per the specific size (mostly six to eight classifications). These nuts are then given for the color based grading. For grading broken into various grades (as per the size), mechanized wire-mesh sieves are used.

Plate 7.26: Cashew kernel size grading machine for wholes



Women labourers are employed for the grading job in almost all the cashew processing countries. These ladies will be given a certain quantity (in terms of weight) of cashew kernel to be graded and separated. Graded kernel is taken back at the end of the day. A supervisor/inspector will verify/inspect whether the graded nuts are as per the specification or not. To be more precise, wholes and splits kernel is distributed to the labour so that grading/sorting can be easier and convenient for them. The wages paid for grading and sorting the split kernel is almost double than the whole kernel. In India, labour is paid INR 2.50-3.0 per kg (USD 0.04-0.05) for grading and sorting the wholes and INR 4.5-5.0 per kg (USD 0.075-0.08) for splits. In general, an individual skilled labour can grade 40-60 kg of cashew kernel in a shift (8 hr.), however the productivity differ based on the skill level and types of nut taken for grading.

Plate 7.27: Cashew kernel size grading machine for splits and broken



India has a good demand for broken cashew. Indian food and snack industry has requirement of various types of broken cashew based on the size, color and shape. Introduction of color sorters has really made the path convenient for the broken cashew. The color sorter sorts the mixed kernels fed into the system after diagnosing color difference among kernels. Currently two types of color sorters are used by Indian processors viz. camera based and a sensor system. The sensor based color sorter is found to be more effective among the users.

Plate 7.28: Different grades of cashew kernels



8) Packaging the Cashew Kernels in Required forms

After grading and sorting the nuts/kernels into various grades, the last process is packaging. Before packaging a final Quality Checking (QC) process is done, in which the graded nuts/kernel is sent for dust removing and metal/hair detection process. Both, dust removal and metal detection processes are mechanical. In the dust removal process, kernel is passed through a closed chamber where pressurized air is used to blow out the dust and light particles. The metal detector process ensures that cashew is not contaminated with ferrous metals; the equipment will have the in-built online metal detection program.

Plate 7.29: Vita packaging machine for tin packing



Once the QC process is over, the final packaging process starts. The kernels are packed in the desired packaging size and materials (Tins, poly bags etc). Packaging machine for specific types and purposes are available in the market.

Exporters of cashew kernel are now adopting complete semi-automatic packaging line for both bulk as well as retail packs. As per the export market specifications, the bulk cashew kernel needs to be packed in multilayer flexible pouches; gas flushed and sealed – 25 pounds net per pouch. In this process, the cashew kernel passed through the QC is filled in the poly bag, weighted manually and then sealed by flushing Carbon-di-oxide (CO₂) and/or nitrogen gas in a specific dosage and using vacuum packing machine.

Plate 7.30: Tin sealing/soldering



Tin packaging is most popular in India, as the domestic bulk market and middle-east market accepts the cashew kernel packed in this type of packaging. Vita packing machine is used for tin packing of cashew kernels. In this process the filled tins are vacuumised and injected with inert gas viz. Nitrogen or Carbon-di-oxide. The gas infused tins are sealed manually, i.e. the tin cap is soldered using lead free solder.

Tin filling machine, Vita Packaging machine, Pouch packaging machine and carton sealing/strapping machine are the key equipments used for packaging segment.

Plate 7.31: Modernised cashew kernel packing unit



Plate 7.32: Modern cashew kernel packing unit- quality check and inspection



Plate 7.33: Vacuum packed kernels



Plate 7.34: Final packaging of vacuum packed kernel in carton- manual strapping



Plate 7.35: Final packaging of vacuum packed kernel in carton- machine strapping



Packaging material- The cashew kernels are packed in “modified atmosphere packaging”. As per the standard norms, the cashew kernel packaging should be in an “inert atmosphere”. An inert atmosphere is created by removal of air which makes the inside of the container free of oxygen. This can be done by having a vacuum pack or infusing it with an inert gas, such as nitrogen. Vacuum Packaging Bags are mostly used for bulk packing the cashew kernels. The material is manufactured by using various technology of Multilayer Co-extrusion with a blend of various Hi-tech polymers. The bags are vacuumised and flushed with Nitrogen. The common specification of the packaging material is 19 inch X 27 inch X 160 & 175 micron for 25 lbs. Also, 23 inch X 31 inch X 160 & 175 micron for 50 lbs packing bag for high barrier properties nylon content bag is used.

Fumigation- Cashew Kernels are fumigated before packing, as many buyers require the fumigation to be done on the finally packed cashew kernel before dispatching it for the shipment. This process is undertaken by the professional agencies that have expertise in the fumigation and also authorized eligible to issue compliance certificates accepted by the buyers. Aluminium Phosphide (Phostoxin) is the key ingredient used for fumigating cashew as

its exposure periods are higher (typically 72 hours) and is not lethal to all insect eggs. The process is done within the closed chamber. Methyl Bromide cannot be used in cashew kernels since the kernels have oil content and the fumigant will be absorbed. Carbon dioxide Fumigation is an excellent method which can be used for all cashews - Organic and Conventional, However, this is time consuming. Most of the Shipments from Vietnam are subjected to fumigation by Aluminium Phosphide (Phostoxin).

Plate 7.36: Rotating Steam Cooker for RCN- Vietnam



Table 7.1: Decision-making criteria for selecting most appropriate equipment for cashew processing

Sl.No.	Crucial Parameters	Typical Statistics
1.	Projected Capacity	4 MT per day
2.	Total no. of workers intended to be employed	125 - 150 Nos.
3.	Space availability & total built up area	1 Acre / 12000 Sq. ft built up area (excluding Raw material storage space)
4.	Power availability	100 HP
5.	Working Capital	Based on individual capacity
6.	Market potential for Sales	Based on Survey
7.	Port connectivity for Import / Export	Based on Location
8.	Open land / Drying yard facility	0.5 Acre
9.	Water availability	4000 to 5000 Ltrs considering [industrial & domestic consumption]
10.	Level of Mechanisation preferred	Selectively mechanised to optimise the yield of whole kernels and minimum broken
11.	Provision for expandability	25%

Based on the above parameters a typical list of equipments required to process assuming 4 MT RCN / day would be as follows:

Table 7.2: Principal Equipments:

Sl.No.	Principal Equipments	Qty	Capacity	Power reqd.	Working space reqd.
1	Material Handling Equipments for the Drying yard	1 Set	10 -20 MT/ day	5 HP	Mobile Eqpt
2	Raw Cashew Nut Sorter	1 No.	8 Mt / day	2 HP	400 ft2
3	Elevator for loading RCN into Sorter	1 No.	12 Mt / day	2 HP	100 ft2
4	Boiler	1 No.	300 kg /hr Steam Generator	2 HP	500 ft2
5	Cookers	2 Nos.	320 Kg /hr	---	250 ft2
6	Elevator for loading RCN into Cookers	1 No.	12 Mt / day	2 HP	100 ft2
7	Automatic Cutting machines	25 – 32 Nos.	160 Kg / Machine / day shift Raw Cashew Nuts	16 HP	2500 ft2
8	Steam Drier	2 Nos.	1000 Kgs/ Drier/ day shift	4 HP	1000 ft2
9	Humidification	1 No.	1500 Kg Kernels / day shift	0.5 HP	150 ft2
10	Peeling Machine including Compressor	1 Set.	1600 Kg Kernels / day shift	32 HP	250 ft2
11	Peeled kernels sorting conveyor	1 No.	1600 Kg Kernels / day shift	0.5 HP	100 ft2
12	Colour Sorter	1 No.	1000 Kg/ day shift	0.5 HP	75 ft2
13	Kernel Grader	2 Nos.	1200 Kg / day shift	6.0 HP	500 ft2
14	Pieces Sizing Machine	1 No.	1000 Kg / day shift	1.0 HP	100 ft2
15	Husk Winnowing Machine	1 No.	250 Kg Husk / day shift	3.0 HP	100 ft2
16	Tin Filling Machine	1 No.	1500 Kg Kernels / day shift	1.0 HP	100 ft2
17	Vita Packing Machine	1 No.	2000 Kg Kernels / day shift	1.0 HP	75 ft2
18	Pouch Packing machine	1 No.	2400 Kg Kernels / day shift	7.0 HP	300 ft2
19	Carton Strapping Machine	1 No.	150 Cartons / day shift	1.0 HP	75 ft2
20	Utility Equipments:				
a.	Wheel Barrow	2 -3 Nos.			Mobile Eqpt
b.	Scooping Tables	24 -32 Nos.			2000 ft2
c.	Peeling Tables	5 – 8 Nos.			750 ft2
d.	Grading Tables	4 -6 Nos.			500 ft2
e.	Platform Trolley	1 -2 Nos.			Mobile Eqpt
f.	Crate Trolley	2 -3 Nos.			Mobile Eqpt

Courtesy: Abhay Engineers, Mangalore, India

Ministry of Environment and Forest Notification
New Delhi, the 1st January, 2010

G.S.R.1 (E)- in exercise of the power conferred by section 6 and 25 of the environment (protection) act ,1986(29 of 1986),the central government hereby makes the following rules further to amend the environment (protection) rules , 1986, namely:-

1. These rules may be called the environment (protection) amendment rules, 2010. They shall come into force on the date of their publication in the official Gazette.
2. In the environment (protection) rules,1986,in schedule 1 ,after serial number 102 and entries relating thereto, the following serial number and entries shall be inserted , namely:-

Sl. No.	Industry	Parameter	Standard	
(1)	(2)	(3)	(4)	
*103	Cashew seed processing industry	A-Emission standards		
			process	Limiting concentration in mg/Nm ³
		Particulate matter	Roasting	250
			Cooking(roasted shell/ deoiled cake as fuel)	150
			Borma oven heater(roasted shell/ deoiled cake as fuel)	150
				Minimum(meters)
		Stake height	Roasting	20
			Cooking	15
	Borma oven heater	15		

Note:

- All value of particular matter shall be corrected at 4% Carbon Dioxide.
- Each stake shall be at least 2 meters above the top most point of the building, shed or plant in the industry.
- The emission from 'Dog-House' shall be channelized along with roasting –drum emissions and shall pass through wet scrubber.
- Bio-gas shall be installed if roasted shells are used as fuel in the unit.

Sl. No.	Industry	Parameter	Standard
(1)	(2)	(3)	(4)
		B-effluent standard	
		Limiting concentration in mg/l, except for pH	
			Inland surface water Public sewer Land for irrigation
		PH	6.5 to 8.5 6.5 to 8.5 6.5 to 8.5
		Oil & greases	10 20 10
		BOD(3 days,27 degree Celsius)	30 250 100
		Suspended solids	100 600 200
		phenols	1.0 5.0 -"

[F.NO.Q-15017/23/2008-CPW]

RAJNEESH DUBE, Jt. Secy.



Chapter 8: Project Profile for Establishing Cashew Processing Unit

In India, to facilitate more cashews processing/value addition and involve farmers in the cashew value chain to maximize their return, cooperative processing society scheme is promoted. In this, to start cashew processing unit, as initial capital, group of cashew farmers should contribute a portion of project cost and remaining will be taken care by the funding/financing agency. Specifically to finance the cooperative processing units, the National Cooperative Development Corporation (NCDC) was established by an Act of Parliament in 1963 as a statutory Corporation under the Ministry of Agriculture. Key function of NCDC includes planning, promoting and financing programmes for production, processing, marketing, storage, export and import of agricultural produce, food stuffs, and certain other notified commodities. Loans and grants are advanced to State Governments for financing primary and secondary level cooperative societies. Purposes for which assistance is provided are:

- Margin money to raise working capital finance (100% loan).
- Strengthening of share capital base of societies (100% loan).
- Working capital to regional/state level marketing federations (100% loan).
- Term loan for creation of infrastructural facilities like godowns, cold storages, equipment financing, purchase of transport vehicles, boats and other tangible assets.
- Term and investment loan for establishment of new, modernisation/ expansion/rehabilitation/diversification of agro-processing industries.
- Subsidy for preparation of project reports/feasibility studies etc.

A model project report for establishing a cashew processing units of 4 ton per day (TPD) capacity under cooperative society scheme is given below. In terms of the costing, there will not be much difference between private

and cooperative processing unit except funding pattern and financial assistance.

Economics of Establishing Cashew Processing Units

Assumptions

- Processing capacity will be 4 tons per day or 4 TPD of raw cashew nut
- Average days of working in a year is 300 days
- Annual requirement of raw cashew nuts (RCN) is 1200 tons
- Average utilized capacity of the plant is 85%
- It is expected that the project is completed within one year after sanction of financial assistance
- The mill will require approximately 200 workers and 20 staff

Pre-requirement from the applying Cooperative Societies

- The society has to raise the requisite share capital;
- Land Purchase/Leased by the society;
- Obtained assurance from State Electricity Board for providing required electricity connection;
- NOC from Pollution control board;
- Prepared plan and estimates for civil work of main plant and other ancillary buildings;
- Obtained quotations from suppliers of plant & machinery and other equipments;
- Identify market for finished products.



Table 8.1: Key Project Components Indicative Costs

Components	Area/Size	Cost (INR Lakh)	Total Project Cost (INR Lakh)	Total Project Cost (USD 000')
Land & Building			100.50	167.5
Cost of Land	6200 Sq.M	7.00		
Cost of Development		1.00		
Cost of Boundary Wall & Fencing		2.00		
Plant Shed	600 Sq.M	48.00		
Raw Material Godown	300 Sq.M	13.50		
Finished Goods Godown	250 Sq.M	11.50		
Boiler, Store & Toilets		10.00		
Security Office		1.00		
Administrative Office		1.50		
Drying Room	250 Sq.M	5.00		
Plant & Machinery			99.00	165.0
Cost of Equipments		85.00		
Taxes and Others		14.00		
Miscellaneous Fixed Assets			38.50	64.17
Office Furniture & Fixtures		2.50		
Computer & Office Equipment		1.50		
Electrical Equipments		6.50		
Fire Fighting Equipments		1.00		
M.S.E.B. Deposit, Transformer Etc.		4.00		
Vehicle (Truck)		18.00		
Miscellaneous Others		5.00		
Pre-operative Expenses			15.50	25.83
Working Capital*			114.50	190.83
Raw Material		90.50		
Electricity Charges		1.50		
Salary & Wages		2.50		
Stores & Spares		1.50		
Packing		0.50		
Stock Of Finished Goods		16.00		
Stock Of Goods In Process		2.00		
Total Project Cost			368.00	613.33

* Margin money required for one month operation

Pattern of Funding:

As per NCDC's pattern of funding for Cooperatively Developed States, 90% of loan is sanctioned to the State Govt. for passing on to the beneficiary societies as 50% loan and 40% share capital contribution. However, the debt equity ratio may vary depending on viability of the proposed project. In case of Under-developed & Least-developed States, subsidy is available 20% and 25% respectively of the project cost.

(Above project profile is prepared by the NCDC for the reference purpose. In terms of bank financing, detailed financial analysis, projections and process-wise calculation is required. Consulting wing of www.cashewinformation.com provides detailed techno economic feasibility report (TEFR) and establishment assistance for cashew processing unit.



Chapter 9: ACi - Committed to the Development of African Cashew Sector

Rita Weidinger, Executive Director, GIZ/ACi

The African Cashew initiative is a new type of broad-based multi-stakeholder partnership in Development Cooperation. The initiative is mainly financed by the German Ministry for Economic Development and Cooperation (BMZ) and the Bill & Melinda Gates Foundation. The Deutsche Gesellschaft fuer International Zusammenarbeit GmbH (GIZ) is the lead implementer in collaboration with Fairmatch Support and Technoserve, as well as private companies and national institutions to build and structure a sustainable African cashew sector.



ACi's achievements since 2009:

- Over 300,000 cashew farmers have received training in areas such as Good Agricultural Practices (GAP) and Harvest and Post –Harvest Techniques. This has improved production and translated into additional family income of more than \$20 million.
- Over 5,000 jobs have been created in the processing industry with 75% women beneficiaries.
- Technical assistance and capacity building of 20 processing facilities to ensure viability of their businesses
- 16 Matching fund projects have been established with 30 partners, targeting 123,000 farmers. The projects with total amount of €6 million ensure the sustainability of the value chain through supply chain linkage and development of improved planting materials.

Through training of trainers, ACi developed local capacities of highly knowledgeable resource persons as trainers in cashew value chain that includes policy advice and facilitating regional exchange for learning and innovation. Series of technical trainings were given to more than 2,200 trainers in the production area. More than 60 Master Trainers from eight West-African cashew producing countries are mandated by their organizations across the value chain to follow a seven months intensive training and coaching program, implemented by ACi and its partners.

The cashew processing technology is undergoing fast and changing developments. GIZ/ACi equipment study from 2011, analyzing equipment's from more than 100 supply companies, is currently updated. The box gives an overview of the summary available under www.africancashewinitiative.org

Summary from the ACi/GIZ Cashew Nut Processing Equipment Study:**Trends in cashew processing**

- The sector is beginning to develop into a modern “industry”.
- Developments in processing have been driven by costs including labor.
- Investment and working capital needs for processors are rising.
- Food safety, security and traceability driving change in the industry.
- The mechanization trend will continue making new demands on processors

Cashew processing equipment market

- The market has developed into a large market with a wide range of equipment and prices.
- Vietnam is the leader and most developed market.
- There are no government trade barriers in the sector.
- Suppliers are reluctant to do business in Africa. They see it as a high risk area therefore the African sector is served by a narrow base of suppliers. The market lacks competition.
- Brazilian suppliers can offer equipment solutions for small and medium processors in Africa.

Processing in Africa

- Processing remains a relatively small scale activity.
- The “steam and cut” model was the right choice for African countries. It is used in almost all processing units in Africa.
- Management of new equipment is poor.
- Labor problems are the major concern of processors especially in East Africa.
- Working conditions in cashew factories remain poor

Challenges for African small and medium processors

- Lack of information on the equipment and suppliers.
- There are very few African equipment manufacturers. Vietnamese and Indian manufacturers are mainly focused on their own fast growing markets.
- Poor financial services are the biggest obstacle for processors.
- As a whole processors lack expertise in processing equipment and lack skills in procurement strategies. They buy machines to solve labor problems but end up with machine problems.



Chapter 10: Man vs. Machines in Technology Selection- Making Judicious Choices to Meet Consumer Demand

A Bharathi and A Sharathi, Directors, Gayathri Industries, India

Cashew Industry in India has evolved from a cottage Industry status to an organized factory setup over a period of time since 1925 and attained leadership as the largest producer and exporter of cashew kernel in the world to meet the global demand.

It made good use of abundant labor force available for cashew processing from the beginning of 20th Century.

Technology Innovation contributed by leading processors and machinery manufacturer paved the way to upgrade Cashew Processing Technology.

While the industry has made strides in developing efficient unit processing – adopting steam roasting over cumbersome drum roasting and refining tray drying process from wood fired traditional Borma to modernized tray drying system and efficient bulk flexi pack system for exports to replace tin packing.

Each cashew kernel still needed to be shelled, peeled and graded by hand. Major reliance on manual labour has not ended.

But towards the end of the century, overall industrial growth has unfolded opportunities in various industrial sectors for skilled and unskilled workers creating a shortage workers for cashew Industry as workers preferred to migrate to less hazardous and less laborious and more paying jobs. Era of cheap and abundant labour has ended.

World has moved from production by the masses to mass production to cater to the ever growing supply demand to meet the consumer needs.

Necessity drove cashew processors and machinery manufacturers to look for process mechanization to meet the growing global competition and demand for cashew kernel.

Efforts were on for long to mechanize the shelling of cashew nut mainly to prevent hazardous corrosive CNSL affecting skin of the shelling workers.

Automatic shelling plants were made in Italy decades back, but it could never find an entry in India although some African countries bought and tried it. It could not succeed due to the fact that broken percentage of shelled kernel was around 60% to 70% as against 3% to 5% obtained in hand and leg operated shelling machines.

An efficient automated shelling machine, peeling and grading machines eluded all stake holders. New model shelling did emerge in Sri Lanka and Vietnam came out with an air operated peeling machine. Both needed expert design for fine tuning.

Innovative technology has resolved twin problems of cutting processing costs and non-availability of trained manpower has speeded up the process of mechanization. Besides, it provides job opportunities for more number of skilled workers.

Mechanized cashew processing- present scenario

Man vs. Machines in technology selection

We now have mechanization starting from warehouse to cashew nut steaming section to convey materials. After steaming the nuts are conveyed to shelling division and fed into steam cooker.

Plate 10.1: Auto Shelling System



The Automatic Shelling Machine (ASM) has achieved same broken percentage as the manual shelling.

Besides shelling, the recently developed innovative shell separating system does the separation of kernels from the shells eliminating manual intervention and avoids the hazardous job giving optimum output not easily achievable by manual labour.

To sum up, in a 4 MT processing unit employs 100 workers which is done precisely by 30 % of work force for the same degree of productivity .

Besides, the ASM and shelling system can be operated round the clock in 3 shifts, which is not possible in conventional processing system.

Mechanized peeling system employs 40 workers in place of 125 workers for the same output.

Manual peeling produces about 15 % peeling broken, whereas mechanized peeling causes 20 % broken. Still mechanized peeling is preferable as ultimately reduces dependence of labour.

A manual grader does about 40 to 60 kg per shift, whereas mechanical size grader and electronic color sorter has come to rescue of processor in reducing dependence of work force.

Technology is still at an infant stage to justify investment to return ratio at present.

The flexible packing has proved economical and reliable ensuring quality product reaching overseas consumers and retains shelf life for a longer duration without any concern for food safety.



Chapter 11: Requirements to Export Cashew Kernels for EU and the USA Markets

Jim Fitzpatrick, Ingredient Sourcing Solutions, Ireland

Buyers' requirements have been changing and developing since the trade first started. The trend has accelerated in recent years and tended to become more and more part of the law of the importing countries. It is vital for continued success in these markets that processors are informed of the requirements and put them into practice in their factories. Today merely paying lip service to food safety and quality issues will no longer work. In the future, a whole range of social, labour and environmental issues will develop as part of the procurement process in line with consumer demands in these markets, which lead the World in developing standards for product and practice.

Buyers requirements are usually divided into legislative (those required by law) and non-legislative (all requirements which buyers impose as part of their purchasing practice). There can be no compromise of legislative requirements whereas buyers may be prepared to allow time to comply or to compromise on their non-legislative requirements.

Trends in legislative requirements

This area has been changing in recent years. The EU has had requirements for many years on toxins and contamination. Aflatoxin is the most well-known issue in the edible nut trade but there is legislation covering micro biological activity, pesticide residues, heavy metals and a range of other contaminants. The EU introduced legislation on traceability of food products some years ago. This allows the source of the product to be tracked in the event of a problem further downstream. High profile incidents widely reported in the media over a number of products (although thankfully not cashew nut kernels) have increased consumers demands for protection. Traceability is a response to these demands. Currently the law is covered by the "one step" rule meaning that any given link in the supply chain must know and document where the product was sourced and where it was sold. In the future it is likely that full traceability will become a requirement although when and whether it will apply to ingredients is not yet decided.

Whereas European legislation has been relatively stable in recent years in the USA the signing into law in 2011 of the FDA Food Safety and Modernization Act (FSMA) marked a change from monitoring and responding to food safety issues toward preventative measures. This approach was already in place in Europe. In both cases the ultimate responsibility rests with the importer but importers need their suppliers to comply with the requirements in order to continue developing business. The developments in legislation do impose additional requirements on exports of cashew nuts but can also be seen as giving processors who are in compliance a competitive advantage over those who are not compliant. It is important that cashew processors who wish to export to either market take note of these developments and implement food safety practices in their plants.

The mechanisms used for this process will be

- Importer accountability: For the first time, importers have an explicit responsibility to verify that their foreign suppliers have adequate preventive controls in place to ensure that the food they produce is safe.
- Third Party Certification: The FSMA establishes a program through which qualified third parties can certify that foreign food facilities comply with U.S. food safety standards. This certification may be used to facilitate the entry of imports.
- Certification for high-risk foods: FDA has the authority to require that high-risk imported foods be accompanied by a credible third party certification or other assurance of compliance as a condition of entry into the U.S.
- Voluntary qualified importer program: FDA must establish a voluntary program for importers that provides for expedited review and entry of foods from participating importers. Eligibility is limited to, among other things, importers offering food from certified facilities
- Authority to deny entry: FDA can refuse entry into the U.S. of food from a foreign facility if FDA is denied access by the facility or the country in which the facility is located.

What does this mean for exporters?**The impact for exporters is that**

- They must be prepared to work more closely than ever before with their customer
- Have in place food safety management systems and risk control identification and control mechanisms such as HACCP (Hazard Analysis and Critical Control Points) which is a systems for identifying the risks and hazards in the process, identifying preventative controls, monitor the effectiveness of the controls, develop a written plan for control and verify the process at least every three years.
- Cooperate with their customers verification efforts
- Be transparent regarding in-plant food safety programs and efforts
- Maintain written records of control plans.
- Ensure that food safety plans are kept up to date

Inspection

Inspection of facilities by individual buyers both European and US has long been a feature of the sector but now under the USA FMSA the FDA has been tasked with the inspection of large number of factories Worldwide. Exporters who do not comply with inspection requests may be denied entry for their products to the USA. This was part of the change of emphasis from intercepting problems at the border to working with the supplier to reduce the risk of a problem arising in the first place. This means that exporters production facilities may be inspected by the US FDA.

USA Food Supplier Verification Programme (FSVP)

According to regulations proposed all importers must establish and follow an FSVP. Under the proposed FSVP regulations, an importer would be required to develop, maintain, and follow an FSVP for each food it imports, which, in general, would need to include the following:

- Compliance Status Review: Importers would be required to review the compliance status of the food and the potential foreign supplier before importing the food and periodically thereafter.
- Hazard Analysis: Importers would be required to analyse the hazards associated with each food they import.
- Verification Activities: Importers would be required to conduct activities that provide adequate assurances that the hazards identified as reasonably likely to occur are adequately controlled. Verification activities could include auditing of foreign suppliers, sampling and testing of food and periodic review of foreign supplier food safety records

- Corrective Actions: Importers would be required to review complaints they receive concerning the foods they import, investigate the cause or causes of adulteration or misbranding in some circumstances, take appropriate corrective actions, and revise their FSVPs when they appear to be inadequate.
- Periodic Reassessment of the FSVP: Importers would be required to reassess their FSVPs within three years of establishing the FSVP and to assess the effectiveness of their FSVP sooner if they become aware of new information about potential hazards associated with the food.
- Importer Identification: Importers would be required to obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number for their company and to ensure that, for each food product offered for importation into the United States, their name and DUNS number are provided electronically when filing for entry with Customs and Border Protection.
- Record keeping: Importers would be required to keep records, including those that document compliance status reviews, hazard analyses, foreign supplier verification activities, investigations and corrective actions, and FSVP reassessments.

Benefits for exporters

- A FSVP requires that an importer work closely with a supplier. The importer must invest time and resources to ensure compliance. Therefore the importer will be less likely to change supplier. This leads to the type of relationships which are not driven simply by price but by longer term considerations enhancing the ability to plan and develop a processing facility.
- Compliance with HACCP or a similar programme is essential for entry to the USA market and the European market. It is also becoming a requirement for major markets in Asia too.
- Importers have always paid higher prices for reliable processors and are now been paying higher prices for factories which have the right accreditation.
- Many cashew processing plants throughout the producing countries are not compliant and will not become compliant which means that compliance with import legislative is in fact a competitive advantage for processors that comply.

Main non-legislative buyers' requirements**Price**

Growth in the market is particularly dependent on prices. The US market in particular as a high per capita consumer of cashew nuts is highly competitive at retail level. This is reflected in the high price consciousness among import-

ers and direct buyers. Both the level of price and the volatility of prices in the market impact buyers' behaviour. This of course is nothing new to cashew processors.

Contract fidelity

Default of contract has been a common occurrence in recent years in the cashew market primarily due to volatile nature of the markets. There are processors who honour their contracts and have done so for decades thereby gaining a reputation for honouring contracts which becomes a competitive advantage and can result in better prices and more flexibility from buyers in other aspects. Defaulting on contracts may be a short term gain but can have long lasting consequences for a business.

Quality

The primary concern of the buyer is that the product is within specification when it arrives at their plant. For many years buyers purchased cargo for final acceptance on arrival – if the cargo did not meet specification on arrival it was rejected. This meant that importers were central to the management of quality in the value chain. Quality management was based on the AFI specification with testing at time of shipment and arrival for conformity. Most buyers will require that the cashew nuts are independently tested according to pre identified testing methods for microbiological activity (e coli, salmonella, mould etc.) and in some cases for pesticide residues. Testing for mycotoxins particularly aflatoxin is required by buyers.

The process of quality assurance is usually started by a quality audit or inspection at the processors plant. If this is satisfactory which may be a full pass or a conditional pass based on certain actions being taken then business can commence. Product will usually be tested by an independent cargo surveyor, samples drawn and sent to a laboratory for testing. Certificates showing the product to be in conformity with the specifications usually accompany the shipping documents when presented to the buyer for payment. Goods which do not conform will not be accepted and may be rejected outright, sent for reprocessing or replaced depending on the contract terms

Since the introduction of the Food Safety Modernisation Act in the USA the buyer/importer has had to take on the responsibility not only for the product quality on arrival at the manufacturing or packing facility but also is responsible for any hazards or adulteration which may have arisen during the shelling and grading process at origin. This means that the buyer / importer is responsible for oversight of the process. This is generally done through

the auditing and monitoring of suppliers who must have in place a risk and hazard identification and management system.

Certification/Quality and Food Safety Management Systems

It is likely that more and more buyers will insist on some form of quality or process management certification in addition to the risk management systems. Accreditations such as ISO (International Standards Organisation www.iso.org) with accreditations for quality management (ISO9000), food safety management (ISO22000) and packaging ISO18000 or BRC (British Retail Consortium) may be demanded by buyers as part of their own quality assurance programmes and risk management strategies. It is important to recognise that requirements in this area are often not within the importers or roasters control but are more and more dictated by supermarkets who strength in dictating the flow and method of trade continues to grow.

It is important for exporters to appreciate that when buyers' purchase cashew kernels they put the supplier's reputation with their own brand name. The brand and reputation may have taken many years and possible multimillion US\$ to establish but can be severely damaged by a food safety scandal such as the salmonella outbreaks which closed some US peanut processing plants in recent years. It is therefore important for exporters to take quality, food safety and traceability as important concerns in establishing their export business. Today compliance in these areas can set an exporter apart from his competitors but as the US food safety strategy evolves it is likely that compliance in these areas will be a basic requirement for market entry.



Chapter 12: Dealing with Broken Kernels - Practices in India

Bhodes R K, Chairman, Federation of Indian Cashew Industry - FICI

Cashew, botanically known as *Anacardium Occidentale* is of Brazilian origin from where it spread to other continents mostly during the 16th century by Portuguese travelers and missionaries. Cashew was mainly used as a soil binding tree to prevent soil erosion. The fruit of the tree, commonly known as 'cashew apple' was the only product consumed those days as food item. With the branches of the tree used as fire wood, the leaves and bark as herbal medicines, perhaps the nut was the only 'waste product' just meant for reproduction. The oil contained in the shell -CNS oil- being acidic and toxic in nature, made the nuts unacceptable for human consumption. Still in the early days, tribes used to cut open the nuts while in primitive stage, before the shell gets hardened and consume the kernel extracted. Later on, by some or other means, (like charring, heating etc.) the cashew kernels were extracted without much presence of CNS oil that made the kernels acceptable for human consumption. Slowly cashew found a way in the Mediterranean diet and attained the status of a food item.

It was India that nurtured cashew as an industry and it was she who presented cashew as a commodity in the international trade. The consumption in India was rather very low that almost the entire kernels produced here used to be exported and those which were not export worthy only got consumed in the isolated local markets in India. Cashew was till recently considered as a 'poor man's crop and the 'rich mans food' and as such the consumption of cashew kernels were mostly oriented around rich and developed nations. No doubt, the US and Europe used to be the major consumers those days. Still the rich segment in the Indian economy started consuming cashew kernels those days, which was even regarded as a status symbol in parties and events.

Till the late 1980's, India continued to be a major processing hub of cashew in the world. Thereafter, the do-

mestic consumption started picking up gradually that in the early 21st century; India emerged out as the biggest consumer in the world. Earlier to 1980's, almost the entire cashew kernels processed here - out of both domestic and imported raw nuts, barring those pieces grades not in demand overseas - used to be exported from here. Brazil's processing was almost steady and stagnant, that most of the raw nuts producing countries were looking at India as the only market for their raw nuts. Those days, other than Brazil and India, East African countries Tanzania, Mozambique and Kenya were processing raw nuts in a small way.

Domestic Consumption in India

Today, India is the largest consumer of Cashew kernels in the world. There exist no statistical records as to the exact quantity of consumption in India. A lot of cashew nuts produced locally are being processed and consumed domestically, that escapes the tax systems and as such those quantities are always off-records. The most effective way of calculating the domestic consumption in India is to calculate the total yield of kernels (calculated at 4.2 Kgs of raw nuts produces 1Kg of kernel, i.e. 23.8% levels or roughly at an out turn of 42 LBS per bag) out of the total cashew nuts processed here, which is again the sum of domestic production and the quantity of imports for which very accurate data is available. Against this the quantity of exports are deducted and imports added to calculate the domestic consumption in India. It is likely to go up a little, considering the domestic processing and consumption that escapes the tax brackets. The domestic consumption on the above basis is calculated as below:

Table 12.1: Domestic consumption of cashew kernels in India

Year	Internal Production of RCN (tons)	Import of RCN (tons)	Total (tons)	Cashew Kernel Yield (tons)	Imports	Cashew kernel export (tons)	Domestic consumption (tons)
1987	127000	50427	177427	42245		37376	4869
1988	132000	30539	162539	38700		32455	6245
1989	152000	48038	200038	47628		44197	3431
1990	132000	93318	225318	53647		48764	4883
1991	294590	76228	370818	88290		46841	41449
1992	305310	117166	422476	100590		51929	48661
1993	349000	136242	485242	115534		62984	52550
1994	348000	264377	612377	145804		78260	67544
1995	321640	193425	515065	122635		72640	49995
1996	417830	220170	638000	151905		69055	82850
1997	430000	159783	589783	140425		58362	82063
1998	360000	259917	619917	147599		73960	73639
1999	460000	195395	655395	156046		92084	63962
2000	450000	268118	718118	170980		81661	89319
2001	470000	390722	860722	204934		97411	107523
2002	506000	394099	900099	214309		107730	106579
2003	535000	435897	970897	231166		98658	132508
2004	544000	567532	1111532	264650	8261	120493	152418
2005	573000	565645	1138645	271106	6576	122192	155490
2006	620000	571474	1191474	283684	1058	120228	164514
2007	665000	592896	1257896	299499	2332	116205	185626
2008	695000	648999	1343999	320000	13082	123369	209713
2009	613000	727814	1340814	319241	7204	127721	198724
2010	631000	564785	1195785	284711	9294	112951	181054
2011	692000	798281	1490281	354829	2817	132660	224986
2012	674000	821648	1495648	356107	4348	101866	258589

Source: Compiled from data available with UNtrade, CEPCI & DGCIS Kolkatta.

As seen from the table above, there has been a steep increase in the consumption of cashew kernels from the year 2000 onwards, that has been supported by the increased level of imports. The consumption in India can be analysed in three phases. The first phase (Prior to 1990) represents the state where the kernel equivalent of a major portion of domestic raw nuts along with the entire imported nuts were exported, where as during the second phase, (1990-2000) the exports accounted for kernel equivalent of imports and domestic consumption accounted for kernel equivalent of domestic production. During the third phase, (2000 onwards) apart from the entire kernel equivalent of domestic production, a portion of the kernel equivalent of imported raw nuts and also the real imports of cashew kernels are consumed here in India.

With all these, it can be seen that the domestic consumption in India has gone up all these days. The domestic consumption of other major countries are listed below for a comparison.

Table 12.2: Domestic consumption of cashew kernels in major consuming countries (in tons)

Year	India	America	Europe	Middle East	Australia	*Others	World
1987	4869	43848	12040	945	2199	15908	79809
1988	6245	41331	13605	1030	2423	21393	86027
1989	3431	45744	17102	1155	2695	18379	88506
1990	4883	59185	12530	1803	3036	4574	86011
1991	41449	52591	13226	2031	3311	8114	120722
1992	48661	64752	15415	2320	2948	12557	146653
1993	52550	63481	17711	3040	3765	10050	150597
1994	67544	64457	19872	4415	4491	13624	174403
1995	49995	56814	23324	4913	5534	19613	160193
1996	82850	65249	39517	4568	1844	30136	224164
1997	82063	69776	45947	3703	2685	2691	206865
1998	73639	69987	47861	5528	3721	11827	212563
1999	63962	76325	37279	5012	4320	30221	217119
2000	89319	87035	39160	6894	5842	28041	256291
2001	107523	89104	40073	7521	7479	39363	291063
2002	106579	103277	39157	10282	9773	50373	319441
2003	132508	111654	42709	12048	12179	39132	350230
2004	152418	151581	48719	14283	11340	59480	437821
2005	155490	136667	61282	15926	14369	86159	469893
2006	164514	141955	71470	19250	15916	73398	486503
2007	185626	132169	82427	24460	16722	77350	518754
2008	209713	147441	85667	28017	15697	65568	552103
2009	198724	131835	93332	36763	15723	88984	565361
2010	181054	139317	89451	36401	16139	71470	533832
2011	224986	112739	84635	51427	13988	104315	592090
2012	258589	121215	86344	45720	13909	102653	628430

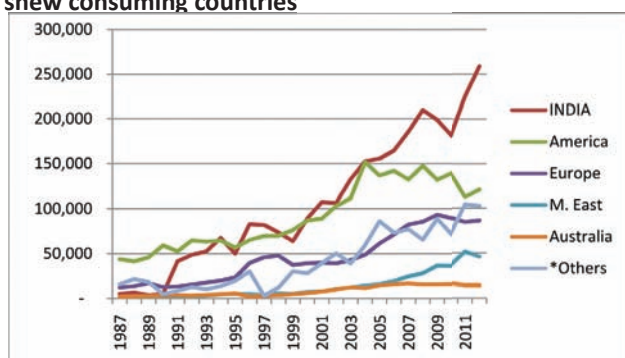
Source: Miscellaneous.

* Others include consumption by other regions and quantity not reported, unexported and consumed internally

Table 12.3: Growth rate (%) of cashew kernel consumption in major countries

Country	India	US	Europe	Middle East	Australia	Others	World
Growth Rate	14.4	5.1	8.8	15.6	9.1	10.4	10.4

Fig 12.1: Trend in consumption of cashew in major cashew consuming countries



(Quantity in tons)

The corresponding growth rate of consumption (exponential) over the last 25 years is worth notice the growth rate of India stands at 14.4% against the major consumers of US at 5.1% and Europe at 8.8%. Though the Middle East region has registered a growth rate of 15.6%, that is higher than India, the volume of consumption is far less compared to India. Indian consumption is more than double the U.S. consumption, the second largest in the world. India's steady growth rates coupled with high levels of consumption points to the fact that India's consumption is growing up. Various studies point to the fact that Indian domestic consumption has developed over the last decade especially on the back of growing economy.

The Pattern of Indian Consumption

Interestingly, the pattern of Indian consumption differs from the rest part of the world. While cashew kernels are consumed in the other part of the world mainly as a snack item for which the 'whole' cashew is in demand, the

Indian consumption is mainly as an ingredient to food items for which the broken grades (including pieces) are in demand. Earlier days, the processing in India was mainly export oriented and only those brokens and pieces that were not much exported was sold and available in the domestic market. Perhaps, this may also be a reason why Indian consumptions developed mainly on brokens and pieces. The consumption is high in the segments such as conventional sweets (as ingredient as well as toppings), confectioneries, chocolates, ice creams and to a large extent in restaurants and catering services for adding thickness and taste to gravy. All these use the cashew in broken and pasty forms where the use of broken cashew kernel is in high demand. Whole grades of cashew are in great demand here which is mostly used in gift packs and marriages and parties. The use of whole grades as a snack is social parties is also on the high.

The traditional exporters of Kerala and Karnataka, who used to sell only the non-exportable grades of brokens and pieces in the domestic market also, started concentrating in the domestic market, when the charm in exports was lost with the withdrawal of income tax benefits (80 HCC) from 2000 onwards. The Indian market stands lucrative in terms of value realization that attracted the exporters that made them to switch between exports and domestic sales based on the net price realization.

The mis-concept about cashew nuts that it contains more fats and hence not advisable for human consump-

tion is slowly changing and the health benefits of cashew is getting more popular. Once properly marketed, the consumption here is likely to grow up still at a higher rate in the years to come.

It is estimated that more than 80% of the world consumption of cashew broken grades is in India. Perhaps in India, there exists equilibrium in production and demand of broken grades that the entire broken cashew produced here is more or less consumed domestically. This indirectly supports and makes the processing viable here against the high cost of manual processing, where the whole items in high demand in the international market can be exported while the brokens find a better domestic market. In short, where the other processing countries have to treat the brokens as a 'by-product', in India, the broken grades are the main products along with wholes.

The quantity of Broken Grade Consumption in India

As stated earlier, when accurate data on domestic consumption is not available, there exists no accurate data on the consumption of Broken grade cashew kernels in India, in the absence of which, only estimates can be made on the basis of established parameters. It is estimated that the manual processing will yield around 30% of brokens while in mechanized processing, the same can go be slightly up. The mechanization in India is still in the primitive stage and as such the broken yield is estimated on the basis of 30%. Further, there is no official data on the exact volume of export of broken grades in the early stages and as such the trade statistics is to be relied on.

Table 12.4: Estimated consumption of cashew kernel brokens in India

Year	Domestic Consumption (Qty in tons)		Year	Domestic Consumption (Qty in tons)	
	Broken	Total		Broken	Total
1987	4869	4869	2000	43407	89319
1988	6245	6245	2001	52717	107523
1989	3432	3431	2002	63274	106579
1990	4884	4883	2003	69244	132508
1991	13254	41449	2004	80054	152418
1992	13626	48661	2005	80694	155490
1993	15392	52550	2006	79535	164514
1994	30883	67544	2007	85835	185626
1995	26516	49995	2008	101646	209713
1996	35929	82850	2009	95248	198724
1997	32741	82063	2010	88688	181054
1998	35449	73639	2011	98243	224986
1999	38679	63962	2012	107612	258589

Source : trade estimates.

On the basis of the above, it can be seen that of late, around 50% of the domestic usage in India is in the form of broken grades. The cashew processing units in Kerala, Tamil Nadu and partly in Karnataka are mostly exporting their wholes cashew where as in other parts of India, the entire cashew processed is sold in the domestic market. As such the lion shares of wholes consumed in India are sourced from areas like Andhra Pradesh, Orissa, West Bengal, Goa etc...

India had basically two elements in particular for its comparative advantage in cashew processing, the first being the skill of cashew workers here and the second the presence of a strong market for broken grade cashew processed here. With mechanization in processing turning to be a success, the former aspects is not that relevant today and the only supporting factor for the cashew industry in India today is the presence of a strong market for broken cashew grade. In fact, that is the backbone of the cashew industry in India.

The Potential Markets in India

With the steady increase of GDP per capita income and the associated Purchase Power Parity, the consumption in India has picked up in every nook and corner. Still the consumption is more concentrated to the northern part of India, may be due to the climatic pattern. Delhi is perhaps the most potential market for Cashew kernels in India. It serves also as a distribution hub to other consuming parts in the nearby localities. Bombay is another trade/ distribution hub of cashew, where the consumption also is very high. Ahmadabad in Gujarat, Jaipur in Rajasthan, Lucknow in Uttar Pradesh, Indoor in Madhya Pradesh, Amritsar in Punjab and Kolkata in West Bengal are the other potential markets of both wholes and broken grades of cashew kernels in India. The emergence of supermarket chains across India has accelerated the sales of cashew kernel in all parts of India. The 'Tirupati' temple in Andhra Pradesh consumes large volumes of broken grades (Fancy splits) in its 'prasadam' (The Loards offering in the form of sweet 'ladu').

The price of cashew is affordable today to an average Indian, whereas the same was a forbidden item in terms of pricing two decades back. Today, the price of whole grade of cashew in the retail level is around INR.800 per Kg (GDP Per Capita @ USD 1085 in 2012), where as two

decades back the same was around INR 450 per Kg (GDP per capita GDP @ USD 390 in 1990). This shows that the net effective pricing of cashew has gone down, making it affordable at medium class level.

Of a variety of broken cashew numbering more than 15 grades, the most popular and most sold grade is the LWP (the large white Pieces, i.e. 1/4th of a white whole kernel). This grade is mostly used in making of sweets, and a variety of food items. FS (fancy splits- the whole cashew cut into two lengthwise) is another popular item that is mainly used for toppings in sweets and confectioneries. WSP, SWP (White Small pieces and Scorched small pieces – i.e. 1/8th of the whole cashew kernels) is widely used by the ice cream industry. BB (Baby bits) is another popular grade, which is widely used by restaurants for making thick and tasty gravy. Other broken grades (including pieces) are also consumed in small quantities for various purposes. However, no data is available for comparing the relative consumption of various grades within the broken cashew.

The Indian Market Vs Export market

The pricing of kernels in the domestic market in India is more or less following the supply and demand positions in India, though the changes in the international prices have some impacts in the sense that the exporters switch their produce to domestic market when the export prices are less, resulting in increased supply levels that brings down the local prices and vice-versa. The quality of cashew from the new generation processing centers in India has to be still improved to make it export worthy, and hence those products find a market in India only- mainly the secondary markets. But in the case of broken grades, the domestic market offers a better price than the international market. May be that other processing countries like Vietnam , Brazil etc., where there is no local demand for the broken grades are forced to sell their broken grades- produced in bulk quantities in mechanical processing- at very lower prices, the strong domestic market for brokens here ensures a better price in India. It is a fact that this high Indian market for broken grade kernels is the thriving factor for the very existence of the cashew industry here, which otherwise is incurring almost double the processing costs due to manual processing compared to its competitors. The high quality and crispness of cashew kernels processed manually is

another reason of wide acceptance of Indian cashew grades fetching it a higher market and heavy demand here. Further, the broken cashew consumption maintains equilibrium with the raw cashew processing here. The pricing of other whole grades is more or less at par with the international market. Since, the local prices vary from origin to origin and processor to processor and owing to the fact that a portion of the domestic trades escapes the tax brackets, there is wide variation in pricing and also no official or trade data available for the local pricing of cashew kernels here.

On the other side, in the domestic market the price difference between wholes and broken has narrowed owing to the fact that whole cashew kernels are priced at par with international market, whereas the strong domestic demand for Indian broken grades always ensures a fair price for the broken grades here.

Imports- threat to Indian Cashew Economy?

The recent past records an alarming trend in the import of broken kernels to India, mainly from her competitors in the international market. Many of the competitors have adopted mechanization to a larger extent that their cost of production is far low compared to Indian levels. In India, cashew is a tradition and the processing is more or less manual. This has provided gainful employment to around one million workers here. Retrenchment of these workers can not be even thought of and the mechanization in India is to be implemented to the effective utilization of full workforce with increase in productivity. The general processing cost in India is 40% more than its competitors, which can be compensated with the strong domestic market here.

The strong market for broken grades here has attracted India's competitors, who always wanted to make use of the same to dump their broken grades, which other ways is difficult to market. To overcome the import duty and make their product marketable at low prices, they mostly resort to fraudulent means of imports by under quoting the prices and bringing cashew kernels declaring the same as cattle and poultry feeds.

The imports of cashew kernels to India, provides a feel of added advantages to the competitor countries mainly due to:

1. The strong market for broken grades in India which otherwise they find difficult to market and dump.
2. The broken grades are produced in bulk (by more than 10%) in mechanized processing they widely adopt.
3. Once, they can sell out their broken grades, the processing becomes more profitable so that they can increase their volumes.
4. They can gain comparative advantage on India at the cost of Indian domestic market.

The import of cashew kernels can accelerate the cashew processing in other countries and can have multiple adverse effects in India in the sense that on one side that the increased processing elsewhere invites competition in the international market and on the other side it reduces the supply of raw cashew nuts from raw nut producing countries. The Government of India has recently protected the industry by fixing floor prices in imports of cashew kernels.

Today, Indian consumption is growing up and almost half of cashew kernels consumed here is in broken forms. The strong domestic market for broken grades in India is the backbone of Indian cashew Industry. The consumption is likely to grow up higher in view of the growing economy. Still it is a fact that the cashew needs better marketing strategy here and there is heavy potential of cashew consumption going high. The need for a data base on Indian consumption exists here, which can support the industry with proper analyses. A primary data collected on surveying the market may bridge the gap in data for a better analysis.

India has the adequate processing capacity which can be multiplied to meet the needs to any level with process automation. The only handicap India faces today is the heavy dependence on imports for raw material. Unless India takes up initiative to attain self sufficiency in cashew production, she may not be able to cater for her own market, where she may find her competitors entering in some or other way. As such India has to protect her domestic market from foreign 'invasion' to protect her cashew Industry.



Chapter 13: ACA Seal Requirements for Processing Factories

Peter Nyarko, ACA Seal Coordinator, ACA, Ghana

The ACA SEAL program is the Food Safety, Quality and Social Responsibility Initiative of the African Cashew Alliance. It is implemented with the aim of raising cashew processing standards in Africa to the same level of international standards, making cashew processed in Africa competitive on the international market. Thus the ACA SEAL program is ideal for Cashew processors in Africa (large and small scale) as a stepping stone towards certification schemes such as HACCP certification.

The ACA SEAL program requires processing companies to be compliant to specific aspects of the 3 pillars of the program: A) Food Safety, B) Quality and C) Social Responsibility.

A. Food Safety

The food safety pillar of the ACA SEAL program ensures that implementing factories put in place basic prerequisite programs (PRPS) necessary for the production of food to assure that it will be safe for consumption. Tailored for the cashew processing industry by a leading industry expert; the PRPs when implemented address issues such as:

- Pest Control
- Foreign Body prevention
- Site Security
- Master cleaning
- Inbound and outbound control

The aforementioned prerequisite works synergistically with a cashew specific hazard analysis program (HACCP) to ensure the production of safe food taking into consideration all hazards and their control associated with cashew processing.

Procedures and implementation guidelines are provided for all prerequisite programs during the launch of the ACA SEAL program in an implementing factory. The launch also includes training sessions with factory personnel to ensure full comprehension of the procedures by the staff, facilitating a smooth subsequent implementation.

Each of these principles has specific details that the SEAL attends to address for example for Pest Control the SEAL

looks at details such as Prevention, exclusion, surveillance and treatment of pests.

B. Quality

The monitoring of quality is pivotal in ensuring that cashew processing in Africa is competitive on the global market. The ACA SEAL guidelines and procedures are structured in reference to international cashew standards such as the Association of Food Industries (AFI) standards.

The procedures include guidelines on finished product inspection with attention to specific quality deviations such as bad taste, clumping etc.

Packing norms to be followed mainly is maximum moisture content of 5%.

C. Social Responsibility

The human resource component of cashew processing cannot be overlooked in a comprehensive system. The ACA SEAL program incorporates guidelines and procedures on child labor, fair wages and working conditions. The guidelines ensure that ACA SEAL factories implement high international standards for employed personnel.

Ensuring Compliance

Implementing and complying with the afore mentioned requirements, after an approval audit would earn the factory a status of being ACA SEAL approved. The ACA also performs an annual licensing (surveillance) audit to verify continual compliance of implementing factories to these standards.

The age and basic pay norms are country specific and the seal requires that approved factories know these national regulations and are compliant per the national regulation. Facilities must also be conducive for working with features such as the availability of medical assistance / first aid and the absence of discrimination and abuse in whatever form.



Chapter 14: Global Food Safety Concerns – New Perspectives

Dr B Jacob, Managing Director, Trans Synergy Qualisystems, Private Limited, India

Introduction

Food Safety has emerged as a major area of critical significance for all food importing countries the world over. USA and EU nations are particularly concerned about the safety of the foods they import for multiple reasons. The food exporting countries may feel that the buying countries are hyper anxious about the safety of foods they buy from importing countries and the likelihood of any bio terrorism. However, the apprehension of USA is not misplaced in view of the terrorist attacks the country faced in the past. EU countries are also equally concerned about terrorism and they stand justified in imposing stricter vigil on imports.

Food borne illnesses in USA is a problem of serious dimension. One out of every six Americans get sick due to food borne infections and 128,000 are hospitalized and 3,000 people die every year, according to recent data from the Centre for Disease Control and Prevention. This is a significant public health burden but is preventable to a very large extent.

Food borne illness is preventable if everyone in global food chain is held responsible and accountable at each step for controlling hazards which can cause illness.

FSMA - the Food Safety Modernization Act of USA

The US-FDA is steadily increasing the number of inspections of foreign food processing facilities which export to United States. The FSMA stipulates mandated inspection frequency for food facilities on a risk based approach. Overseas food facility inspections are designed to identify potential food safety problems before they arrive in US and to verify compliance status of firms to FDA Food Safety Standards.

The preventive controls of FSMA give FDA the mandate to require hazard analysis and risk based preventive controls at registered facilities that manufacture, process, pack, and hold regulated foods. FSMA will require all registered foreign and domestic facilities to implement and maintain a written preventive control plan.

What the FDA inspectors will look for in a food processing facility exporting to USA.

1. Ground and sanitary operations

Grounds around a food plant under the control of the op-

erator must be kept in a condition that will protect against the contamination of food. The maintenance of grounds includes proper storage of equipment, removal of waste and litter, maintenance of roads, yards, parking area, adequate draining area, waste treatment, disposal etc.

2. Plant construction and design

FDA requires that plant building and structures are suitable in size constructed and designed to facilitate maintenance and sanitary operations for food manufacturing purposes. They would be evaluating the facility for adequacy of space for placement of equipment and storage of materials, proper precautions to reduce the contamination of food contact surfaces or food packaging materials with microorganisms, chemicals, filth or other extraneous material. The construction and design of the facility also permits to take proper precautions to protect food in outdoor bulk storage containers using protective coverings, controlling the area, over and around the containers to eliminate harborage of pests and for checking on regular basis pests and pest infestation.

The plant must be constructed in such a manner that the walls and ceilings are clean and kept in good repair, providing adequate lighting in hand washing area, dressing and locker rooms and toilet rooms. It also stipulates that all areas where food is examined processed or stored and where equipment or utensils are cleaned should have adequate lighting. Glass suspended or exposed to food in any step of preparation or otherwise it should be protected against food contamination in case of glass breakage. The construction should also provide adequate ventilation or control equipment to minimize odours and vapors in areas where they may contaminate foods and provide where necessary adequate screening or other protection against pests.

Sanitation operations

Eight key areas of sanitation

1. Safety of water
2. Condition and cleanliness of food contact surfaces
3. Prevention of cross contamination
4. Maintenance of hand washing, hand sanitizing and toilet facilities
5. Protection from adulterants
6. Labelling, storage and use of toxic compounds
7. Employee health condition
8. Exclusion of pests

FSMA – New rules proposed

It is understandable that the Government of USA is concerned about protecting the Health and Safety of their citizens against any food borne illness and fatalities. USA is importing food from more than 150 countries in the world and Government has to ensure that the food imported is safe from any risk.

The FSMA is a step towards ensuring food safety through stricter monitoring and audit of facilities in the countries from where they import foods. The FDA calls it Foreign Supplier Verification.

On the basis of the FSMA, the foreign supplier will have the responsibility to develop, maintain and follow a food safety management system. FSMA requires that importer conducts a hazard analysis to determine the hazard reasonably likely to occur in the imported food. However, if the foreign supplier has conducted its own hazard analysis, the importer may simply review and evaluate the foreign supplier's hazard analysis.

FSMA has proposed two important new rules, which would be finalized by June 2015.

A. Identifying High risk Foods.

FSMA under this rule would designate high risk foods for which additional record keeping requirements are vital to protect public health and also to enable quick and effective tracking and tracing of foods during a food borne illness outbreak. Designation of high risk foods would be based on historical public health significance in addition to food processing related factors.

- Frequency of outbreak and occurrence of illness
- Severity of illness including illness duration, hospitalization and mortality
- Likelihood of contamination
- Growth potential / shelf life
- Manufacturing process contamination probability / intervention
- Consumption
- Economic impact

B. Sanitary Transportation of Human and Animal Food

The proposed rule is aimed to adjudge a number of areas where food may be at risk for physical, chemical or biological contamination during transport, storage, including but not limited to:

- Proper refrigeration of temperature control of food products
- Proper management of transportation units or storage facilities to preclude cross contamination,

including improper sanitation, not maintaining tanker wash records, improper disposal of waste water, back hauling hazardous material

- Proper packing of transportation units or storage facilities including incorrect use of packing materials and poor pallet quality
- Proper loading and unloading practices, conditions or equipments
- Effective Pest control in transportation units or storage facilities
- Driver / Employee training and /or supervisor / manager/ owner knowledge of food safety and / or security
- Adequate transportation unit design and construction
- Employee hygiene
- Adequate policy for safe and secured transport or storage of foods
- Proper handling and tracking of rejected loads and salvaged, reworked and returned products or products destined for disposal and
- Proper handling practices for food products awaiting shipment or inspection, delayed holding of products, shipping of products while in quarantine and poor rotation.

The proposed rule applies to food shippers, receivers, and carriers who transport food in the US by motor or rail vehicle.

Exemption:**The proposed regulation does not apply to:**

- Transportation of shelf stable foods that is completely enclosed by a container
- Transportation of raw agricultural commodities that is performed by a farm
- Food that is transhipped through USA to another country
- Food that is imported for future export that is neither consumed nor distributed in USA
- Transportation of compressed food gases
- Transportation of live food animals

FSMA has key elements, which can bring about control of food borne illnesses through preventive system management.

FDA has new tools to ensure that imported foods meet US Standards and are safe for their consumers. For the first time, importers are required to verify that their foreign suppliers have adequate preventive controls in place to ensure safety of foods.

Again FDA will have mandatory recall authority for all food products.

To make imported foods safe, FDA has been given new tools to ensure that those imported foods meet US standards and are safe for US consumers

- Importer Accountability – Importers must verify that their foreign suppliers have adequate preventive controls in place to ensure safety.
- Third party certification – FDA will be able to accredit qualified third party auditors to certify that foreign food facilities are compliant to US Food Safety Standards.
- High risk foods – FDA has now the authority to require that high risk imported foods be accompanied by a credible third party certification as a condition of admission to this country.

Food Defense

What is food defense?

Food defense is the effort to protect the food supply against intentional contamination due to sabotage, terrorism, counterfeiting or other illegal intentionally harmful means.

Potential contaminants include biological, chemical and radiological hazards that are generally not found in foods or their food production environments. Food defense differs from food safety. Food safety which is an effort to prevent unintentional contamination of food products by agents reasonably like to occur in the food supply, example E coli, salmonella, listeria etc.

European Union Food Safety Requirements

Countries of European Union are also increasingly concerned about Food Safety and security from bio terrorism. Buyers in Europe ask suppliers to fill up questionnaires on various aspects on the products, the processing activities, storage and transportation etc.

The questionnaire is designed to elicit information on

1. The plant and its location
2. Technical specification of the product
3. Allergen information (most common food allergens: cereals/crustaceans/eggs and products/fish and products/peanuts and products/sesame seeds and products/sulphur dioxide and sulphites/lupin and products/molluscs/soybeans/milk and products/nuts/celery and products/mustard and products)
4. GMO information (conformance with EU regulations that the product does not contain GMO or GMO derivatives)
5. Microbiological values of the product (Mesophilic/ mold and yeast/Enterobacteriaceae)
6. Contaminants which would include
 - a) Nitrates

- b) Mycotoxins (Aflatoxin/ Ochratoxin A/Patulin / Fusarium)
- c) Metals (arsenic/lead/copper/cadmium/tin/mercury)
- d) Others (Dioxins and PCBs)

7. Ionizing radiation information
8. Nutritional facts
9. Logistics information
10. Packaging
11. Quality and alimentary securities
12. Other information

The buyer may also require the vendor (supplier) in India to provide information on

1. Food Safety and sanitation audit history
2. Customer or Government audits
3. HACCP programme
4. Recalls and traceability programme
5. Allergen programme
6. Food Safety Programme
7. Personnel training and hygiene records
8. Production facility
9. Maintenance positive air pressure in biologically sensitive areas
10. Quality of water used in processing
11. Pest control programme
12. Transportation and storage
13. Equipment and sanitation
14. Manufacturing and process control
15. Customer complaints
16. Finished products monitoring
17. Metal detection

Conclusion

The world food trade scenario is becoming complex due to the demands of the consumers for safe food coupled with the responsibility of governments to ensure the health and safety of their citizens. New scientific information on pathogens, allergens, safe levels of additives, ingredients etc make food safety regulations more and more stringent. Along with this, the threat of bioterrorism has added a new dimension to the entire food safety system which has to be tailored not only for food safety but for ensuring protection against threat of ulterior elements jeopardizing the life and security of consumers all over the world.



Chapter 15: Quality Specification for Cashew Kernels for U.S Association of Food Industries (AFI)

General Requirements

A. Each shipment to the U.S. shall be of good quality and be stored in accordance with good commercial practice. No live infestation is permitted.

B. The cashews shall be packed in new, clean, dry, leak-proof, lead-free containers with an airtight (hermetic) seal and without internal paper liners. Packaging shall be of sufficient strength to assure the integrity of the product during normal shipment and storage.

The outer container shall be constructed of a new cardboard, free of infestation and visual mold and sealed without staples, unless otherwise specified by the end user. Cartons must be a minimum of 200-pound test, 32 ECT. Only food-grade CO₂ is permitted.

C. Only pesticides approved for use on cashews may be used and residues must be within the tolerances set by the government of the importing country. No detectable residue is permitted for any pesticide that is not approved for use on cashews in the importing country. Fumigation with methyl bromide is prohibited.

D. All cartons shall be clearly marked with the following:

1. Name of the product and trade name or brand name, if any.
2. Name and address of producer or packer.
3. Grade.
4. Net weight.
5. Country of Origin.
6. Buyer's name or marks.
7. Destination.
8. Other marks agreed to by buyer and seller.

Lot numbers or production codes must be marked legibly on the outside of the cartons, in accordance with the laws of the country of destination.

E. Bill of Lading must list the number of cartons, source of origin, and the marks that are on the cartons.

F. All shipments shall be inspected prior to loading and

shall be carried on conveyances suitable for transporting food products in good condition, i.e. free of odors, insect or mold damage, rodent activity, and all other foreign materials.

G. The moisture level of the cashews shall be 3%-5%, as determined by the AOAC reference method.

H. If a roast test is required in a contract, it should be conducted in accordance with Appendix II. (Scrapes)

I. Strong blocking is not permitted. Strong blocking is defined as blocking which cannot be freed other than with the use of external tools.

J. Cashew kernels shall be free of hard or sharp foreign objects and hair.

Quality and Grading

Cashew kernels are classified as: First Quality Fancy; Second Quality Scorched; Lightly Blemished Wholes (LBW), Blemished Wholes (BW), Third Quality Special Scorched; Fourth Quality; and Dessert.

First Quality Fancy: cashew kernels have a uniform color which may be white, light yellow or pale ivory.

Second Quality Scorched: cashew kernels may be yellow, light brown, light ivory, light ash-grey or deep ivory.

Third Quality Special Scorched: cashew kernels may be deep yellow, brown, amber, and light to deep blue. They may be slightly shriveled, immature, light-brown speckled, blemished or otherwise discolored.

Fourth Quality: cashew kernels would qualify as first or second quality, except that they have pitted spots.

Lightly Blemished Wholes (LBW): cashew kernels may be light brown, light ivory, light ash-grey or deep ivory. Kernels may show light brown speckles or blemishes on the surface, provided that not more than 40 percent of the kernels are affected.

Lightly Blemished Pieces (LP): cashew pieces may be light brown, light ivory, light ash-grey or deep ivory. Pieces may show light brown speckles or blemishes on the surface, provided that not more than 20 percent of the pieces are affected.

Blemished Wholes (BW): cashew kernels may be deep yellow, brown, amber or light to deep blue. Kernels may be slightly shriveled, immature or may be brown speckled or blemished on the surface, provided that not more than 60 percent of the kernels are affected.

Dessert: cashew kernels may be scraped, deeply scorched, shriveled, deep-brown-speckled, black-speckled, blemished or otherwise discolored.

Sizing: Sizing is compulsory in first quality/fancy cashew kernels but is optional for other whole grades.

Size Tolerance:

- Whole kernels of a lower size grade shall not exceed 10% by weight.
- The quantity of broken kernels or pieces in whole kernels shall not exceed 10% by weight.
- The quantity of pieces present in butts and splits shall not exceed 10% by weight.
- The quantity of the next lower size grade in pieces shall not exceed 5% by weight.

Table 15.1: Size designation for cashew kernel grades

Size Designation	Count per	
	Kilo	Pound
180 (or SLW)	266-395	140-180
210 (or LW)	395-465	180-210
240	485-530	220-240
320	660-706	300-320
450	880-990	400-450

Whole (W): A cashew kernel is classified as whole if it has the characteristic shape of a cashew kernel and not more than 1/8th of the kernel has been broken off. This grade may also be designated as W. An excessive number 7/8th kernels or splits that detract from the appearance of the sampled lot may be the basis for claim.

Butts (B): Kernels which have been broken cross-wise are less than 7/8 but not less than 3/8 of a whole kernel and the cotyledons are still naturally attached. This grade may also be designated as B.

Splits (S): One half of a cashew kernel that has been split lengthwise, provided not more than 1/8 of this cotyledon has been broken off. This grade may also be designated as S.

Definitions

Serious Damage: includes but is not limited to insect, rodent or bird damage, visible mold - rancidity – decay or adhering dirt - solder - shell - or mesocarp. Examples include:

Adhering Matter - cashew meal or extraneous matter on the surface of the kernel causing permanent discoloration.

Insect Damage - is visible damage to the kernel from live or dead insects, mites in any stage of development, insect excreta or fragments - frass - webbing - boring - powdery residue - cast larval casings and/or the evidence of insects or insect activity in the packaging.

Rodent Damage - evidence of rodent activity.

Bird Damage - pieces of feather, bird excreta.

Visible Mold - mold filaments detectable with the naked eye.

Rancidity - is a breakdown of the oils in the kernel giving it an off-flavor or odor. An off-flavor aroma is any atypical flavor or aroma, including those caused by rancidity, decomposition, fermentation, microbial activity, infestation or chemical taint.

Foreign Matter - includes but is not limited to shell, mesocarp, stones, dirt, glass, metal, solder, straw, twigs, sticks, plastic, hair, industrial fibers, paper and threads.

Defects - include superficial and intrinsic damage which adversely affects the appearance of the lot such as scorching, blemishes, discoloration, immature or shriveled kernels, kernels with pitted black or brown spots, adhering testa, scrapes, flux marks and speckles. Defects vary by grade. The presence of kernels of a lower grade is scored as a defect. Examples of defects include:

Scorching - a discoloration due to over heating during shelling or blanching.

Blemishes or Discoloration - spots in aggregate in excess of 3 mm on the kernels from causes other than shelling or blanching.

Immature - kernels are underdeveloped and do not have the characteristic shape of a cashew kernel.

Slightly Shriveled - a slight withering of the outer surface of the kernel.

Scraped – damage to the outer surface of the kernel by knife scratches affecting an aggregate area >5mm. Scrapes on the inside of the natural curve of the kernel are not counted as scrapes.

Shriveled - a complete withering of the kernel that distorts its characteristic shape.

Pitted Spots - black, brown, or other colored spots in aggregate in excess of 1 mm caused by pre-harvest attack on the kernel.

Adhering Testa – Testa is the natural integument of the cashew seed. Kernels are scored as affected by adhering testa when a surface area greater than 2mm in aggregate is affected; provided, that not more than 1/16 of the surface of a whole or equivalent, or 1/8 of a split or butt, in aggregate, are damaged by adhering testa; in which case, the affected kernels shall be scored as “seriously damaged” by adhering testa.

Superficial Damage - deep knife cuts on the surface of the kernel that changes the characteristic shape of the nut.

Flux Marks - black or brown marks on the surface of kernels caused by flux dripping onto them when a tin container is sealed.

Speckled - a brown stain which appears after removal of the testa on some kernels.

Spotting After Roasting – Brown spots on the surface of the kernel that are not apparent when the kernels are raw but when the kernels are roasted.

Scrapes After Roasting – Damage to the surface of the kernel when testa and other defects are removed by the use of a knife. The scraped areas are lighter after roasting and give an uneven appearance to the roast.

Blocking – Bonding of cashew kernels in the presence of high moisture and high vacuum pressure.

Tolerances for Defects and Damage in Raw Cashew Kernels

The following tolerances establish the maximum limits for damage and defects in raw cashew kernels. To determine compliance with these tolerances, one should follow the Sampling Plan found in Appendix I, and use established analytical procedures. Tolerances for a lower grade include the kernels defined by the lower grade but not the defects that are specific to the lower grade. Percentages are determined by weight.

Table 15.2: Tolerances for Defects and Damage in Cashew Kernels

	First Quality	Second Quality Scorched	Third Quality Special Scorched	Dessert
Serious Damage				
Insect Damage	0.5%	1.0%	1.0%	1.0%
Mold rancidity, decay, adhering matter	0.5%	1.0%	1.0%	1.0%
Foreign Matter ¹	0.01%	0.01%	0.01%	0.01%
Maximum Serious Damage	1.0%	2.0%	2.0%	2.0%
Defects				
Second Quality Scorched	5.0%	B	B	B
Third Quality Special Scorched/	1.5%	5.0%	B	B
Lightly Blemished Pieces	1.5%	5.0%	(*20% Light Brown Speckled)	
Lightly Blemished Wholes	1.5%	5.0%	(*40% Light Brown Speckled)	

	First Quality	Second Quality Scorched	Third Quality Special Scorched	Dessert
Blemished Wholes	0.5%	2.5%	(*60% Brown Speckled)	
Dessert	0.5%	2.5%	7.5%	B ²
Superficial Damage (scrapes)	1.0%	2.0%	5.0%	B
Adhering Testa/Seriously Damaged ³	3.0%/1.5%	3.0%/1.5%	3.0%/1.5%	3.0%/1.5%
Black Speckled Kernels				0.05%
Maximum Defect Level	8.0	11.0	14.0	(*Maximum speckled for LBW and BW)

1. The tolerance for foreign matter is in addition to the tolerance for maximum serious damage.
2. Dessert quality is the lowest grade but the defects cannot be so severe that the product is not merchantable. A delivery is acceptable provided it is equal or better than the approved pre-shipment sample. Two sealed pre-shipment samples are to be sent to the buyer for approval, one of which shall remain sealed for possible use in settling a dispute on quality at arbitration.
3. Maximum of 3% by weight for testa greater than 2mm in aggregate, but not more than 1.5% seriously damaged by adhering testa.

Table 15.3: Tolerances for Defects and Damages in Small Pieces

	SP1-SSP1 G1	SP1-SSP2 G2	SP1-SSP3 G3
Serious Damage			
Insect Damage	0.5%	1.0%	1.0%
Mold rancidity, decay, adhering matter	0.5%	1.0%	1.0%
Foreign Matter ¹	0.01%	0.01%	0.01%
Maximum Serious Damage	1.0%	2.0%	2.0%
Defects			
Second Quality Scorched	5.0%	B	B
Third Quality Special Scorched/	2.0%	5.0%	B
Fourth Quality	0.5%	1.0%	B
Dessert	0.5%	2.5%	10.0%
Superficial Damage (scrapes)	B	B	B
Adhering Testa	3.0%	3.0%	5.0%
Maximum Defect Level	10.0%	10.0%	12.0%

1. The tolerance for foreign matter is in addition to the tolerance for maximum serious damage.

Source: Association of Food Industries, Inc, Revised in 2012.



Chapter 16: Inspection and Testing of Cashew

Ravi Anand Thakur, BDM – Agricultural Services, SGS India Pvt Ltd, India

Cashew, having annual import and export value soaring more than USD 4 billion, is one of the important agricultural produce. Being one of the main high value agricultural commodities, a small change in quality or quantity leaves significant impact on total commercial value. In such a crucial market, testing and inspection of cashew plays a critically important role in protecting the interest of cashew growers, processors, traders, exporters, buyers and other stake holders involved in cashew nut business by ensuring the quality of cargo by Visual inspection, Sampling and testing services, quantity and weight determination, packaging and label verification, checking transport for its cleanliness, cargo loading followed by sealing of transport, Fumigation, pest management and real time reporting with situation updates and monitoring the cargo. It is important to keep traceability of cargo at each point of supply chain including- production and processing plant, warehouse, container stuffing, truck/ rail/ vessel/ ship hold loading and discharge point.

1.Raw Cashew Nut Inspections (Import survey)-

Weight and quality inspection services for raw cashew import consignments are usually followed. Majority of

the raw cashew imports are through 20'containers in 80 kilogram jute bags. The quality of the raw nuts is determined with respect to out-turn in pounds per 80 kgs bag. Price of the raw nuts is based on the out turn of the nuts in the trade.

- 100% container weighment is carried out in nominated weighbridges
- Representative samples are drawn at random from approximately 10 % of the bags during de-stuffing of the cargo from the containers at the buyer's warehouses by our Inspectors
- Approximately 2 kg sample per containers is drawn. B/L wise samples drawn from the containers are mixed thoroughly and cutting test is carried out on this sample. Cutting test is done on two samples of one kg each and the average result is considered for the out turn
- Moisture is analyzed at laboratory for one sample B/L wise

Table 16.1: Parameters are usually checked during cutting test

Parameters	Protocol	Results	
Cutting Test	Physical Test		
1.	Void	''	Expressed in %
2.	Rotten	''	Expressed in %
3.	Diseased	''	Expressed in %
4.	Partly Damaged	''	Expressed in %
5.	Spotted	''	Expressed in %
6.	Immature	''	Expressed in %
7.	Total Defectives	''	Expressed in %
8.	Yield (Unsound)	''	Expressed in GMS
9.	Yield (Sound)	''	Expressed in GMS
10.	Total Yield	''	Expressed in GMS
11.	Out turn	''	Expressed in Pounds /80 kgs Net Bags
12.	Nut Count	''	Nos / KG

2. Pre-shipment and stuffing supervision- cashew kernel (processed nuts)

Generally the cashew kernels for export are packed in tins or flexi-pouched and then packed in master cartons. Such tins/flexi-pouches are filled with cashew kernels, gas infused and vacuum sealed. Generally lot of 700 or 750 cartons is shipped in 20F containers. General scope of inspection covers following points, which could be customized based on client's exact requirements-

- Verify the quantity offered/presented for inspection with respect to packing list or other relevant documents provided by the client
- Packing verification and physical condition of packing.
- Reporting of marking, available on packing and verification of marking with respect to packing list or other relevant documents provided by the client
- Representative sampling from randomly selected master cartons/ bags.
- Analysis of drawn samples in SGS laboratory for contractual specification or as per the standards and specifications of the Cashew Export Promotion Council
- Check the cargo with respect to order requirements and/or to the relevant specification of the Cashew Export Promotion Council
- Weighing of randomly selected packages in order to determine and report average weight of total consignment.
- Supervise the stuffing operation and if required then the loading of the containers into the nominated vessel

Quality Testing Parameters- (Processed cashew nut)

The drawn samples are checked for visual observation, count per pound (to determine the grade of cashew nuts), NLG/NLSG, Infestation, visual mould, foreign matters at the location. The samples are tested for moisture and colour at the laboratory.

The most common specifications followed for Cashew nut Inspections are as per the CEPC (Cashew Export Promotion Council) and the AFI.

Cashew kernels are also subjected to a various physical tests, roast test, sensory tests (taste and smell), chemical tests such as 2,4-Dichlorophenol, 2,4-Dichloroanisole, BHC, Aflatoxin and various other microbiological tests at our laboratories.

Current Certification Status –

Certification services are required during various phases of trade process-

- **For Importers-** There is good volume of raw cashew being imported in India. The interest of importers is to ensure the quality of cargo, as per their contract terms. So that they can encash the value by further value addition.
- **For Exporters-** India is one of the leading exporters of cashew nuts. The interest of exporters and buyers is to involve independent third party certification companies to issue weight and quality certificate, which (the certificates) further plays a vital role in decision making of both parties.
- **For Processors-** Brand value is always an important asset of companies. Certification companies help the processors in enhancing the company brand name by various system certificates i.e. ISO, HACCP, FSSAI etc.

Issues in Indian processing unit-

- In India most of the processors are following conventional manual grading system. The implementation of modern & sophisticated machinery system could help the sector by reducing the processing time.
- Sufficient adequate storage infrastructures are not made specially keeping the Cashews in mind. Proper storage condition may help growers to reduce the post harvest losses.



Chapter 17: Steps to Improve RCN Quality

Vinacontrol

Problems arising during the import of RCN, reasons and proposes solution

1. Mold and musty cashews

Here the cashew nuts coated with white or green mold/ musty. It is easy to realize the mold and musty cashews to realize them on the top-layer and under the container ceiling, at two side-partitions of the container and behind the container exit and front.

Plate 17.1: Mold and musty cashews



Reasons:

- High moisture of the whole cargo or some parts of the cargo (> 10%), the goods have been stored in the container during long days (≥ 40 days)
- Due to natural-breathing of cashew nuts, the temperature inside the container will be increased gradually and as a result, the water vapors will be evaporated from the high-moisture cashew nuts, along with the difference of day-and-night temperature. It will make the water vapors condensed and fallen down the above-said positions (the top-layer and under the container ceiling, at two side-partitions of the container and behind the container exit and front). This temperature and humidity will be an ideal condition for development of molds and yeasts.

Proposed solutions:

A. At the ports of loading:

- Well drying the commodities for the favourable moisture (< 10%) before loading into the container.
- Besides, the exporter should insert carton papers around and inside the container with desiccant bags in full.
- It will be better if the shippers use containers 40" to load the commodities (Each container 40" is permitted to load 26.5 tons only so that it will have more upper space for better ventilation and minimization of molds and yeasts).

B. At the port of discharge:

- After found, re-drying all mold and musty commodities at the soonest time after being discharged. However, it will still bring many losses to the importers like (a) Actual quantity will be decreased from 2 to 4% based on actual moisture (b) Actual quality of spoil-cashews after being processed will be poorer than the standard ones (the rate of blemished/ yellow and scorch cashew kernels will be increased the value of the exported cashew kernels will be reduced accordingly).

2. Sprouting cashews rot and decay

The raw cashew nuts which are sprouted and deformed with rot and decay, causes serious losses to the buyers. Quality of the processed cashew kernels will be seriously reduced (rate of blemished/ yellow and scorch nuts will be increased, changes of smell, non-natural smell to sour taste).

Plate 17.2: sprouted, rotted and decayed cashews





Reasons

- Due to very high moisture of the raw cashew nuts (> 12%) and being contained in the container for a long time (≥ 40 days)
- The natural-breathing of raw cashew nuts creates high temperatures and evaporation, combined with the difference of day-and-night temperature it will make the water vapors condensed and fallen down the positions (the top-layer and under the container ceiling, at 2 side-partitions of the container and behind the container exit and front). The air humidity inside the container in addition to high temperature and moisture of cashew nuts will be favourable conditions for development of cashew sprouts. As a result, some raw cashew nuts which were deformed with sprouts, rot and decay can not be used for processing.
- Due to hole-leaking container, rainwater will absorb easily and create good conditions for cashew sprouting. They will be gradually deformed with sprouts, rot and decay if being stored in long time.

Proposed solutions:

A. At the port of loading:

- Should control the moisture well (<10%) by drying, frequent hoeing upon drying for even moisture.
- Should insert carton papers around and inside the container with desiccant bags in full
- Should check the container to ensure it tight, clean and no leak

B. At the port of discharge:

- Classifying and removing sprouted and serious damaged nuts out of the cargo.
- Re-drying all remaining commodities of the above-said spoil cargo

3. Delivery of old-crop raw cashew nuts:

The delivery of old-crop cashew nuts has causes many difficulties for processing factories. The old-crop raw cashew nuts have the following characteristics:

- Cashew shells are black or yellow in colour.
- After cutting, the testa is red or dark brown in colour.
- The goods are very dry in feelings and its shells are very dry and hard when cutting, very little cashew liquid or the kernels inside are rot and decay.
- The cashew kernels are shriveled to create a gap between the cashew shell and cashew kernels.

- Qualities of cashew kernels which will be processed by this kind of materials are much poorer (the rate of blemished/ yellow, scorch, spot kernels will be increased and their value will be decreased accordingly).

Remarks: Checking the goods carefully and removing the bags containing old-crop nuts before loading into the container.

Plate 17.3: Illustrations for old crop



Old crop



New crop

4. Mixture of baby cashew nuts and crushed raw cashew nuts.

The very small raw cashew nuts (baby nuts) will not be used for processing. Currently, most of processing factories are using cutting machines and these machines could not cut the baby cashew nuts.

Plate 17.4: Illustration for baby nuts



Size: Small

Size: small

Size: Normal

The exporters should check the moisture, quality and quantity of goods carefully before delivery using clean, durable and sealed containers without smell inside. Besides, the exporter should insert carton papers around and inside the container and desiccants.

Courtesy: Mr. Bach Khanh Nhut, Vice Director – VINA-CONTROL presentation at Vietnam Golden Cashew Rendezvous, May 2014



Chapter 18: Pest Management and Fumigation in Cashew Industry

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Introduction:

Cashew (*Anacardium occidentale*), the wonder-nut of the world, native to Brazil was introduced in India by Portuguese four centuries ago as a means for controlling coastal erosion. Cashew tree is short, stocky, low spreading evergreen tropical tree which flowers once a year between November to January. Fruit ripens fully within 2 months of flowering. Cashew fruits consist of two main parts viz. cashew apple and cashew nut. The raw cashew nut is the main commercial product of the cashew tree. These cashew nuts while processing releases the by-product cashew nut shell liquid (CNSL) which has industrial and medicinal applications. Cashew apple is generally processed and consumed locally by making juice from it which is very high in Vitamin C. It can also be fermented to give a high proof spirit. The raw cashew nuts collected from field are moved into the factories for processing which is done by either sun drying, drum roasting, oil bath roasting and steam cooking. India is the largest producer, processor and exporters of cashew in the world.

Important stored product insect pests: There are many stored product insect pests associated with various stored products including cashew. These different stored product insect pests are classified based on their behavior pattern, life cycle and feeding habits into four types which are as under –

1. **Internal feeders** – These insect larvae feed entirely within the kernels of whole grain and may remain undetected until adults emerge out from the kernels. Examples: Rice weevil, Maize weevil, Lesser grain borer, Angoumois grain moth etc.
2. **External feeders** – These insects feed on the outside of the grain. They can also chew through the outer seed coat and devour inside. Example: Indian meal moth, Khapra beetle, Cigarette beetle etc.
3. **Scavengers** – They feed on grain only after the seat coat is broken either mechanically or by some other insects. Examples: Mediterranean flour moth, Red and Confused flour beetle, Saw toothed grain beetle etc.
4. **Secondary Pest** – They feed only on materials that are deteriorating, damp and have some mold growth present. Example: Foreign grain beetle, Mites, Meal-worm etc.

Out of all the stored product insect pests Flour beetle (*Tribolium spp*), Cigarette beetle (*Lasioderma serricorne*) and Indian meal moth (*Plodia interpunctella*) are the most important and prominent stored product insect pests associated with cashew nut storage.

Integrated Pest Management in cashew storage warehouse:

Generally cashew is stored in warehouse as raw nut in gunny or PP bags or processed nut in carton boxes. There are several key components necessary for successful pest management programs in cashew warehouses which are as following:

- I. Sanitation Considerations
- II. Building Design and Pest Proofing
- III. Storage Practices
- IV. Insect Traps and Monitoring
- V. Pesticides Application

I. Sanitation Considerations – In warehouses, the first step in managing stored product pests is to ensure that there is an effective sanitation program in place and operating. The program must include the sanitation measures on both outside and inside of the warehouse. Exterior areas of the warehouse must be kept neat, clean and simple so that they might not attract insects or rodents. A vegetation free zone or barrier (preferably strip of gravel not less than 18 inches wide) around the outside perimeter of warehouse will discourage insects and rodents. Decorative vines and any planting should be made at least 10 feet away from warehouse. Pest proofing of doors and windows and in some cases the installation of air curtains is all necessary to prevent pest entry inside the warehouse.

Like the exterior, good sanitation practices are important for all interior areas of the warehouse as well. All food spills should be cleaned up immediately. Basically, all cleaning duties are divided into two types namely Daily and Periodical (weekly or longer) frequencies. There should be master cleaning schedule well set and implemented on regular basis. Proper waste disposal mechanism is necessary to avoid stored pest problems. Additionally regular inspection of all incoming goods is important and if sign of infestation is suspected, under no circumstances should the material be unloaded.

II. Building design and Pest proofing – Despite careful attention to design, some areas of the warehouse will remain prone to pest infestation. For instance the roof area is frequently overlooked. Outside docs should be smooth and sloped to prevent pooling of water. All cracks and crevices in dock areas should be sealed to prevent pest harborage or entry into the facility. The walls of the warehouse should not contain voids which will provide harborage for pests. All cracks and crevices in walls must be caulked. Edges where wall meets floor need special attention because these often times provide cracks and crevices for pest harborage. The wall-floor junction should be covered to provide easy cleaning. Outside lighting of warehouse should be of amber, sodium vapour type mounted high on light poles and located away from building exterior to prevent attracting flying insects to the immediate vicinity.

Pest proofing is excluding the pest from entering the food warehouses. Pest proofing provides best long term solution and reduces the need for repeatedly relying on chemical control. Pest proofing can be applied on exterior as well as interior areas.

A) Exterior area: Many pest problem originates on the outside of the warehouse. Therefore most exterior pests can be effectively and efficiently managed by eliminating conditions near the structure which allow for pest to find harborage and thrive. Exterior pest proofing techniques involves proofing at -

1) Entrance and Exit doors: All the doors should be fitted with automatic door closing mechanism. Screen doors should open outwardly and should be fitted with screen of mesh 14 X 14 mesh size. Air curtains or plastic stripes should be installed to prevent entry or movement of flying pests.

2) Windows: Windows should be properly designed and fitted with 14 or 16 mesh screening. Caulking may be necessary to seal small cracks and crevices around windows.

3) Foundations: Both insects and rodents gain entry through structural defects and damaged foundation wall. All cracks and holes must be patched up with cement. When considering rodent proofing, all openings greater than ¼ inch for mice and ½ inch for rats should be sealed.

4) Drains and Vents: They provide convenient entry points for insects as well as rodents. In addition, drains are excellent harborage sites because they contain plenty of moisture, food debris and dark and secluded conditions. To discourage them, all drains must be adequately screened and cleaned. Drains and opening around drain pipes must be tightly sealed and in good working condition to discourage rodents. Floor drains should be designed with traps. Ventilation systems must also be pest proofed as rodents can get entry through unscreened ventilation system.

5) Utility lines: Plumbing pipes, electrical conduits, and conveyor entrances all serve as convenient runways for pest entry in to building as gaps are created where they enter the structure. Caulking and other sealants can be used to seal the gaps. Pipes and wiring are sometimes grouped into “gangs” which act as ideal harborage for pests and hence need to be readily accessible and easily opened in order to facilitate a thorough cleaning. Rodents can be deterred from climbing pipes from outside by fitting metal rat guards around the pipes.

6) Roofs: It should be designed to minimize food debris around exhaust fans and to be cleaning accessible, thus preventing the accumulation of food which attracts insects, birds and rodents. All openings in roof must be tight fitting and properly sealed to prevent any entry of pests. Roof ventilators, screen vents must be checked regularly for any defects.

7) Shipping and receiving docs: All exterior docs should be rodent proofed. Ideally docs should be constructed with the 10-12 inch overhang which acts as barrier to rodent.

B) Interior area: Proper building design and interior pest-proofing of a food warehouse will go a long way towards discouraging proliferation of any pests that have already gain access to the building.

1) Ceilings and Walls: Ceiling should be a source of pest problems inside food warehouse and hence it should be free of pits and cracks and other entry points. To deny access to insects seeking harborages, walls must be designed so that they are smooth, un-pitted and easily cleaned.

III. Storage practices –

- One of the most important pest management practices in storage areas is the maintenance of inspection aisles. Those aisles next to wall should be painted white and allow for product to be stored away from walls and other products stacks at distance of 18-24 inches. Without adequate inspections aisles inspections cannot be conducted to determine pest evidence, pest presence or conditions conducive for pest infestation. Inspection aisles can help to reduce moisture damage. When there is sharp difference between outside and inside temperatures, perimeter walls often “sweat” enough to damage products that are stored too close to the walls.
- Proper management of storage pallets used inside for cashew warehouses is an important aspect as they can harbor various pests, rodents and even snakes and birds. When goods are received into a warehouse, both the goods and pallets should be inspected for cleanliness, pest and overall condition. Pest infested pallets should be rejected on the spot.

These pallets should be regularly treated for managing pallet pests.

- An important source of stored product pests is infested packaging materials which act as breeding grounds which cause infestation to neighboring products. Proper cleaning, quarantine and pest management procedures must be implemented to get rid of this type of infestation.
- Always implement and follow Good Warehouse Practices (GWP) like FIFO etc.

IV. Insect Traps and Monitoring – One of the key factors in insect pest management in cashew warehouses is to locate the source of infestation and to identify the insects involved. To pin-point sources of infestation there are number of insect traps and survey devices which use insect pheromones. Visual inspections require a skilled technique and are very time-consuming as well can't rely upon cent percent. Insect pests can be monitored effectively by use of Insect Pheromone Traps. These pheromone traps are sensitive monitoring tools for various stored insect pests and are species specific and attract only precise species of insects. Many of the pheromone traps are basically sticky traps with insect pheromone added to the trap to attract specific pest or group of pests. There are two types of pheromones used in the traps namely sex pheromone to attract opposite sex insects (mostly to attract males) of same species or aggregation pheromones to signal to the other individuals of the same species that a food or harborage resources is available. Sometimes a food attractant may be added to increase trap capture.

Pest management specialist use pheromone traps to determine the location and intensity of insect infestations. Insects are very sensitive for low concentration of these chemicals, pheromone traps are excellent devices for discovering low population levels of adult insects. However, the success of pheromone trap monitoring depends upon various factors like size of structure, process flow of operations, specific pests being monitored for skill and expertise of the person handling the trap, interpretation of the trap catch and presence of dust or other factors which may reduce the efficacy of the pheromone lure.

V. Pesticides application – Pesticides application within cashew warehouses may involve fumigations, space treatments and the application of residual sprays in various spots and cracks and crevices. When considering using pesticides in any food warehouse, the list of pesticides which are approved by CIB (Central Insecticide Board) for the said purpose must be selected. Refer pesticide labels for the best information regarding the correct use of the pesticides. Broadly pesticides applications are classified as residual and non-residual insecticides.

1) Residual applications - are those products applied to obtain insecticidal effects lasting several hours or longer. Three types of residual applications are generally in practise namely

a) General Applications – Application to broad expanses of surfaces such as walls, floors and ceilings or as an outside treatment. General applications are usually permitted only in non –food areas and a classical example is barrier treatment. Barrier treatments using residual sprays, dusts or granules are effective in controlling various outdoor pests which may periodically enter the plant.

b) Spot Applications – Application to limited areas on which insects are likely to occur, but which will not be in contact with food and will not ordinarily be contacted by workers. For this purpose, a “Spot” will not exceed two square feet.

c) Crack and Crevices - Application of small amount of pesticides into crack and crevices in which insects hide, or through which they may enter a building. The crack and crevices treatment includes the use of sprays, dusts or baits.

2) Non-residual applications - are those products which are effective only during the time of treatment or for a short time thereafter. These treatments are either space treatments or contact treatments.

a) Space treatments - are often as integral part of insect control programs in food warehouses. Space treatment is defined as fogging or misting application using canned aerosol, ULV (ultra low volume) or fogging devise to produce small droplets (aerosols) for the control of exposed insects. However, it is important to understand that the insecticide aerosols produced during a space treatment will not readily penetrate into objects and insects that are hidden in concealed harbourages will not be killed.

A schedule of monthly or fortnightly space treatments is the treatment regime in many food warehouses. More frequent applications may be necessary during summer and rainy seasons when insects are more active. The insecticides used for space treatments in food warehouse are mostly pyrethroids. Preparing the area to be treated, protecting the pest management specialist and applying the pesticide at the proper rate are key components in the safe application of these space treatments. Space treatments are generally carried out when the food stacks are either in fumigation (covered under fumigation cover) or when the warehouse is empty.

b) Contact treatment – It is application of wet spray for an immediate insecticidal effect. This treatment can be used where the immediate reduction of localized insect population is required.

While applying the pesticides, first and most important step is to read and understand the label instructions.

PPE's (Personal Protective Equipments) like hand gloves, coveralls, boots, goggles, hats and respirators are must to wear depending upon the pesticides used. Pesticides should not contaminate foods stored in the warehouse and due importance should be given to food safety aspect.

Fumigation - It may be defined as act of introducing toxic chemical in an enclosed space in such a manner that it quickly disperse in the gas phase to reach the target organism. Fumigants used are broad spectrum insecticide and kill all living creatures in an enclosed area. Fumigation is curative treatment and kills whatever insect pests present inside the fumigation enclosure.

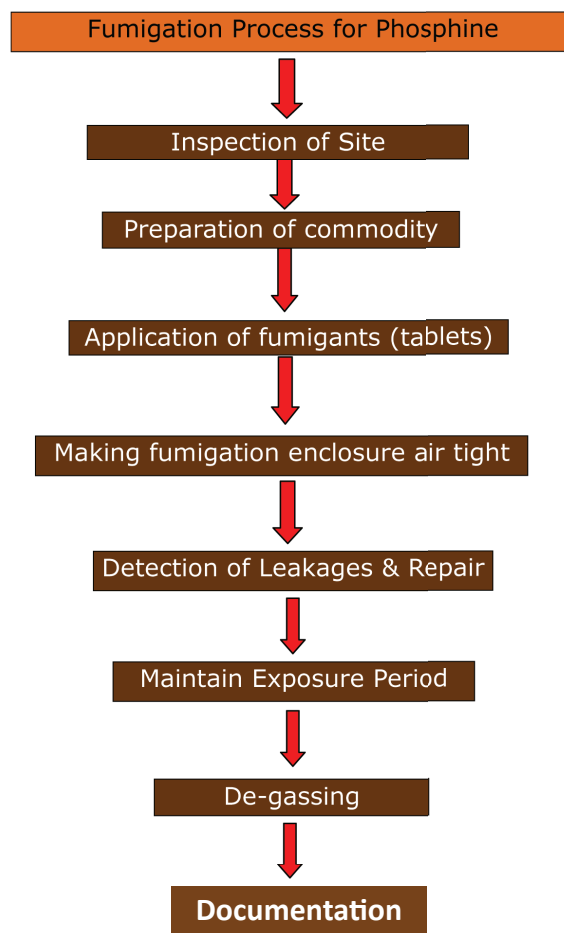
No protective residues are left behind (if used properly), unlike liquid and solid pesticides. Fumigation delivers the pesticides to target pests located in areas or material not accessible through application of other pesticide formulation (solid and liquid). For this reason fumigation is best suited for insect control in any commodity storage. There are only two fumigants registered in India namely methyl bromide and phosphine and both are classified as restricted pesticides as both are extremely toxic. However since methyl bromide is ozone depleting substance its use is legally only restricted for quarantine and pre-shipment fumigation purposes in India (only allowed for export and import consignments). Directorate of Plant Protection, Quarantine and Storage (Dt. PPQS) has sole authority and governing body on the entire aspects related to fumigation in India. DPPQ&S authorizes and issues licenses to fumigators to carry out fumigation jobs in India. It has constituted (National Standards for Phytosanitary Measures) NSPM-11 and NSPM-12 related to methyl bromide fumigation and NSPM -22 related to phosphine fumigation in India. Carrying out fumigation job without having any valid license from Dt.PPQS is illegal.

For fumigation success, the fumigator must have thorough knowledge of the properties and qualities of fumigant and characteristics and nature of commodities in depth. The fumigation team must know how to seal the fumigation enclosure, as well as apply, monitor and aerate the fumigant. Safety is priority number one. The fumigation process can be organized into seven major activities which are as under:

1. Planning and preparing
2. Sealing, securing and posting the fumigation enclosure
3. Fumigant introduction
4. Monitoring and adjusting for safety and success
5. Aeration
6. Clearance for re-entry
7. Clean-up and follow-up

As per NSPM-11 standard, there are few commodities which are forbidden to be fumigated with methyl bromide since they contain higher amount of fat and oil and they absorb higher amount of fumigant leading to safety hazards and they become unsuitable for intended use of consumption. Cashew nut is one such commodity containing higher amount of fat and oil. Hence cashew nuts are recommended to be fumigated with phosphine.

Fig 18.1: Fumigation Process:- Flow Chart for Phosphine
Fumigation Process:- Flow Chart for Phosphine



Hermetic storage – This is advance technology used for organic fumigation of cashew with CO₂ gas. The important advantage of this technology is it can be used for long term storage of cashew in natural condition eliminating the need for regular fumigation for pest control. It is a green, eco-friendly, organic yet cost effective storage technology which works on principle of modified atmosphere storage. Hermetic means air tight. Hermetic storage products create an airtight barrier between the agro commodities stored in them and the outside atmosphere i.e. No exchange of air. Continuous respiration by the commodity as well as insects inside the hermetic storage products increases the level of CO₂ and depletes the level of O₂ and as there is no exchange of air it naturally

kills the insects by asphyxiation (lack of O₂). Though this process can be hastened by artificial application of CO₂ gas in the hermetic storage products.

Hermetic storage products are worldwide patented and manufactured by GrainPro, Inc. US based company. Pest

Control (India) Pvt. Ltd. is the exclusive distributor for GrainPro in India. Various hermetic storage products namely Cocoon™, GHF Cocoon™, SuperGrainBag™ etc are being regularly used in India for pest and pesticides free storage of various agricultural commodities including cashew.

Plate 18.1: Cocoon™



Plate 18.2: SuperGrainBag™



SECTION 3

By - Product Utilization

Chapter 19: Processing, Utilization of Cashew Nut Shell Liquid

Omprakash N Phadnis, Phadnis Cashews, India

Cashew Nut Shell Liquid (CNSL) is by-product of cashew industry. Many articles have been written on the structure and composition of this in this magazine as well as on various websites.

Five decades ago, CNSL was produced by two methods in India.

1. Oil bath process of cashew nuts, in which raw cashew nuts were given CNSL bath and oil used to ooze out and get added to the basket of oil and used to remain at the same temperature for longer duration. The oil had good colour but viscosity was slightly higher (about 300-450 cps). This oil was very good for use in brake lining industry. A giant buyer for this in India was Hindustan Ferodo Ltd., Bombay. This oil was also getting exported to USA, UK etc.
2. Second method was kiln grade. This process was more popular in Tamil Nadu and parts of Kerala. In this raw shells were subjected to heat in steel chamber and oil used to ooze out and get collected. Advantage of this method was even shells of fully roasted nuts could be used for this. The oil thus extracted has dark colour and lot of impurities including moisture etc. This oil had to be refined or de-carboxylated to get a standard quality oil. This oil after purification

used to have lower viscosity, but colour was darker. The oil was used in paints, waterproofing and also brake linings.

By end of 1970s, people thought of having some standardization in the processing of raw nuts. So cashew processors in India opted for steam roasting of nuts and by 1985, this process was opted by almost 95% of industry. As the raw cashew nuts were steam roasted, the shells did not have ash etc and the oil used to be purer. Same time, running cost of bath oil method was too high and this was sidelined. Now, processors in Mangalore area like Achal cashews, KVS Kamath & co, BRK or Sanoor who were considered as most technical people in the area thought of using oil expellers and started extraction of CNSL by using ordinary oil expellers. After their R&D, it was discovered that the oil needed proper dehydration and settling along with filtration. The good outcome of this was almost uniform quality was produced by all of them. I must mention here that this was also tried in Goa by M/S. NGP Zantye Cashews and Bappa Lavando along with Kamath. In this Bappa's was the best quality oil with viscosity of 75 cps. All others opted for mass production and are continuing it even today. Advantage is entire production is almost of uniform quality. In Tamilnadu, though people opted for the process, even today shells are

not handled properly and the heating as well as settling is not done properly. Therefore, the quality of CNSL is still considered inferior. Recently, a few companies have understood the value of the quality and have improved their process.

Orissa proved to be good new centre. In Jeypore area many units started CNSL production after relatively new industrialists like Mr. Ramesh, Mr. Sai ventured in to huge cashew kernel production. M/S. Sai Cashews did not leave any stone unturned till they achieved quality in their produce and also started good quality CNSL production. The venture was so lucrative that many CNSL industries prospered in the area.

In Andhra especially Seemandhra, there are lot many small industries who are in CNSL production. Most of these units have production quality suitable for their own customers in Hyderabad or Gujarat.

Till 1990s, the biggest consumer of CNSL was brake lining industry followed by paints. But by 1995, the distillation of CNSL picked up and many industries started making cardanol (distillate of CNSL) and residol. Cardanol has excellent potential in use in place of phenol. Since prices of phenol increased, cardanol got good buyers and so the consumption of CNSL went up. M/S. Sanoor Cashew

in Mangalore, Golden products in Pondicherry and Shyam Pheno in Hyderabad along with Golden in Goa could be considered as pioneer in the field. Today there are over 15 units all together manufacturing cardanol.

The prices started rising since 1995 when the cardanol units started buying CNSL in large quantity. The prices were still under control till 2010 and the maximum price reached till then was INR 15/- per kilo. By then, one more use was discovered. CNSL found way its use as substitute for fuel oil / furnace oil. Furnace oil is used by almost all industrial units and it's cost was going up as international oil prices were increasing. Big suppliers of furnace oil exist more in Gujarat, Mumbai and Chattisgarh. So they started lifting hundreds of tons of CNSL from manufacturers and their business was very profitable. In about one and half years, CNSL prices doubled and CNSL became practically scarce. There started competition between cardanol makers and furnace oil adulterators. There were overseas inquiries also for the CNSL for use in fuel oil. At present, due to appreciation of value of rupee against USD, furnace oil prices as well as phenol prices are steady and therefore prices of CNSL have steadied around INR 38/- to INR 40/- per kilo.

Now, it is high time to emphasize the need of quality production of CNSL. Raw shells should be made available to these parties. When government is allowing a new industry in CNSL, they should check the availability of raw shells for that industry. If the raw shells are not made available, the industry would suffer a lot. Pollution control norms also should be strictly implemented. There are challenges with selling by-product of CNSL i.e. cake. At some places like in

Tamilnadu, the cake is sold at very high rate as it goes directly to hotel industry as fuel. But on the west coast, the major consumers are tile industry and tobacco industry. Both of them are seasonal and therefore, the realisation from cake is slightly uncertain in this area.

It is certain that unless the cost of petroleum products i.e. furnace oil, phenol come down, the CNSL would remain in the high price range only. India's own consumption being high, one need not bother about global prices of CNSL.

Processing economics:

1. It is found that when shells are crushed about 28-32% oil is obtained from it. With about 3-7% oil remaining in cake. Then and then only the cake could be used for fuel purpose or some other industrial purpose. The oil contains moisture, volatile matters as well as sludge. When properly dehydrated and held constantly at elevated temperature, the moisture and volatile matters escapes, making oil thin and enabling the sludge settle in the bottom. (Gravitational settling). If the oil is kept still for about 3 days, the 90-95% of the settling takes place and pure oil could be pumped out. This pure oil recovery is about 19-22.5% depending upon the shells quality and extraction method.
2. It is generally noted that the shells which are thin contain lesser percentage of oil. In India, the cashew season is generally from March to May end. Therefore, if the nuts are shelled in November or December the percent of moisture is lesser in the extracted oil itself. Same phenomenon is observed from

the nuts and their shells from various countries.

3. India, Sri Lanka shells have good percentage of oil. Many West African nuts are having thinner shells and therefore, the oil content is naturally low.
4. Indian standard oil specification viz. ISI 840 is amended from time to time and describes the standard quality CNSL. The total volatile loss including moisture along with specific gravity and viscosity are vital in pricing of CNSL for any industry.
5. Cashew shells are costing less than 10% of the total nuts value. The transportation and storing of the shells matter lot. Generally, the CNSL units located closer to a cashew factory or processing cluster would save on transportation cost. The CNSL units of the cashew processors prosper because of this. Moreover, many other expenses are taken care by the parent unit (cashew factory) and make CNSL unit viable.

(Disclaimer: Views are personal and not the views of the publisher.)



Chapter 20: Trend and Dynamics of CNSL Exim Trade

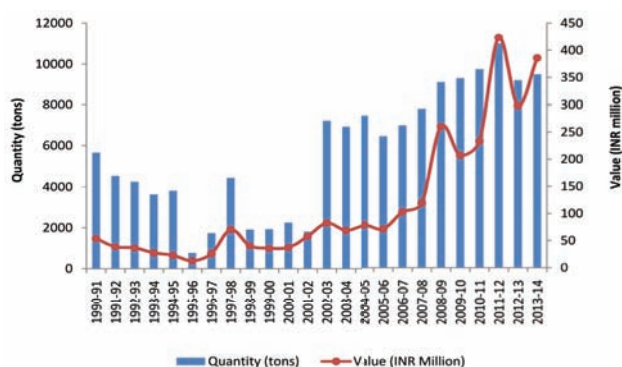
Cashew Nut Shell Liquid (CNSL) is a versatile by-product of the cashew industry. The nut has a shell of about 1/8 inch thickness inside which is a soft honey comb structure containing a dark reddish brown viscous liquid. It is called cashew nut shell liquid, which is the pericarp fluid of the cashew nut. It is often considered as the better and cheaper material for unsaturated phenols.

The main by product of cashew nut shell, Cashew Nut Shell Liquid (CNSL) has innumerable applications, such as friction linings, paints, laminating resins, rubber compounding resins, cashew resins, foundry chemicals, and intermediates for chemical industry. It offers much scope cements; polyurethane based polymers, surfactants, epoxy and varied opportunities for the development of other tailor-made polymers. CNSL and its derivatives are also used as demulsifying agents for water in oil type petroleum emulsions. It is also used for manufacturing of CNSL based Resins, Cardanol (card-phenol) Anti corrosive hiring chemicals, Acid resistant paints and varnishes, Insecticides and Fungicides, cashew lacquers bakelite and enamels.

The production potential for the product is very high. The total production of raw cashew nut in the country could be as much as 0.76 million tons and at 15% recovery by weight, the production potential for CNSL is as much as 108 thousand tons.

The main markets for CNSL are the United States, the European Union (mainly the United Kingdom), Japan and the Republic of Korea. Together these account for over ninety percent of world trade, most of which is supplied by India and Brazil.

Fig 20.1: Trend in export of CNSL from India



Source: DGCI & S, Export Import Data Bank of India

The use of this oil by indigenous industry presently is limited. USA, China, Republic Korea, Japan, Slovenia, Taiwan, Indonesia, etc are the major international markets for Indian CNSL.

Since 1989-90 CNSL export has grown steadily and reached its high during 2011-12 with the export of 11 thousand tons worth of 424 million INR. Then it started declining continuously.

Fig 20.2: Indian CNSL export over the decades

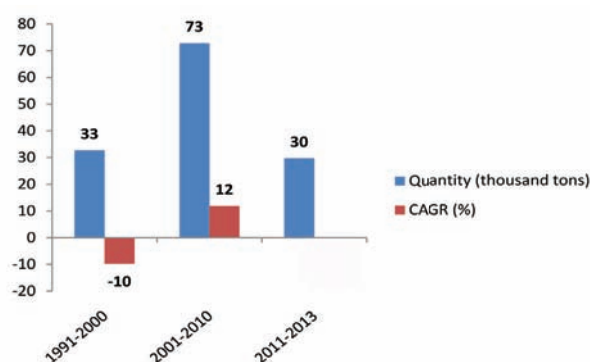
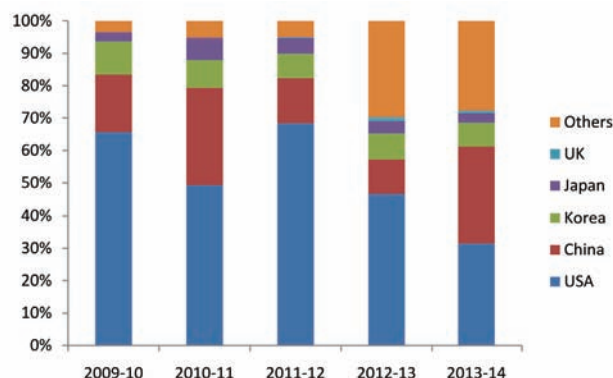


Fig 20.3: Country-wise % share in yearly import of CNSL from India



Source: DGCI & S, Export Import Data Bank of India

USA is the traditional importer of CNSL from India. However, its share in total export of CNSL from India has decreased from 66 per cent in 2009-10 to 32 per cent in 2013-14. Recently, India's export of CNSL is increasing to other export markets viz., France, the Netherlands, Iran, Egypt, Nepal, Poland, etc.



Chapter 21: Cashew Apple – an Unexploited Fruit for Processing

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Introduction

Cashew (*Anacardium occidentale* L.) which is considered to be the 'Gold Mine' of the waste land is one of the important commercial cash crops of India. Cashew, a major commercial horticultural crop of India, is primarily cultivated for its nut. India ranks first in its cultivation, processing and export since its commercial cultivation and utilization has been started. However, may be due to the high value of the nut, another important produce from cashew i.e., cashew apple, has been neglected all along without any utilization. The production of cashew apple in India is estimated to be 0.6 to 0.7 million tons per annum which are totally wasted now except in Goa where it is profitably used for the production of feni. Cashew apple is highly nutritious and comparable with other tropical fruits in its nutritive value and contains more Vitamin C and riboflavin. Research studies as well as experiences in running India's first cashew apple processing unit at Cashew Research Station, KAU, Madakkathara have clearly revealed that the cashew apple, weighing about 8-10 times that of the nut, is an equally valuable produce from the crop, if it is economically exploited.

The cashew apple

Cashew apple is the pseudo fruit, attached to the nut which develops from the pedicel. The ripe apple is

very juicy, spongy, somewhat fibrous, having a unique smell and has a very thin skin that gets easily bruised. The astringent and acid principles in cashew apple produce a rough, unpleasant and biting sensation on the tongue and throat, which is a major draw back of the fruit. The astringency of cashew apple is determined to a large extent by the tannin content, a phenolic compound, and its content varies from 0.06 to 0.76g per 100g.

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. The pH of the apples varies between 4.1 and 4.7 and total sugars from 6.7 to 10.5%. Ripe apples contain 0.76 to 1.17% pectin.

Post harvest handling-limitations and possibilities for exploitation

Fruits have special significance to human health as protective food due to their vitamin and mineral contents. They are highly perishable and begin to deteriorate immediately after harvest mainly because of their high moisture content. The post harvest spoilage of fruits is attributed to the continuing

physiological activities like respiration and transpiration which result in the degradation of stored energy and loss of moisture. Shriveling, wilting, spoilage by micro organisms, loss of texture, etc are the symptoms of deterioration and perishability. Cashew apple is a non climacteric fruit and is usually collected after falling on the ground along with the nut. This increases the chances of bruising and further damage by micro organisms leading to fermentation and deterioration. Since many of the fruits are seasonal, long term storage techniques are needed for the availability of raw material and product preparation throughout the year. Cashew apple is such a fruit and is available mainly during December - May. All these are to be looked in to during the post harvest handling and preservation of cashew apple.

Cashew farmers miss the opportunity for enhanced income generation since they sell raw nuts to traders and completely wasting the nutritious cashew apple. The seasonal production of cashew apple is one of the greatest handicaps for the processing industry, along with its unpleasant biting sensation when used in raw form and limits the use of cashew apple as a commercial table fruit. KAU has standardized the value addition technologies in cashew apple for the first time in India and rather value addition in the

commonly wasted pseudo- fruit of Kerala. The seasonal production, one of the limitations in cashew apple processing, is overcome through long term storage techniques developed by Kerala Agricultural University. Technologies are also standardized for the removal of the unpleasant biting sensation of raw cashew apple before processing, which limits its use as table fruit. Though various techniques are available to process the fruit into various products, they are yet to become popular among the common man. By effective utilization of cashew apple on a commercial scale, the farmers can be assured of increased income, in addition to the income from nut, which definitely will encourage them to take up cashew cultivation with profound interest. Large number of technologies has been developed by various research stations in India, more specifically Cashew Research Station, Madakkathara, for the economic utilization of cashew apple by processing it into various value added products.

Scope for commercialization of value addition technologies

Since fresh cashew apples are not eaten as other fruits, the apples are available in plenty at cheaper rates. The products are natural and relishing. The commercially potential technology is not exploited fully and can be made available to the women groups like SHGs or Kudumbasree units as well as private entrepreneurs so that the net income from cashew plantation can be increased thus making cashew cultivation more economic and attractive to farmers. Osmotic dehydrated cashew apple is a novel value added product developed from the cashew apple. Sugar has been completely replaced with honey in preparation of this product, hence having medicinal property with no

side effect of sugar. Thus it is possible to make the seasonal fruit available to the consumers throughout the year. There is also a vast untapped export market for the cashew apple products.

Uses of cashew apple

I. Direct consumption

Cashew apple is widely eaten raw as fresh fruit. Either whole apples are consumed or they are cut into small pieces, mixed with table salt and eaten. Quality for fresh consumption is related to low astringency and acidity, sweetness, firmness, size and pear shape. The market requirements for appearance are to be taken into consideration. A niche market for cashew apple for direct consumption can be located at least in major towns. This can be exploited successfully, if constraint like poor storability is overcome.

II. Preparation of food products

1. Beverages

a. Fresh apple beverages

Clarified and cloudy juice, juice concentrate, syrup, squash and ready- to- serve drink are some of the nutritious and refreshing beverages that can be made from the unfermented juice of cashew apple by adding varying concentrations of sugar, citric acid and preservative. The Kerala Agricultural University has standardized the technique for the preparation of juice, syrup, carbonated drink and ready to serve beverage.

b. Fermented beverages

Cashew apple can be utilized for the manufacture of the fermented products like wine, vinegar, liquor and alcohol. Cashew apple vinegar can be prepared by alcoholic and subsequent acetic fermentation of juice, which is perhaps the

oldest known fermentation product. Cashew liquor is made by distillation of the pure juice of cashew apple without addition of any extraneous matter. One litre of 60-62% ethyl alcohol can be obtained from eight liters of cashew apple juice. Kerala Agricultural University has standardized the method of producing four different grades of liquor from cashew apple.

Cashew apples are utilized widely in Goa for the preparation of the liquor, feni, by distillation mostly through crude country methods on cottage industry basis, in almost all plantations.

Cashew wine is a product of fermentation of hexose sugar of cashew apple juice by intact yeast cells to form ethyl alcohol and carbon dioxide. Kerala Agricultural University has developed methods for producing four grades of wine such as soft, medium, hard and sweet, based on the alcohol percentage and sweetness.

Cashew apple wine can be mixed with fresh juices of orange, pineapple, tomato, grape and cashew apple as well as tender coconut water to produce wine coolers to serve as good health drink as they contain both wine with its medicinal properties and fruit juices with high amount of nutrients and minerals.

2. Products from cashew apple pulp

Jam is the most important pulp product of cashew. It can be prepared by boiling the cashew fruit pulp with a sufficient quantity of sugar and a pinch of citric acid to a reasonably thick consistency. Mixed fruit jam can also be prepared by mixing cashew apple pulp with equal quantity of banana pulp, mango pulp or pineapple pulp. The Madakkathara

Centre is commercially producing Cashew apple - Mango mixed jam named Cashewman.

Fruit bar having 800 brix can be prepared by heating layers of fruit pulp mixed with pectin, sugar, glucose and potassium metabisulphate to 900 C and drying to 15% moisture. Different layers of cashew apple paste mixed with 1% citric acid are sun dried and cut into required size after placing one on top of the other to form leather. The layers, after smearing sugar syrup and pressed together, can be eaten like fruit wafers.

3. Confectionery products

Candied fruit is prepared from cashew apple by impregnating with cane sugar with subsequent draining and drying. One kilogram of cashew apple on processing gives 745 gm candies. The Madakkathara Centre is commercially producing cashew apple candy. The syrup left over from the candying process can be used for sweetening chutneys, in vinegar making or for candying another batch of fruits. Cashew apple can also be utilized for the preparation of tutti frutti. One kilogram of cashew apple on processing gives 715 gm tutti frutti. The whole fruit can also be processed in to nutritious toffee, a feasible dessert item with extended shelf life.

Cashew apple juice can be used for preparing frozen deserts and dairy/confectionery items by optimization of juice concentration and spray drying. The only constraint here is the large capital investment required for spray drier equipment.

Dehydrated powder is used to prepare dehydrated cashew apple products. 1 Kg of good quality fresh cashew apple on processing can yield about 200 gm of osmotically dehydrated cashew apples.

Ready- to- serve beverage mix, fruit-milk/ milk shakes, ice creams, ice candy mix, etc. can be prepared from clarified juice by homogenization, spray drying and mixing with fruit / milk powder as required.

4. Culinary products

Sliced raw green fruit can be used to prepare pickle using chilli powder, gingelly oil, fenugreek powder, asafoetida, turmeric powder, garlic, mustard powder, a pinch of sodium benzoate and salt to taste. Madakkathara Centre is commercially producing and marketing Cashew Apple Pickle. Chutney can be prepared from sliced cashew apple using sugar, onion, ginger, cumin, pepper, cardamom, cinnamon, coriander powder, salt, vinegar etc. Dried pulp prepared from semi- boiled apples is preserved for off- season and used for culinary purposes.

Several traditional culinary preparations are in vogue in cashew growing areas using both unripe and ripe cashew apples.

III. Medicinal properties

Several preparations from cashew apple have been extensively used traditionally for several ailments. Cashew apple is used as a curative against scurvy and stomach ailments like dysentery and diarrhea. It is used as a tonic to mothers in confinement.

Cashew apple liquor is used for medicinal purposes for ailments like worms, sickness, cold, body ache, fever, toothache, fresh wounds and cuts. Cashew apple juice kept in sunlight for a fortnight can be preserved for 2 to 3 years, which would have effect in treating fever and diarrhea of both human beings and domestic animals. It is believed that cashew apple juice induces sleepiness when given

along with medicines for patients affected by fever, thus helping in fast recovery.

IV. Nutraceutical application

Cashew apple is a source of ascorbic acid, fibre, carotenoid pigments and minerals. Cashew apple powder lipids are rich in unsaturated fatty acids, the major ones being palmitoleic and oleic acids. Vitamin C present in cashew apple is an anti oxidant.

A valuable by- product that can be obtained from cashew apple waste is pectin. Pectin is used in manufacturing jams, jellies, marmalades, preserves etc. It is useful as thickening, texturing and emulsifying agent and finds numerous applications in pharmaceutical preparations, cosmetics etc.

V. Agricultural uses

Considerable amount of cashew apple residue is obtained as waste when bulk quantities of cashew apple is utilized for the manufacture of soft drinks or fermented beverages on a commercial scale. The cashew apple waste can be converted to vermi compost with good nutrient content.

The ripened cashew apple or its residue could be utilized for the preparation of cattle feed, pig feed and poultry feed.

It is reported that cashew apple extract is an effective insecticide against red palm weevil (*Rhynchophorus ferrugineus* Olive) in coconut. Cashew apple and gum extract, in combined form or alone, acts as an effective repellent against leaf feeding pests of vegetables. The cashew apple is dried and powdered into meal which can be used as bait for catching crustaceans.

VI. Energy production and industrial uses

Bio fuel- The potential to utilize cashew apple for production of alcohol to be used as a bio fuel is immense. It is estimated that cashew apple can yield 8 to 10 % of ethanol. The residue, after extracting juice for feni preparation, is used as fuel in liquor industry in Goa.

Biogas-Ripened fruits can be used as raw material for biogas plant.

Tannin extraction-Cashew peel can be used for the extraction of tannin which is useful in leather industry.

Value addition in cashew apple Constraints in cashew apple processing

The seasonal production of cashew apple is one of the greatest handicaps for the processing industry, along with its astringent and acid principles. In addition, the utility of cashew apple is limited because of its high susceptibility to physical injury, which leads to microbial spoilage by yeast and fungi during harvest, transportation and storage. More than 60 per cent of cashew apple collected at ripe stage exhibits moderate to heavy damage. The storability of cashew apple is thus very poor and complete spoilage can occur within hours after harvest. Fragmented and scattered nature of cashew plantations also creates problem in collection and utilisation of cashew apple in some cases. The system of collection of cashew nuts from fallen fruits after considerable delay also limits the availability of quality cashew apple for processing purposes.

Suitability of apples for processing

Cashew apple suited for processing should have medium to large fruit size with more than 70% juice, containing more than 11% sugar

and 0.39- 0.42% acidity. Though the yellow coloured apple is preferred in some regions because of its sweetness, more or less sweet or astringent apples have been found in all colour groups. Crisp, firm, tight and full colour developed apples are to be collected. The apples are to be collected every day when it falls to the ground and if the apples are left for some time, rotting of cashew apples takes place. Once damaged, the apples may ferment and deteriorate rapidly. After collection, fruits are to be sorted and the best quality ones are to be selected and washed thoroughly with water.

Removal of tannin (Clarification/ detanning)

The presence of tannin interferes with the taste of the apple and the processed products from it. Removal of tannin is a must before preparation of products. Steaming of cashew apple for 5 to 15 minutes and subsequent washing or treatment of the fruit for four to five minutes in boiling solution of common salt (2%) or sulphuric acid (0.2 N), followed but washing in water can remove the undesirable tannin. Clarification can also be done by using gelatin, calcium hydroxide or pectin. Madakkathara station has developed effective low cost and organic technology for the removal of tannin by using sago.

Clarification and storage of juice

The extracted juice is strained through a muslin cloth and kept for clarification. Powdered and cooked sago at 5 gm/litre of juice is added for clarification. Then potassium meta bisulphite (KMS) 2.5 gm and citric acid 5g are added to every litre of the juice. Stirred well kept for 12 hours to allow the tannin to settle and the upper layer of clear juice is decanted carefully without mixing the sediments. This clarified juice is stored in well sterilized air tight

plastic barrels for one year which could be used for off season product preparation.

Detanning and storage of cashew apple

The cleaned apples are dipped in 5% salt solution for three days, changing water every day. Fourth day the fruits are taken out and washed thoroughly in fresh water. They are steamed in pressure cooker for 10 - 15 minutes, made into pulp and stored in air tight glass bottles after adding 2.5 gm KMS and 5 gm citric acid for every kilogram of pulp. Cashew apples are also stored in KMS solution which can be used for candy preparation.

Green cashew apples are detanned in the same way by dipping in 8% salt solution and then used for pickle preparation.

Cashew apple products developed at Cashew Research Station, K.A.U., Madakkathara, Kerala

1. Cashew apple syrup

The clarified juice is siphoned out as the raw material for the preparation of syrup. Sugar, citric acid and lemon yellow colour, if required, are added to the clarified juice in required quantity to produce syrup. Taste is better if served chilled. Syrup has a storage life of one year. Cashew apple syrup contains 276 mg Vitamin C and drink contains 140 mg vitamin C/ 100 gm. Syrup has a storage life of one year.

2. Cashew apple drink

The drink is an RTS (Ready – To -Serve) beverage. It is prepared by adding water and sugar to the required quantity of clarified juice. Drink is marketed both in glass bottles and in attractive food grade pouches. The drink contains 140 mg vitamin C/ 100 gm Pasteurized drink in glass

bottles has a storage life of three months under ambient storage conditions.

3. Cashew apple carbonated drink

Cashew apple carbonated drink (soda) is made by adding chilled carbonated water at 100 psi pressure to the required quantity of syrup.

4. Cashew Apple- Mango Mixed Jam

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

5. Cashew apple candy

It is a sweet product and quality apples with good shape are selected for candy preparation. As in 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 700 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. Vitamin C content of the product is 28.4 mg/100 gm.

6. Cashew apple pickle

Mature but unripe cashew apples are collected directly from plantations 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 pickle is prepared using oil, chilly powder, fenugreek powder, turmeric powder and ginger -garlic paste.

7. Cashew apple vinegar

Vinegar is prepared from cashew apple juice by adding a little sugar and yeast to cashew apple juice and keeping for one week for alcoholic fermentation. After one week alcoholic ferment is got to which three times mother vinegar is added and again kept for 2 weeks. After this period the vinegar is ready with the acidity of 4 – 5 %.

8. Cashew apple chocolate

Cashew apple powder is used to make chocolate, by adding sugar, milk powder and ghee in appropriate proportions.

9. Cashew apple biscuit

Cashew apple biscuit is prepared using cashew apple powder, ghee, sugar and maida in required quantities and further baking.

10. Cashew apple wine

Wine is a fermented product from cashew apple. This is made by mixing cashew apple, sugar and luke warm water after adding starter solution. Starter solution is prepared by adding 5g yeast and 10 g sugar to 100ml luke warm water and keeping for half an hour. The mixture should be kept in glass bottles or clay pots for 21 days with daily shaking. Then strained the solution and again kept for another 21 days by which time the wine is ready. Better flavour is obtained by the addition of

spices like clove, cardamom, cinnamon etc.

11. Cashew apple squash

For making cashew apple squash, sugar and citric acid are added to water and boiled. The flame is switched off and then clarified juice is added, cooled, a pinch of colour is added, strained, bottled and sealed. This can be diluted to three times for drinking.

12. Cashew apple bar

Cashew apple bar is prepared from the pulp by adding 40% sugar.

13. Cashew apple halva

Halva is made from cashew apple pulp by adding coconut milk, sugar and ghee.

14. Cashew apple pudding

Cashew apple pudding is another confectionery which is prepared by mixing cashew apple powder, sugar, milk and gelatin along with vanilla essence.

Commercial application of the cashew apple processing technologies

An FPO licensed cashew apple processing unit (now converted to FSSAI) has been established at Cashew Research Station, Madakkathara, Thrissur under Kerala Agricultural University during 1997 for the manufacture of unfermented cashew apple products. It is the first ever unit established in India for cashew apple processing. It is a fully fledged commercial unit which is undertaking commercial production of eight cashew apple products viz., cashew apple syrup, cashew apple drink, mixed cashew apple-mango jam, cashew apple pickle, cashew apple candy, cashew apple

soda, cashew apple chocolate and cashew apple vinegar.

The constant transfer of technology initiatives by the Madakkathara station has resulted in the establishment of several units by private entrepreneurs and Self Help Groups. The first ever cashew apple processing unit in private sector using Madakkathara technology has been established at Iritty, Kannur, Kerala under the trade name "TOMCO PRODUCTS" and they are marketing cashew apple syrup and cashew apple candy. YELCO is another attempt on cashew apple processing at Kannur by the trained personnels from CRS, Madakkathara.

The success of these units largely depends upon the support of the state and central governments. Being a processed product, cashew apple products are also charged Valued Added Tax @ 14.5% at present. This is a major impediment in selling the cashew apple products at attractive prices.

Economics and marketing of cashew apple products

The economics of processing cashew apple for syrup production has been worked out. By processing one tone of cashew apple, a net profit of INR 12000/- (USD 196.72 when INR/USD exchange rate is 61.00) can be obtained. Considering that the average yield of nuts in India is 800 kg/ha, a production of 6.4 ton/ha of cashew apple can be anticipated. A production of about 2 ton/ha of good cashew apple can be ensured, taking 30% of the total production as for processing. Thus the additional income from a hectare of cashew orchard from the processing of cashew apple worked out to INR 24000/- (USD 394.44), if a farmer or farmers' groups can venture into this endeavor. Compared to other fruits,

the advantage of cashew apple is that it is available free of cost and hence the price of cashew apple beverages can be fixed by about INR 12/- (0.19 USD per kg) less than that of conventional fruit drinks like mango and pineapple.

Processing of cashew apple is an economically viable enterprise in cashew growing tracts. Women Self Help Groups can very well take up this enterprise, thereby effectively contributing to the cause of women empowerment. If legal permission is available for production of fermented products like liquor and wine, it can substantially enhance the income from cashew apple processing many folds.

The total production of cashew apple in the country is estimated to be 0.6 to 0.7 million tons. At least a minimum of 30% of the total quantity can be economically utilized for production of value added products, working out to 0.18 to 0.21 million tons. Based on our study, a net profit of INR 12000/- can be obtained by the processing of one tone of cashew apple. Thus the total national income that can be obtained through cashew apple processing is estimated to be around INR 21600 to 25200 million INR. Even though imaginary figure, this can be considered as significant contribution to national economy.

The increasing preferences for natural products, over synthetics, are to be given emphasis while marketing cashew apple products. Higher content of vitamin C and medicinal properties of cashew apple are added advantages to be popularized for the marketing of cashew apple products.

Conclusion

Processing of cashew apple is to be considered as a programme

of agricultural waste utilization, adding income to the growers. The excellent qualities of cashew apple offer immense opportunities for its processing to various value added products. Commercial exploitation of cashew apple is the need of the hour considering its vast potential in enhancing the income from cashew plantations. It is one of the prime areas of utilizing the indigenous fruit and opens up wider market possibilities and hence tremendous scope for commercialization. The running of the cashew apple processing unit at CRS, Madakkathara under Kerala Agricultural University for the commercial production, clearly demonstrates the economic viability of cashew apple processing. However the support of the state and central governments are vital in promoting the processing of cashew apple, including financial and policy support, such as exemption of VAT for cashew apple products, at least in the initial years. Extending financial support for establishing cashew apple processing units under National and State Horticulture Mission, National Horticulture Board and Rashtriya Krishi Vikas Yojana can encourage entrepreneurs to start new units.

(Disclaimer: Views are personal and not the views of the publisher.)



SECTION 4

Annexure

Annexure 1
Major country-wise Raw Cashew Nut Area (1961-2013)

Country/Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	
India	200	200	215	215	230	241	249	257	266	281	303	320	328	351	361	375	376	386	420	447	464	481	492	502	510	518	523	527	
Viet Nam	1	1	1	1	1	3	3	3	3	3	5	5	5	5	5	7	7	7	7	8	10	10	17	30	59	90	115	130	97
Brazil	47	58	66	47	67	67	118	116	114	99	140	171	180	170	100	180	293	376	317	366	361	390	439	361	561	585	366	625	
Côte d'Ivoire	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	9	9	9	9	10	13	15	20	20	22	30	30	20	
Mozambique	180	180	230	230	210	190	180	300	250	290	320	320	360	340	300	200	150	110	120	130	130	110	63	36	44	52	61	75	
Tanzania	83	108	80	100	113	120	140	163	183	186	210	200	240	200	190	135	162	110	96	70	97	73	58	80	58	40	35	35	
Others	44	58	59	288	69	70	78	212	87	93	91	91	91	95	155	160	171	186	189	248	276	345	329	359	280	296	304	332	
Total	563	614	659	889	698	699	776	1058	911	960	1077	1115	1213	1169	1119	1065	1167	1183	1158	1279	1351	1432	1431	1417	1565	1637	1449	1711	

(Contd...)

Country/Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Past 5 year CAGR (%)	Past 10 Year CAGR (%)	1961-2013 CAGR (%)	% Share in total area (2013)
India	529	531	532	534	560	565	577	635	659	675	706	686	700	750	780	820	843	854	868	893	923	953	979	992	1009	2	2	3	20
Viet Nam	110	140	155	79	123	173	189	195	203	192	144	196	199	240	184	296	348	402	440	403	391	373	363	342	324	-5	0	14	6
Brazil	664	583	645	695	726	681	700	548	582	621	613	651	639	665	683	691	700	710	731	747	753	759	764	769	726	-1	1	5	14
Côte d'Ivoire	40	30	40	45	70	70	70	70	70	95	208	176	133	292	292	400	520	650	660	660	670	710	860	878	882	8	8	11	18
Mozambique	85	40	54	85	45	45	55	75	60	65	70	69	70	65	75	60	120	75	90	60	60	77	76	77	77	5	-1	-3	2
Tanzania	35	35	55	55	55	55	60	65	60	80	85	90	90	80	80	80	80	90	93	94	94	80	79	80	80	-3	-1	-1	2
Others	345	374	449	501	565	627	735	872	1345	1402	1518	1541	1546	1577	1576	1582	1647	1723	1457	1454	1490	2028	1879	1895	1920	4	3	8	38
Total	1809	1733	1930	1994	2143	2215	2387	2460	2978	3130	3344	3409	3377	3669	3669	3929	4259	4504	4339	4311	4381	4979	5000	5034	5017	3	3	4	4

(Unit in thousand ha)
Source: FAO Stat, DCCD Cochín, MARD Vietnam, IBGE Brazil, Ministry of Agriculture Republic of Indonesia

Annexure 2 Major country-wise RCN Production (1961-2013)

Country/Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
India	85	88	92	95	100	104	114	119	120	123	127	130	130	135	144	162	162	165	172	180	185	196	201	211	221	234	246	260	274
Viet Nam	1	1	1	1	1	2	2	2	2	2	4	4	4	4	4	5	5	5	5	6	7	7	8	9	9	10	12	8	9
Brazil	10	12	14	10	14	14	24	24	23	20	29	35	37	35	20	37	60	77	65	75	74	80	90	74	115	120	75	128	136
Côte d'Ivoire	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.2	0.4	0.5	0.4	0.5	0.5	0.6	0.6	1	1	2	2	4	6	5	3	9
Mozambique	107	108	149	156	136	119	101	186	154	184	202	200	240	213	188	122	92	61	66	71	71	61	36	20	25	30	35	45	50
Tanzania	50	70	50	71	76	83	84	93	96	107	126	126	145	122	116	84	93	68	57	41	64	43	33	38	33	19	18	22	19
Others	35	46	43	51	59	59	62	60	56	74	71	64	69	76	91	98	107	111	92	90	92	97	93	119	116	128	135	144	155
Total	288	325	349	383	386	381	388	484	453	512	559	558	624	585	564	508	520	489	458	464	494	485	463	473	523	547	526	611	652

(Contd...)

Country/ Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Past 5 year CAGR (%)	Past 10 Year CAGR (%)	1961-2013 CAGR (%)	% Share in total pro- duction (2013)
India	286	295	305	350	350	322	418	430	440	440	450	470	500	535	544	579	620	665	695	613	675	725	753	757	5	3	4	29
Viet Nam	26	32	58	65	78	53	59	67	54	41	68	73	129	164	205	232	340	350	349	350	400	350	275	252	-10	2	14	10
Brazil	99	186	108	77	150	164	167	125	40	131	167	124	165	183	188	153	244	141	243	221	104	231	76	138	-12	-5	5	5
Côte d'Ivoire	7	8	8	17	16	39	31	37	39	52	64	88	105	85	141	168	211	251	320	350	360	385	460	480	9	14	18	18
Mozam- bique	23	31	54	24	23	33	65	43	52	52	35	50	64	51	102	100	75	85	80	90	97	80	60	50	-15	-5	-2	2
Tanzania	17	30	41	39	47	63	82	65	93	107	121	122	123	123	100	100	94	94	99	79	98	100	129	120	12	2	0	5
Others	154	200	225	251	260	283	313	359	407	455	455	496	513	510	650	688	717	624	525	672	676	587	719	806	4	1	6	31
Total	611	781	799	824	924	958	1135	1127	1125	1277	1359	1423	1598	1652	1929	2014	2292	2335	2311	2454	2481	2515	2572	2600	2	3	4	4

(Unit in thousand tons)

Source: FAO Stat, DCCD Cochin, MARD Vietnam, IBGE Brazil, Ministry of Agriculture Republic of Indonesia

Annexure 3
Major country-wise RCN Productivity (1961-2013)

Country/Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
India	425	440	428	442	435	430	459	461	453	439	420	406	395	386	399	431	432	428	409	403	399	407	409	420	434	452	470	493	518	538	
Brazil	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	205	171
Viet Nam	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	684	588	667	678	667	696	769	825	909	1000	
Côte d'Ivoire	50	50	50	50	50	50	50	50	50	37	50	48	28	44	56	41	56	56	61	63	85	87	110	110	159	200	167	150	225	217	
Mozambique	594	600	648	678	648	626	561	620	617	634	631	625	667	628	627	610	610	555	550	547	547	555	565	564	572	577	574	600	591	563	
Tanzania	602	648	625	710	673	693	599	567	523	578	602	628	605	609	610	620	576	623	595	592	660	592	570	476	565	480	528	642	550	487	

(Contd...)

Country/Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Past 5 Year CAGR (%)	Past 10 Year CAGR (%)	1961- 2013 CAGR (%)
India	554	572	625	619	557	658	653	533	652	758	643	627	649	686	663	685	726	766	778	685	732	772	751	0	1	1
Brazil	288	155	106	220	265	305	215	87	237	213	194	247	268	272	218	343	192	325	288	1074	965	804	777	18	19	1
Viet Nam	1032	1200	1522	1204	1069	1213	1321	1126	1147	1382	1470	2145	3570	2767	2760	2719	2745	2957	2957	1894	1074	965	804	-28	-14	3
Côte d'Ivoire	188	171	241	234	563	446	522	413	358	360	657	360	291	352	356	362	424	424	424	507	448	524	544	5	5	6
Mozambique	577	638	532	511	608	887	722	795	839	839	829	772	851	716	869	838	827	1417	1417	1260	1055	775	653	-18	0	1
Tanzania	543	751	715	847	1057	1257	1090	1165	1247	1347	1356	688	1021	1160	1125	860	996	1054	1054	1225	1269	1204	1209	3	2	2

(Unit in kg/ha)

Source: FAO Stat, DCCD Cochín, MARD Vietnam, IBGE Brazil, Ministry of Agriculture Republic of Indonesia

Annexure 4 State-wise RCN Area in India (1993-2013)

Year	Kerala	Karna- taka	Goa	Maha- rashtra	Tamil Nadu	Andhra Pradesh	Orissa	West Bengal	Others	Total
1993	156	75	46	51	97	72	60	7	1	565
1994	156	75	48	58	97	73	61	7	2	577
1995	119	84	50	67	77	118	102	9	10	635
1996	119	85	51	80	79	121	105	9	10	659
1997	120	87	52	104	81	121	109	9	16	701
1998	122	89	53	119	83	101	114	9	16	706
1999	122	91	54	121	85	103	84	9	17	686
2000	100	91	55	121	86	130	90	8	19	700
2001	100	90	55	143	90	135	110	9	18	750
2002	100	92	55	148	92	136	120	9	18	770
2003	101	94	55	148	95	136	124	9	18	780
2004	102	95	55	160	105	150	126	9	18	820
2005	80	100	55	160	121	170	120	10	21	837
2006	80	102	55	164	123	171	125	10	24	854
2007	84	103	55	167	123	171	131	10	24	868
2008	70	107	55	170	131	182	137	11	30	893
2009	72	118	55	175	133	183	143	11	33	923
2010	78	119	56	181	135	183	149	11	33	945
2011	83	121	58	183	136	184	158	11	28	962
2012	85	122	57	184	136	184	164	11	39	982
2013	85	124	58	184	139	185	167	11	55	1009
Past 5 year CAGR (%)	4	1	1	1	1	0	4	0	12	2
Past 10 Year CAGR (%)	-1	3	1	2	3	2	4	2	10	2
1993-2013 CAGR (%)	-3	2	1	6	3	4	4	2	22	3
% Share in total area (2013)	8	12	6	18	14	18	26	1	4	

(Unit in thousand ha)

Source: DCCD Cochin

Annexure 5 State-wise RCN Production in India (1990-2013)

Year	Kerala	Karna- taka	Goa	Maha- rashtra	Tamil Nadu	Andhra Pradesh	Odisha	West Bengal	Others	Total
1993	140	32	16	47	19	47	43	4	0	348
1994	119	26	17	38	22	59	37	3	0	322
1995	140	38	18	69	31	72	43	7	1	418
1996	134	52	20	80	30	60	40	6	8	430
1997	100	35	25	60	30	50	45	6	9	360
1998	130	40	20	85	35	80	50	8	12	460
1999	100	60	30	125	45	100	40	8	12	520
2000	76	42	25	98	59	75	59	6	10	450
2001	87	40	30	103	46	86	59	7	12	470
2002	90	40	30	110	50	90	70	8	12	500
2003	95	46	32	120	51	95	71	9	16	535
2004	64	43	26	174	53	88	74	8	14	544
2005	67	45	27	183	56	92	78	10	15	573
2006	72	52	29	197	60	99	84	10	17	620
2007	78	56	31	210	65	107	90	10	18	665
2008	75	60	30	225	68	112	95	11	19	695
2009	66	53	26	198	60	99	84	10	17	613
2010	71	57	24	208	65	107	91	11	19	653
2011	73	60	25	223	68	110	97	11	25	692
2012	77	75	30	225	62	118	101	12	29	728
2013	83	81	32	243	67	100	86	13	52	757
Past 5 year CAGR (%)	6	12	7	5	2	1	1	6	31	5
Past 10 Year CAGR (%)	2	6	1	3	2	2	2	4	12	3
1993-2013 CAGR (%)	-3	4	2	9	6	4	5	5	19	4
% Share in total production (2013)	11	11	4	32	9	13	11	2	7	

(Unit in thousand tons)

Source: DCCD Cochin

Annexure 6 State-wise RCN Productivity in India (1993-2013)

Year	Kerala	Karnataka	Goa	Maharashtra	Tamil Nadu	Andhra Pradesh	Orissa	West Bengal	India's Average
1993	925	500	370	1246	203	723	812	596	694
1994	781	400	390	1100	232	880	679	490	631
1995	1000	550	410	1440	330	1000	720	870	720
1996	1140	690	430	1570	390	830	670	870	835
1997	850	460	530	1500	390	690	750	860	740
1998	1100	500	420	1500	460	800	750	890	800
1999	850	700	610	1470	540	1100	670	900	900
2000	765	500	500	1050	750	650	700	900	710
2001	870	470	590	880	570	720	570	780	710
2002	890	470	660	1000	570	740	810	890	760
2003	890	500	690	1100	600	750	850	760	800
2004	900	680	660	1200	610	840	810	800	810
2005	900	700	690	1300	640	880	860	950	815
2006	900	700	690	1500	670	890	860	1000	820
2007	900	710	700	1500	700	900	860	1000	860
2008	1071	561	545	1323	519	615	693	1000	778
2009	957	461	473	1186	472	544	641	909	695
2010	910	479	429	1149	481	585	611	1000	691
2011	880	496	431	1219	500	598	614	1020	719
2012	898	640	540	1282	469	646	685	1096	772
2013	979	650	558	1317	483	543	514	1168	751
Past 5 year CAGR (%)	0.3	10.2	5.8	3.2	0.2	1.0	-3.2	6.1	2.7
Past 10 Year CAGR (%)	0.3	-2.5	-4.3	-0.7	-4.1	-5.6	-5.0	2.7	-1.5
1993-2013 CAGR (%)	0.1	0.8	1.3	-0.2	3.0	-1.8	-0.7	2.4	0.2

(Units in kg/ha)

Source: DCCD, Cochin

Annexure 7 RCN imports into India (1990-91 to 2013-14)

Year	Quantity	Value	Year	Quantity	Value
1990-91	83	1340	2004-05	579	21832
1991-92	106	2667	2005-06	565	21630
1992-93	135	3763	2006-07	586	18116
1993-94	191	4827	2007-08	606	17468
1994-95	228	6909	2008-09	606	26318
1995-96	223	7601	2009-10	753	30374
1996-97	192	6406	2010-11	504	24795
1997-98	225	7440	2011-12	809	53378
1998-99	181	6802	2012-13	892	53311
1999-00	201	9535	2013-14	771	45640
2000-01	249	9608	Past 5 year CAGR (%)	6	17
2001-02	356	9600	Past 10 year CAGR (%)	4	13
2002-03	401	12366	1990-2013 CAGR (%)	10	14
2003-04	452	14009			

(Quantity in thousand tons, value in INR million)

Source: UN Comtrade, Export Import Data Bank of India, DGCI & S Kolkatta

Annexure 8
Origin wise import of RCN into India (2000-2013)

Year/Country	Benin	Côte d'Ivoire	Gambia	Ghana	Guinea-Bissau	Indonesia	Mozambique	Nigeria	Senegal	Tanzania	Others	Total
2000	Qty 27	50	0.2	3	57	17	19	11	7	68	11	271
	Val 23	42	0.2	3	60	16	17	7	5	74	11	259
2001	Qty 15	39	1	3	17	4	14	5	5	68	3	174
	Val 8	20	1	2	10	3	8	2	3	42	2	100
2002	Qty 37	87	6	5	62	33	15	19	7	75	13	359
	Val 22	50	4	3	47	22	8	9	5	50	8	228
2003	Qty 47	78	6	32	71	52	32	22	9	67	19	434
	Val 30	46	4	20	51	36	21	11	6	48	12	284
2004	Qty 48	118	9	31	81	43	43	19	8	67	15	481
	Val 35	81	7	22	69	42	30	11	6	64	10	379
2005	Qty 55	138	12	32	89	78	32	16	6	47	18	523
	Val 49	114	11	28	92	77	28	12	5	43	15	474
2006	Qty 67	198	23	48	59	44	27	22	10	67	12	577
	Val 47	129	16	31	44	35	20	13	7	52	8	402
2007	Qty 57	196	23	31	111	49	22	18	10	40	13	571
	Val 40	111	14	19	71	42	16	10	6	33	8	369
2008	Qty 85	219	24	43	85	61	35	14	4	65	20	655
	Val 78	198	27	37	103	69	32	12	5	66	18	643
2009	Qty 114	213	27	46	95	36	7	16	12	67	22	662
	Val 93	147	23	32	85	39	6	11	10	69	29	539
2010	Qty 83	196	12	53	53	27	28	7	6	86	13	565
	Val 79	165	14	46	60	34	30	5	7	122	12	574
2011	Qty 120	174	25	125	131	30	33	10	18	66	67	798
	Val 166	221	37	165	215	54	47	13	24	112	89	1143
2012	Qty 158	244	20	79	90	41	6	27	11	118	28	822
	Val 167	237	25	83	121	54	6	26	14	160	30	924
2013	Qty 102	235	32	97	135	25	14	13	25	123	30	830
	Val 102	199	31	89	136	32	13	11	22	151	25	812
Past 5 year CAGR (%)	Qty 4	4	8	21	13	-3	0.1	10	22	16	9	9
	Val 10	10	13	30	18	1	-0.2	18	27	20	12	14
Past 10 year CAGR (%)	Qty 12	6	8	15	4	-8	-12	-4	11	9	12	6
	Val 18	11	15	21	10	-2	-8	2	17	16	18	11
2000-2013 CAGR (%)	Qty 15	13	31	29	8	5	-3	1	8	3	12	10
	Val 20	18	37	33	13	11	1	7	13	9	17	14
Share in total import (2013)	Qty 12	28	4	12	16	3	2	2	3	15	4	4
	Val 13	25	4	11	17	4	2	1	3	19	3	3

(Quantity in thousand tons, value in million USD)
Source: UN Comtrade, Export Import Data Bank of India

Annexure 9 Exports of cashew kernels from India (2000-01 to 2013-14)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Past 5 year CAGR (%)	Past 10 year CAGR (%)	2000-2013 CAGR (%)
Qty	89	98	104	101	127	114	119	114	110	118	106	132	104	120	0.2	-0.4	1.5
Val	20498	17768	19359	18546	27092	25149	24552	22890	29884	28016	28194	43907	40672	50958	16.9	7.9	7.3

(Quantity in thousand tons, value in INR million)
Source: UN Comtrade, Export Import Data Bank of India, DGCI & S Kolkata

Source wise export of Cashew kernels from India (2000-2014)

Year/Country	USA	Netherlands	UAE	Germany	France	UK	Singapore	Saudi Arabia	Japan	Australia	Others	Total
2000	Qty 35	16	3	1	2	5	1	1	4	1	9	79
	Val 185	86	18	4	11	29	6	8	23	5	49	423
2001	Qty 44	14	3	1	3	7	1	1	4	1	11	89
	Val 179	55	14	4	13	26	4	6	16	2	46	362
2002	Qty 61	14	5	1	2	6	2	2	5	1	15	113
	Val 207	48	17	4	8	23	4	7	19	4	50	391
2003	Qty 46	12	6	2	2	5	1	2	4	0	16	96
	Val 170	43	19	5	7	18	4	3	15	2	55	347
2004	Qty 53	13	7	2	3	6	1	3	5	1	19	111
	Val 234	60	29	7	11	28	5	11	23	3	83	492
2005	Qty 53	19	8	2	4	7	2	3	5	1	26	130
	Val 250	95	38	10	17	35	7	14	27	6	120	618
2006	Qty 45	20	10	2	3	5	1	4	4	1	25	121
	Val 211	88	44	8	16	24	5	14	17	5	112	544
2007	Qty 40	14	13	2	4	4	1	4	5	2	23	111
	Val 193	66	59	8	17	18	6	18	23	10	112	530
2008	Qty 41	15	16	1	5	4	1	3	6	3	28	123
	Val 219	79	91	8	23	19	7	17	33	13	158	667
2009	Qty 40	12	19	1	4	6	1	4	6	2	33	128
	Val 170	53	93	7	17	24	6	21	31	7	147	576
2010	Qty 32	12	19	2	3	3	2	5	7	1	28	113
	Val 159	59	96	8	17	15	9	23	33	5	139	562
2011	Qty 50	12	14	3	4	4	2	4	7	2	32	133
	Val 303	76	127	19	25	23	12	38	45	10	216	893
2012	Qty 33	9	11	2	3	3	2	6	6	1	26	102
	Val 256	66	86	15	20	20	12	43	50	5	194	766
2013	Qty 36	11	20	3	4	3	2	7	8	0	32	126
	Val 270	79	151	21	26	21	15	50	60	2	222	917
Past 5 year CAGR (%)	Qty -1	-4	-4	18	-3	-14	7	11	4	-30	1	-1
	Val 15	10	9	33	9	0	21	27	19	-22	13	13
Past 10 year CAGR (%)	Qty -4	-6	10	5	0	-9	6	9	6	-6	5	0
	Val 1	-1	18	11	6	-4	13	19	12	-2	11	6
2000-2013 CAGR (%)	Qty -2	-3	15	7	4	-6	3	11	5	1	9	2
	Val 2	1	21	13	8	-2	9	17	9	6	14	7
% Share in total Export (2013)	Qty 29	9	16	2	3	2	2	5	6	0	24	
	Val 29	9	17	2	3	2	2	5	7	0	22	

(Quantity in thousand tons, value in thousand USD)
Source: UN Comtrade, Export Import Data Bank of India, DGCI & S Kolkata

Annexure 11 CNSL exports from India (2000-01 to 2013-2014)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Past 5 year CAGR (%)	Past 10 year CAGR (%)	2000-2013 CAGR (%)
Qty	2246	1814	7215	6926	7474	6463	6993	7813	9099	9291	9727	11006	9192	9480	-0.16	4.68	6.64
Val	39	59	84	70	79	72	103	120	261	207	234	424	298	386	16.06	22.19	12.28

(Quantity in thousand tons, value in INR million)
Source: UN Comtrade, Export Import Data Bank of India, DGCI & S Kolkata

Annexure 12 Import of Cashew Kernels into USA from major cashew processing countries and global

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	5 year CAGR (%)	10 Year CAGR (%)	CAGR (%) (2000-13)	Per cent Share in total US import (2013)
India	Qty	43	48	54	46	58	45	42	40	31	31	36	33	35	3.4	-5.9	-3.7	26.5
	Val	248	221	214	189	259	221	203	237	172	188	312	268	269	13.3	0.9	0.9	29.0
Vietnam	Qty	10	13	20	28	41	38	45	47	52	58	47	56	76	7.2	6.8	13.5	57.5
	Val	52	50	72	101	174	158	204	264	251	348	406	393	517	16.9	14.6	19.3	55.8
Brazil	Qty	24	20	20	26	29	27	32	20	28	23	15	13	9	-24.5	-10.5	-4.4	7.0
	Val	127	82	72	101	128	122	146	117	143	131	134	101	60	-18.2	-4.7	0.1	6.5
Global	Qty	82	84	95	102	131	114	125	112	117	119	105	109	132	1.5	-0.5	2.4	2.4
	Val	450	362	365	398	569	525	579	651	597	707	895	817	927	10.8	6.3	7.1	7.1

(Quantity in thousand tons, Value in Million USD)
Source: UN Comtrade

Annexure 13 Import of Cashew Kernels into UAE from major cashew processing countries and global

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	5 year CAGR (%)	10 Year CAGR (%)	*CAGR (2000-13)	Per cent Share in total UAE import (2013)
India	Qty	3	5	6	7	8	10	13	16	19	19	14	11	20	-4	10	15	84
	Val	18	14	17	19	29	44	59	91	93	96	127	86	151	9	18	21	89
Vietnam	Qty		0.0	0.0	0.4	0.3	0.4	1	1	2	3	3	3	3	7	32	51	13
	Val		0.1	0.1	2	2	2	4	6	9	19	24	16	15	8	35	57	9
Brazil	Qty	0.4	0.1	0.1	0.0	0.1	0.1	0.3	1	2	0.3	9	0.1	1	-29	40	19	2
	Val	0.4	1	0.4	0.2	0.1	1	0.3	1	1	1	7	1	3	24	36	19	2
Global	Qty	4	3	5	6	7	9	11	14	18	23	26	14	24	-4	13	17	
	Val	19	15	18	21	31	41	64	98	104	116	158	103	169	9	20	22	

(* CAGR for Vietnam is from 2001 to 2013)
(Quantity in thousand tons, Value in Million USD)
Source: UN Comtrade

Annexure 14 Import of Cashew Kernels into EU-27 from major cashew processing countries and global

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	5 Year CAGR (%)	10 Year CAGR (%)	*CAGR (2000-13)	Per cent Share in total EU-27 import (2013)
India	Qty	29	29	30	33	39	41	37	30	29	26	25	25	-6	-4	-1	31
	Val	165	136	120	123	149	197	173	183	173	164	205	199	3	3	3	33
Vietnam	Qty	4	7	11	15	17	23	34	41	39	36	37	42	0	12	19	54
	Val	26	32	44	62	77	109	161	241	216	223	303	315	9	20	24	52
Brazil	Qty	3	3	4	4	5	5	7	6	8	9	6	7	-1	6	8	9
	Val	13	9	10	12	15	21	30	28	40	41	47	52	14	17	16	9
Côte d'Ivoire	Qty	0.2	0.3	0.1	0.0	0.0	0.2	1	0.4	0.2	0.4	1	1	21	71	22	1
	Val	1.3	1.2	0.2	0.1	0.0	1.0	2.1	2.1	1.1	2.2	4.4	5.2	39	91	30	1
Others	Qty	2	2	2	1	1	2	6	6	7	5	5	5	-9	18	15	6
	Val	8	6	5	5	6	10	28	33	37	27	34	35	0.2	25	21	6
Global	Qty	38	41	46	51	56	67	74	85	84	76	72	79	-3	4	7	6
	Val	214	184	181	202	246	353	394	488	468	457	593	605	7	12	12	

(Quantity in thousand tons, Value in Million USD)
Source: UN Comtrade

Annexure 15 Import of Cashew Kernels into Australia from major cashew processing countries and global

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	5 year CAGR (%)	10 Year CAGR (%)	*CAGR (2000-13) (%)	Per cent Share in total Australia import (2013)
India	Qty 1	1	2	1	1	1	1	3	2	2	1	1	1	0.3	-28	-6	-1	2
	Val 4	3	5	2	3	6	5	11	15	8	6	9	7	2	-23	-1	4	2
Vietnam	Qty 4	6	7	10	11	11	13	12	12	12	13	11	14	14	5	3	8	91
	Val 21	19	23	35	47	54	54	51	70	57	78	96	102	96	14	9	14	92
Indonesia	Qty 0.2	0.2	0.1	0.01	0.03	0.1	0.02	0.2	0.2	0.2	0.3	0.3	0.3	1	17	34	16	3
	Val 1	1	0.4	0.02	0.2	1	0.1	1	1	1	2	3	2	4	23	43	25	4
Brazil	Qty		0.02	0.1	0.1	0.5	0.3	0.1	0.2	0.2	0.1	0.2	0.2	0.5	20	5	14	3
	Val		0.1	0.3	0.3	2	1	0.3	1	1	1	2	1	2	30	13	21	2
Others	Qty 0.1	0.1	0.0	0.1	0.2	0	0	0.1	0.1	0.1	0.3	0.2	0.1	0.1	-21	-4	5	0.4
	Val 0.3	0.3	0.1	0.4	1	0	1	0.4	1	1	1	1	0.3	0.5	-17	2	9	0.5
Global	Qty 5	7	9	11	12	13	14	15	15	14	15	13	16	16	3	2	7	
	Val 26	23	29	38	51	62	61	63	87	68	88	111	112	105	12	9	13	

(Quantity in thousand tons, Value in Million USD)

* CAGR of Brazil (2002-13)

Source: UN Comtrade

Annexure 16 Monthly average prices of W320 in India and Vietnam market

Market/ Month	May 11	Jun 11	Jul 11	Aug 11	Sep 11	Oct 11	Nov 11	Dec 11	Jan 12	Feb 12	Mar 12	Apr 12	May 12	Jun 12	Jul 12	Aug 12	Sep 12	Oct 12	Nov 12	Dec 12	Jan 13	Feb 13	Mar 13	Apr 13	May 13	Jun 13	Jul 13	Aug 13	Sep 13	Oct 13	Nov 13	Dec 13	Jan 14	Feb 14	Mar 14	Apr 14	May 14	
Vietnam	4.08	4.42	4.42	4.45	4.28	3.75	3.69	3.69	3.20	3.28	3.18	3.55	3.64	3.33	3.33	3.18	3.23	3.23	3.13	3.28	3.23	3.28	3.40	3.36	3.35	3.23	3.21	3.23	3.20	3.18	3.08	3.18	3.23	3.23	3.18	3.13	3.10	3.09
India	4.18	4.55	4.63	4.55	4.40	3.85	3.88	3.88	3.33	3.38	3.38	3.25	3.58	3.68	3.43	3.23	3.38	3.33	3.33	3.40	3.33	3.38	3.43	3.38	3.43	3.38	3.35	3.35	3.33	3.23	3.20	3.25	3.35	3.38	3.30	3.23	3.20	3.23

(Unit in USD per lb job) Source: www.cashewinformation.com

Annexure 17
Monthly average cashew kernel prices for different grades
(FOB Cochin/Tuticorin)

	W240	W320	W450	SW320	SW360	SSW
May-11	4.53	4.18	4.03	4.63	3.88	3.45
Jun-11	4.80	4.55	4.38	4.50	4.35	4.00
Jul-11	4.90	4.63	4.48	4.35	4.35	4.15
Aug-11	4.88	4.55	4.50	3.80	4.43	4.15
Sep-11	4.70	4.40	4.30	3.75	4.43	4.10
Oct-11	4.35	3.85	3.80	3.75	3.68	3.30
Nov-11	4.10	3.88	3.75	3.20	3.55	3.18
Dec-11	4.03	3.88	3.55	3.23	3.48	3.13
Jan-12	3.70	3.33	3.18	3.23	3.05	2.40
Feb-12	3.83	3.38	3.18	3.23	3.00	2.85
Mar-12	3.83	3.25	3.18	3.23	3.00	2.85
Apr-12	3.80	3.58	3.18	3.23	3.00	2.85
May-12	3.80	3.68	3.18	3.23	3.00	2.85
Jun-12	3.80	3.43	3.18	3.05	3.00	2.85
Jul-12	3.80	3.23	3.18	2.98	3.00	2.85
Aug-12	3.68	3.38	3.03	2.95	2.83	2.50
Sep-12	3.90	3.33	3.13	2.95	2.80	2.48
Oct-12	3.78	3.33	3.08	3.08	2.65	2.45
Nov-12	3.78	3.40	3.08	3.08	2.65	2.45
Dec-12	3.95	3.33	3.10	3.08	2.85	2.48
Jan-13	3.95	3.38	3.10	3.08	2.85	2.48
Feb-13	3.95	3.43	3.10	3.08	2.85	2.48
Mar-13	3.95	3.38	3.10	3.35	2.85	2.48
Apr-13	3.95	3.43	3.10	3.05	2.85	2.48
May-13	3.85	3.38	3.08	3.05	2.88	2.45
Jun-13	3.80	3.35	3.03	3.03	2.88	2.45
Jul-13	3.75	3.35	3.00	3.03	2.85	2.48
Aug-13	3.73	3.33	3.00	3.05	2.85	2.45
Sep-13	3.73	3.23	3.00	3.05	2.85	2.45
Oct-13	3.83	3.20	3.08	3.05	2.85	2.48
Nov-13	3.83	3.25	3.08	3.05	2.85	2.48
Dec-13	3.83	3.35	3.08	3.05	2.85	2.48
Jan-14	3.83	3.38	3.08	3.05	2.85	2.48
Feb-14	3.83	3.30	3.08	3.05	2.85	2.48
Mar-14	3.83	3.23	3.08	3.05	2.85	2.48
Apr-14	3.83	3.20	3.08	3.05	2.85	2.48
May-14	3.83	3.23	3.08	3.05	2.85	2.48

(Unit in USD per lb)

Source: www.cashewinformation.com

Annexure 18 Monthly average nut prices at Delhi Market

Commodity/Month	Pistachio Irani		Walnuts		Almond California		Cashew W320		Cashew 4 pieces	
	INR/kg	Indicative price in USD/kg	INR/kg	Indicative price in USD/kg	INR/kg	Indicative price in USD/kg	INR/kg	Indicative price in USD/kg	INR/kg	Indicative price in USD/kg
May-11	675	15.0	625	13.9	374	8.3	480	10.7	388	8.6
Jun-11	675	15.1	625	14.0	381	8.5	538	12.0	430	9.6
Jul-11	725	16.4	575	13.0	394	8.9	573	13.0	470	10.6
Aug-11	690	15.0	575	12.5	425	9.2	578	12.5	475	10.3
Sep-11	803	16.4	525	10.7	370	7.6	565	11.5	463	9.5
Oct-11	803	16.4	500	10.2	379	7.8	558	11.4	455	9.3
Nov-11	803	15.4	450	8.6	392	7.5	510	9.8	433	8.3
Dec-11	825	15.5	450	8.4	379	7.1	500	9.4	403	7.6
Jan-12	713	14.3	450	9.1	381	7.7	500	10.1	358	7.2
Feb-12	700	14.3	463	9.5	389	7.9	485	9.9	335	6.8
Mar-12	700	13.7	463	9.0	389	7.6	480	9.4	320	6.3
Apr-12	775	14.8	450	8.6	399	7.6	490	9.3	340	6.5
May-12	810	14.4	450	8.0	437	7.7	550	9.7	388	6.9
Jun-12	810	14.4	450	8.0	421	7.5	540	9.6	355	6.3
Jul-12	810	14.5	500	9.0	421	7.5	500	9.0	348	6.2
Aug-12	810	14.5	500	9.0	409	7.3	500	9.0	340	6.1
Sep-12	850	16.1	650	12.3	436	8.3	495	9.4	335	6.4
Oct-12	875	16.2	675	12.5	463	8.6	495	9.1	330	6.1
Nov-12	900	16.5	675	12.4	486	8.9	498	9.1	338	6.2
Dec-12	903	16.5	665	12.1	505	9.2	510	9.3	344	6.3
Jan-13	963	18.1	650	12.2	545	10.2	500	9.4	350	6.6
Feb-13	965	17.9	663	12.3	491	9.1	500	9.3	323	6.0
Mar-13	938	17.2	650	12.0	474	8.7	500	9.2	315	5.8
Apr-13	1000	18.4	675	12.4	504	9.3	500	9.2	318	5.9
May-13	980	17.3	675	11.9	493	8.7	500	8.9	318	5.6
Jun-13	1088	18.2	675	11.3	529	8.9	500	8.4	305	5.1
Jul-13	1100	18.0	675	11.0	581	9.5	545	8.9	325	5.3
Aug-13	1175	17.6	675	10.1	615	9.2	545	8.2	330	5.0
Sep-13	1250	19.9	725	11.5	608	9.7	565	9.0	350	5.6
Oct-13	1288	21.0	813	13.2	598	9.7	550	9.0	350	5.7
Nov-13	1263	20.2	775	12.4	603	9.7	550	8.8	358	5.7
Dec-13	1263	20.4	725	11.7	636	10.3	530	8.6	370	6.0
Jan-14	1263	20.2	750	12.0	673	10.8	530	8.5	370	5.9
Feb-14	1263	20.3	750	12.1	661	10.6	530	8.5	370	6.0
Mar-14	1288	21.4	750	12.5	641	10.7	525	8.7	370	6.2
Apr-14	1338	22.2	750	12.4	639	10.6	525	8.7	368	6.1
May-14	1250	21.2	750	12.7	619	10.5	525	8.9	385	6.5

Source: www.cashewinformation.com

Annexure 19 Global and country-wise production and export of almond (shelled)

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	5 year CAGR (%)	10 Year CAGR (%)	*CAGR (%) (2001-02 to 2013-14)
USA	Prod 376	494	472	456	415	508	630	739	640	744	921	857	839	7	9	7
	Exp 266	306	317	323	330	348	404	444	468	539	616	581	615	6	9	8
Australia	Prod 10	11	12	16	16	27	26	36	39	38	50	57	70	17	17	18
	Exp 3	2	3	5	6	11	14	23	20	23	29	40	50	27	27	32
EU	Prod 88	92	76	80	80	104	89	80	104	93	83	83	63	-11	-2	-1
	Exp 7	7	5	5	6	7	9	10	10	12	12	10	11	1	9	7
Turkey	Prod 14	14	14	12	14	14	16	16	16	14	16	17	18	3	3	2
	Exp 1	1	1	1	1	1	2	4	4	5	7	8	8	21	35	33
Chile	Prod 4	6	5	8	4	7	9	8	6	9	9	8	9	8	5	6
	Exp 3	3	4	6	4	5	6	8	7	9	8	8	9	4	7	10
China	Prod Nil	Nil	Nil	Nil	0.1	1	1	0.4	1	3	4	5	6	53	49	64
	Exp Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
India	Prod 1.0	1.1	1.0	1.1	1.2	1.2	1.0	1.2	1.1	1.2	1.1	1.2	1.1	0.0	0.2	1
	Exp Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Global	Prod 493	618	578	573	531	661	772	881	807	901	1084	1029	1007	6	8	7
	Exp 279	318	328	340	347	373	435	489	507	589	673	647	693	7	9	8

(Unit in thousand tons)
* CAGR of China is from 2004-13
Source: USDA

Annexure 20 Global and country-wise import and consumption of almond (shelled)

Year/Country	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	5 year CAGR (%)	10 Year CAGR (%)	CAGR (2001-02 to 2013-14) (%)
EU	Imp 151	170	181	184	192	181	219	211	204	223	226	215	225	2	2	3
	Consm 212	255	252	259	265	268	299	286	294	304	297	293	284	-1	1	2
China	Imp 14	10	4	8	6	18	15	30	44	64	112	103	120	28	42	31
	Consm 14	10	4	8	7	18	16	31	45	66	116	108	126	29	42	31
India	Imp 25	27	22	27	34	33	39	46	40	48	55	58	60	10	9	9
	Consm 27	28	25	29	36	34	40	48	41	49	56	59	61	10	8	8
UAE	Imp 11	14	11	14	10	15	19	30	30	39	47	39	42	7	18	15
	Consm 11	14	11	14	10	15	19	30	30	39	47	39	42	7	18	15
Japan	Imp 23	25	26	26	25	26	23	22	24	25	27	28	30	6	1	1
	Consm 23	25	26	26	25	26	23	22	24	25	27	28	30	6	1	1
Canada	Imp 11	15	17	21	16	18	21	20	20	24	25	26	26	6	5	6
	Consm 11	15	17	21	16	18	21	20	20	24	25	26	26	6	5	6
US	Imp 0	1	1	3	4	4	3	2	3	4	7	18	25	86	23	28
	Consm 123	153	162	140	100	154	185	214	217	239	275	302	313	10	12	8
South Korea	Imp 5	6	5	7	5	6	8	9	12	14	20	21	22	18	19	15
	Consm 5	6	5	7	5	6	8	9	12	14	20	21	22	18	19	15
Turkey	Imp 0	0	0	1	1	1	7	13	16	16	27	18	20	6	53	54
	Consm 16	14	14	12	14	13	21	25	28	27	36	27	30	2	12	9
Others	Imp 19	24	31	27	27	33	37	51	57	66	58	59	0	0	11	11
	Consm 19	26	31	26	26	32	36	51	55	56	56	56	59	0	11	10
Global	Imp 260	292	298	316	320	335	390	435	448	522	603	585	631	8	9	8
	Consm 470	555	556	555	516	601	680	750	785	868	974	982	1017	7	8	7

(Units in thousand tons)
Source: USDA

Annexure 21 Global and country-wise production and export of Pistachio (Inshell)

Year/ Country	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	5 Year CAGR (%)	10 year CAGR (%)	CAGR (%) (2001-02 to 2012-13)
USA	Prod	137	54	157	128	108	189	126	161	237	201	250	17	12	10
	Exp	40	41	34	69	73	117	130	123	138	157	180	9	17	17
Turkey	Prod	30	35	90	30	40	100	85	38	110	50	125	11	6	8
	Exp	10	4	6	4	5	3	4	0	1	1	4	5	-16	-16
Syria	Prod	42	42	50	21	45	60	70	62	65	65	65	-1	8	6
	Exp	11	10	12	5	7	10	8	8	10	10	10	7	3	0
Iran	Prod	160	250	175	135	210	250	90	184	216	160	200	16	1	0
	Exp	103	148	161	114	139	141	77	130	162	115	140	12	-1	0
EU	Prod	8	10	9	8	14	13	11	11	11	10	8	-9	-1	1
	Exp	1	1	2	2	1	1	1	2	2	2	2	6	4	3
Global	Prod	313	474	378	351	479	552	382	456	638	486	647	12	6	5
	Exp	165	204	215	193	215	229	268	263	313	284	336	10	5	5

(Units in thousand tons)
Source: USDA

Annexure 22 Global and country-wise import and consumption of Pistachio (Inshell)

Year/ Country	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	5 year CAGR (%)	10 Year CAGR (%)	CAGR (2001-02 to 2012- 13)	
USA	Imp	1	1	2	1	2	1	1	1	1	1	2	3	-2	2	
	Consm	54	57	51	73	41	48	63	28	51	50	74	73	26	2	1
Ukraine	Imp	1	1	2	2	4	8	11	2	2	2	2	2	2	-7	4
	Consm	1	1	2	2	4	8	11	2	2	2	2	2	2	-7	4
Taiwan	Imp	3	5	3	2	3	4	1	3	16	8	5	49	14	8	
	Consm	3	5	3	2	3	4	1	3	16	8	5	49	14	8	
Turkey	Imp	1	4	3	3	4	5	2	2	6	4	5	35	5	9	
	Consm	41	42	50	44	47	54	70	71	62	86	96	10	9	8	
UAE	Imp	5	3	6	4	7	8	9	14	18	18	22	8	20	19	
	Consm	5	3	6	4	7	8	9	14	21	18	22	8	20	19	
Syria	Imp	4	4	4	15	5	5	7	6	6	5	5	-8	-2	1	
	Consm	35	37	40	38	43	45	55	69	60	60	60	-3	6	6	
Russia	Imp	7	11	11	9	12	19	25	9	15	18	20	26	5	6	
	Consm	7	11	11	9	12	19	25	9	15	18	20	26	5	6	
Pakistan	Imp	2	2	2	2	2	2	3	3	4	3	4	8	7	6	
	Consm	2	2	2	2	2	2	3	3	4	3	4	8	7	6	
Mexico	Imp	5	3	3	2	2	4	5	4	3	4	5	9	9	4	
	Consm	5	3	3	2	2	4	5	3	4	4	5	9	9	4	
Others	Imp	106	133	160	120	138	147	179	176	200	187	230	8	5	6	
	Consm	162	235	199	148	196	223	290	206	236	244	290	7	5	4	
Global	Imp	135	168	197	162	180	205	249	204	229	253	302	9	6	6	
	Consm	315	396	369	326	359	417	536	407	452	519	579	9	6	5	

(Unit in thousand tons)
Source: USDA

Annexure 23
Global and country-wise production and export of Walnut (inshell)

Year/ Country	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	5 Year CAGR (%)	10 Year CAGR (%)	CAGR (%) (2001-02 to 2012-13)
China	Prod	340	325	365	388	425	460	490	560	580	700	720	760	9	9
	Exp	16	22	25	29	32	27	31	12	16	17	16	15	6	-8
US	Prod	277	256	296	295	322	314	396	396	457	418	451	449	2	6
	Exp	111	120	134	144	209	165	154	220	314	278	310	325	6	9
Ukraine	Prod	22	40	50	60	30	70	80	100	80	115	90	110	3	11
	Exp	6	21	22	31	44	17	54	62	82	67	101	78	4	15
EU	Prod	41	53	41	40	45	70	61	87	80	113	104	103	6	11
	Exp	13	18	36	35	18	27	14	20	23	19	16	20	0	-5
Turkey	Prod	68	60	69	50	73	75	90	85	88	85	85	75	-3	3
	Exp	1	0.1	1	1	1	3	3	7	8	12	10	8	3	41
Chile	Prod	12	14	13	15	18	22	26	28	36	42	53	45	7	14
	Exp	11	12	11	14	14	20	24	27	33	39	50	43	8	16
India	Prod	29	32	30	31	27	28	31	33	36	40	36	40	4	4
	Exp	16	17	15	14	11	12	16	15	19	10	12	13	-6	0
Global	Prod	705	799	818	850	939	1037	1204	1306	1357	1508	1542	1585	5	8
	Exp	174	212	246	268	330	270	297	357	416	480	493	515	5	8

Unit in thousand tons
Source: USDA

Annexure 24
Global and country-wise import and consumption of Walnut (inshell)

Year/ Country	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	5 Year CAGR (%)	10 Year CAGR (%)	CAGR (%) (2001-02 to 2013-14)
China	Imp	2	2	3	6	14	9	34	44	71	75	142	150	37	44	48
	Consm	238	320	302	342	370	413	437	516	593	635	758	846	895	12	12
EU	Imp	75	98	105	113	149	105	108	117	144	124	114	115	-3	0	2
	Consm	83	134	110	118	166	155	152	178	171	216	211	203	3	6	7
Turkey	Imp	1	8	23	23	20	24	32	43	48	51	39	40	-4	12	23
	Consm	69	71	87	76	92	109	120	133	127	118	114	108	-5	5	5
South Korea	Imp	4	5	7	8	17	13	20	21	22	28	28	28	8	13	18
	Consm	4	5	7	8	17	13	20	21	22	28	28	28	8	13	18
Japan	Imp	24	25	26	23	43	27	25	30	30	30	28	28	-2	-0.1	1
	Consm	24	25	26	23	43	27	25	30	30	30	28	28	-2	-0.1	1
Canada	Imp	13	14	13	17	19	16	15	17	20	19	21	22	6	3	4
	Consm	13	14	13	17	19	16	15	17	20	19	21	22	6	3	4
Russia	Imp	0.2	0.3	0.4	1	1	4	11	21	26	26	12	15	-23	45	57
	Consm	0.2	0.3	0.4	1	1	4	11	21	26	26	12	15	-23	45	57
USA	Imp	0.3	0.3	0.4	1	1	3	11	4	1	6	10	10	57	22	32
	Consm	131	160	157	163	130	172	155	146	174	145	140	146	-3	-1	0
Others	Imp	35	33	40	48	51	48	50	62	73	72	60	67	-0.3	4	7
	Consm	70	72	78	89	88	86	113	103	113	109	103	120	2	4	4
Global	Imp	154	185	217	238	315	264	331	375	434	431	453	475	5	8	9
	Consm	633	801	781	835	925	959	1003	1152	1279	1334	1444	1516	1564	5	8

(Units in thousand tons)
Source: USDA



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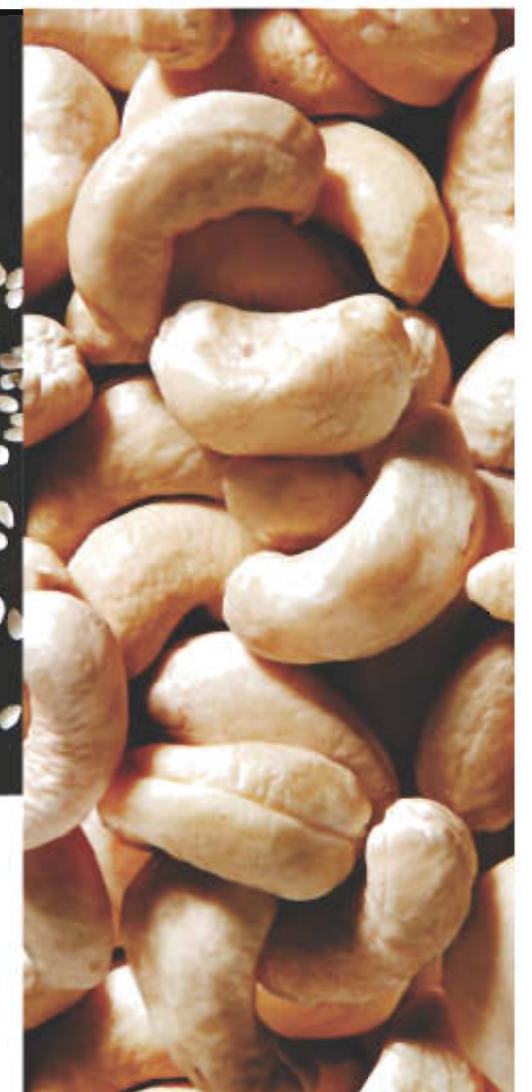
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