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# Value chain development for improving the income of cashew growers

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## Abstract

Development of the Cashew Industry needs the immediate attention of the policymakers, processors, and farmers to remain competitive and profitable. There is scope to improve quality and profitability by adopting the improved method of roasting and mechanized shelling of cashew nuts. Agencies engaged in cashew processing, need financial support in the form of liberal loans with a soft rate of interest. Increasing cashew production is another important opportunity, by increasing the crop yield as well as by expanding the area under cashew plantation. About 75 percent of plantations are owned by farmers while the rest are owned by the Government. More than 50 percent of plantations are old plantations, aged between 35 to 50 years, established with seedlings of the nondescript genetic base, spaced widely, and maintained without any recommended crop husbandry practices. These plantations should be closely monitored for their performance and trees yielding less than 4-5 kg of nuts per year, should be replaced with newly grafted plants of good varieties. The spacing between the trees can also be reduced to increase the tree population. Good crop husbandry practices such as improving soil productivity and moisture content and efficient management of nutrients, pests, and diseases should be promoted by Agricultural Extension Agencies to increase the yield of nuts. There is good scope to promote cashew cultivation along the seacoast as a profitable cash crop. Suitable schemes should be developed to enable small farmers and absentee landowners to establish cashew plantations on unproductive lands. To provide timely support to small farmers and to improve their production, the value chain can play a significant role. With efficient backward and forward linkages and an increase in RCN yield, cashew can be more profitable than many other crops, including mango and other plantation crops. This will also help India to restore its leadership in cashew.

**Keywords:** Cashew kernel, Cashew nut, Commercial, Economics, Industries, Products.

## Introduction

Cashew nut is a high value, delicious and luxury food, consumed by the affluent class in most of the countries in the world. With regard to popularity and price, cashew nut can compare well with pecans and macadamia, recording a growth of 60 per cent in demand during the last 10 years. Cashew kernel along with Basmati rice, spices and tea, are the top four agricultural exports in India. In 2017, India earned a foreign exchange of Rs. 52.13 billion, through cashew export. Cashew industry has been providing income to 7.5 million rural families under farming and 0.3 million families for processing. However, the industry in India is not in a position to encash the global opportunity of maximising the profitability, due to several challenges such as small and scattered plantations established on poor soils, inadequate investment on crop production, and absence of technical guidance and lack of efficient processing facilities. Like many other agricultural commodities, farmers are deprived of backward and forward linkages to enhance their production and profitability.

## Commercial importance of cashew

Cashew is native to North-East Brazil. It was introduced in India by the Portuguese between 1563 and 1570 when they brought cashew to Goa. Later, it was introduced across the western region of the country. In the 19th century, it was introduced in other countries in Asia and Africa. Presently, cashew is cultivated in 32 countries located in the tropics, between 25°N and 25°S, with a preference for low lands, along the sea coast. Cashew grows into a tree up to a height of 14 metres (m), with a wide canopy. However, cashew trees generally attain a height of 9-12 m in widely spaced plantations, with a canopy diameter of 6-8 m, which is ideal for inducing heavy flowering and easy harvesting. Cashew is well adapted to high rainfall above 1000 mm, with a preference for temperature ranging between 19° C and 35°C, with an average monthly temperature of 25° C. Being a tropical tree, cashew requires warm and humid climate and can tolerate temperature up to 45°C (Kumar *et al.,* 2012). However, it is sensitive to low temperature and frost. Trees necessitate at least 6 hours of sunlight every day for a better performance.

Cashew trees start yielding fruits after 3-4 years but grafted plants start bearing from the second year itself. A mature tree produces about 7–12 kg nuts per year and continues to yield economically for 50-60 years. Cashew fruit consists of oval shaped colourful false fruit, in attractive red and yellow colours, developed from the receptacle of the flower, known as cashew apple with the nut attached at the tip. Ripe cashew apple is sweet and juicy, with a very short shelf life, and is consumed directly or processed into juice, squash or alcohol. However, cashew apple is wasted in most of the growing areas, due to lack of infrastructure for storage and processing.

## Cashew products of economic importance

The products of cashew fruit are cashew apple and nut. Raw cashew nut (RCN), removed from ripe fruit is separated into kernel and shell. The shell is crushed, to extract a liquid, known as Cashew Nut Shell Liquid (CNSL) which contains phenolic compounds, used in the paint industry. RCN yields 20-24 per cent kernel and 20 per cent CNSL, which are traded in the international market. Cashew kernel is found inside the nut, covered by a thin membrane known as testa, which contains a non-edible substance like tannin, which protects the kernel from damage. Cashew plant parts also have several uses. The economic uses of different parts of cashew are presented in Table 1. Cashew kernel is a rich source of fat (46%), protein (18%), minerals such as calcium, phosphorous and iron and unsaturated fatty acids, inoleic acid, in particular. It is consumed directly and is also used in confectionery and bakery products. Cashew apple is a rich source of vitamin C (262 mg/100 mi juice, which is five times higher than orange juice), calcium and iron. The nutritive value of cashew kernel and cashew apple is presented in Table 2.

Cashew tree bark, leaves and gum are generally used for treating toothache and sore gums. A paste made by grinding the bark with water, is used for curing ringworm. Root extract, by boiling in water is used as a purgative. Fibre from leaves is used to treat calcium deficiency and intestinal colic. Water resistant wood is used for boats, furies and as farm tools. Resin from wood is also used as a cough remedy and insect repellent (Anonymous, 2013). Cashew leaves are also used in traditional medicine to treat venereal diseases. Cashew seed extract stimulates blood sugar absorption by muscle cells, resulting in regulating blood sugar level and preventing insulin resistance in diabetic patients. Cashew nuts also contain

anti-oxidising properties, due to presence of phenolic compounds and ascorbic acid. Extracts from bark, stem and leaves can be used for treating gastro-intestinal diseases. Cashew extracts can also be used for treating, impotence, leishmaniasis, scrofula, swelling and pain (Okpala, 2014). CNSL, extracted from roasted or boiled raw cashew nut, yields up to 25 per cent dark brown viscous phenolic liquid, which is used for producing fuel, in paints, lubricants, varnishes, as brake fluid, clutch linings, fungicides, insecticides, agglutinants and lacquers.

**Table 1: Uses of different parts of cashew tree**

| Sl. No. | Tree Part | Products Prepared | Uses |
|---|---|---|---|
| 1 | Root | Water extract | Excellent purgative |
| 2 | Wood | Charcoal, Tool handles | Fuel, Packing and utility items |
| 3 | Bark | Water extract | Dyeing fishing nets |
| 4 | Bark sap | Gum | Used for indelible ink and gum for book binding |
| 5 | Leaves | Fresh leaves<br>Dried leaves | For medicines and flowering rice<br>For fuel and for producing Farm yard manure |
| 6 | Cashew Apple | Fruit, Juice, *feni*, syrup, jam, jelly, chutney | Fresh fruit consumed directly and fed to livestock fresh or after extracting juice. Juice is taken for controlling diarrhea, dysentery, cholera, as anesthetic in leprosy. Syrup, jam, jelly and chutney are delicious food products. |
| 7 | Cashew nut shell liquid | Phenol | Waterproof coating for cement and brick flooring, preparation of printing ink and varnishes, smearing native canoes and for medicines |
| 8. | Testa | Powder | Used in leather industry and for poultry feed |
| 9 | Kernel | Nut and powder | Cashew milk and nuts used against loss of appetite, depression, scurvy, anemia, diabetes. Kernels consumed raw or roasted. |

**Source:** ***Srivastava and Srivastava, 2018***

**Table 2: Nutritive values of cashew kernel and cashew apple**

| Constituents | Kernel (%) | Apple (%) |
|---|---|---|
| Moisture | 6.9 | 87.9 |
| Protein | 21.0 | 0.2 |
| Fat | 47.0 | 0.1 |
| Carbohydrates | 22.0 | 11.6 |
| Fibre | 1.3 | 0.9 |
| Minerals | 2.4 | 0.2 |
| Phosphorous | 0.45 | 0.01 |
| Calcium | 0.55 | 0.01 |
| Iron (mg/100 gm) | 5 | 0.2 |
| Carotene (I.U/100 gm) | 100 | - |
| Vitamin B1 (mg/100 gm) | 630 | - |
| Riboflavin (mg/100 gm) | 190 | 0.5 |
| Vitamin C (mg/100 gm) | - | 170-350 |

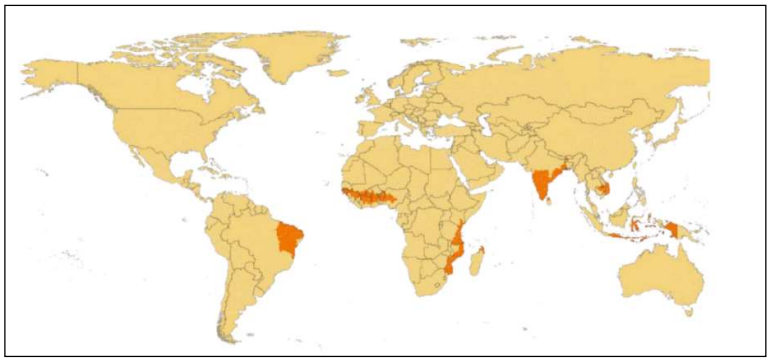
**Source:** ***Kumar et al., 2014*.**

In most of the cashew producing countries, only cashew nut is processed while a small quantity of cashew apple is consumed directly. In West Africa, cashew wine is a popular alcoholic drink. In Goa, India, fermented cashew apple juice is distilled to produce a liquor, locally known as *feni*. In Brazil, the juice is used for preparing soft and alcoholic drinks.

**World cashew production**

Figure 1 presents the major cashew growing countries in the world. Important cashew production regions are South Eastern Asia, West Africa, East Africa and Brazil. Important countries growing cashew are India, Vietnam, Ivory Coast, Tanzania, Guinea-Bissau, Benin and Brazil. In 2017, the total area under cashew plantation was 5.985 million ha, with the highest area of 1.676 million ha in Ivory Coast, followed by 0.978 million ha in India and 0.549 million ha in Tanzania. Vietnam has expanded the cultivation during the last 2-3 decades to bring 0.284 million ha of its land under cashew plantation.

**Fig. 1. Cashew growing countries in the world**



**Source:** ***INC, 2015***

With good crop husbandry practices, Vietnam has achieved higher RCN yield of 3042 kg per ha, as against the world yield of 663.5 kg/ ha. This has enabled Vietnam to secure first rank in world cashew nut production, with the total production of 0.863 million tonnes of RCN, as presented in Table 3. This is a significant change in the world cashew nut production scenario, as in 2012-13, Vietnam was in the third position, sharing only 9.26 per cent of the world cashew production, next to West Africa and India, who shared 33.37 per cent and 27.68 per cent of the production respectively (Anonymous, 2018). Philippines has recorded the highest yield of 7773 kg/ha, 10 times higher than the average yield in India. Average Indian cashew nut yield in 2017 was 762 kg/ha, only about 15 per cent higher than the world average, and mere 25 per cent of the average yield of Vietnam. The world RCN production in 2017 was 3.97 million tonnes, while India shared 19 per cent of the world production, next to Vietnam, as presented in Table 3 (INC, 2018).

Processing of RCN is the key commercial activity of the cashew industry, which is mainly confined to India, Vietnam and Brazil. India and Vietnam are the major cashew nut exporters sharing 73 per cent of the world trade. These countries imported RCN from Western and Eastern Africa. During 2016-17, world cashew kernel production was 0.784 million tonnes. Out of this, 0.496 million tonnes were exported to various countries, while India used 0.302 million tonnes of kernels for local consumption. Among the importers of cashew kernel, USA was the

largest importer with 0.147 million tonnes, followed by Netherlands (50,347 kg), Germany (47,397 kg), UK (21,395 kg) and Australia (16,704 kg). Vietnam began importing raw cashew nuts from Africa in 1996. After 20 years, in 2015, Vietnam imported 1.1 million tonnes of the total world import of 3 million tonnes of RCN. In 2016, Vietnam exported 0.347 million tonnes of cashew kernel valued at USD 2.84 billion to over 100 countries and surpassed India to become the largest cashew kernel exporter in the world (Anonymous, 2018).

**Table 3: Major cashew growing countries with area, yield and production in 2017**

| Rank in Prodn. | Country | Area Million ha | Yield Kg/ha | Production RCN (tonnes) | % of Total Production |
|---|---|---|---|---|---|
| 1 | Vietnam | 0.284 | 3041.2 | 863,060 | 21.73 |
| 2 | India | 0.978 | 761.8 | 745,000 | 18.76 |
| 3 | Ivory Coast | 1.676 | 424.2 | 711,000 | 17.90 |
| 4 | Philippines | 0.029 | 7772.6 | 222,541 | 5.60 |
| 5 | Tanzania | 0.549 | 299.0 | 164,245 | 4.14 |
| 6 | Guinea-Bissau | 0.277 | 1166.7 | 155,953 | 3.93 |
| 7 | Benin | 0.456 | 333.2 | 151,836 | 3.82 |
| 8 | Mozambique | 0.167 | 833.7 | 139,000 | 3.50 |
| 9 | Brazil | 0.488 | 273.2 | 133,465 | 3.36 |
| 10 | Indonesia | 0.511 | 257.6 | 131,685 | 3.32 |
| | **Total world** | **5.985** | **663.5** | **3,971,046** | **100.00** |

**Source:** ***INC, 2018***

**Indian leadership in cashew industry**

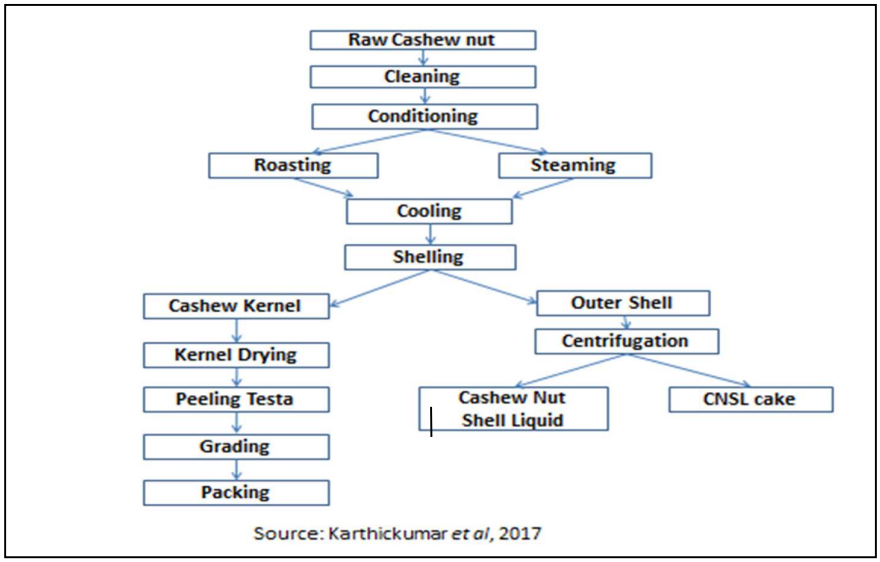
Cashew was initially promoted in India primarily for control of soil erosion along the sea coast in Goa during the 16$^{th}$ century and subsequently along the West and East coasts for nut production. India was the world leader in cashew production, processing and export marketing, with over 45 percent of the global production, for many decades. However, with the entry of other countries, India is now the second largest producer, sharing only 18.8 per cent of the world production after Vietnam, as presented in Table 3. With regard to the area under cashew plantation, India with 16.34 per cent of the world area, stands next to Ivory Coast, who own 28 per cent of the plantation area. With regard to yield of RCN, India is in 5$^{th}$ position, after Philippines, Vietnam, Guinea-Bissau and Mozambique (Table 3). Among the top cashew kernel exporting countries also, India stands second and is now maintaining its first rank only with respect to consumption of cashew nut. This scenario strongly reflects on the lack of organized efforts to optimize the production and profitability and calls for in-depth analysis of the on-going practices and adoption of a suitable strategy to regain supremacy.

**Cashew nut processing method**

Separation of cashew kernel without breaking from the nut is the most important part of cashew processing. This is because pricing of cashew kernels is based on the colour and size. The processing is done by different methods. Traditionally, the nuts were processed manually but since 1960s, mechanization has been introduced for roasting, shelling and CNSL extraction. The flow diagram of processing is presented in Figure 2. The process starts with cleaning of nuts to

make it free from sand, dried apple and other foreign matter. The nuts are then soaked in water, while changing the water 2-3 times, to increase the moisture content in the shell to 9 per cent. To make the shell brittle, the nut is either roasted in an open pan or closed drum or steamed. In this process, CNSL is also released. Steam roasting is the improved method, where uniform cooking takes place and CNSL is collected separately. The roasted cashew nut is dried on the floor before shelling either manually or by using mechanical devices. Centrifugal shelling machine is an efficient device, which requires the nuts to be graded before shelling, as it operates at different speeds based on the size of the nut. The kernel is separated from the shell and pre-grading is done by separating unbroken kernels. These kernels covered with brown testa are dried to reduce the moisture content from 6 per cent to 3 per cent, either by sun drying or by using dryers. This is followed by peeling of testa, either manually or by mechanical peelers. After peeling of testa, the kernels are graded on the basis of colour and size. Table 4 presents the grades and classes of cashew kernel, based on the colour and sizes. These graded kernels are packed in different quantities, generally in 25 pounds, in air tight tin containers, using 'vita pack' process. This involves removal of air from the container and replacing with carbon dioxide, thereby maintaining the kernels in good condition.

**Fig. 2. Flow chart of cashew nut processing operation**




**Cashew business development**

India has been the leader in export of cashew kernel since the 1950s. Although cashew was introduced along the sea coast for soil conservation in the 16$^{th}$ century, commercial cashew processing in India was first started as a cottage industry under the name of Indian Nut Company in 1920s by a Sri Lankan entrepreneur, Roch Victoria, who migrated to Kollam in Kerala. With the increasing demand for processed cashew kernel, others also established processing facilities and by 1939, the export of cashew kernel increased to 1350 tonnes. However, World War II brought a complete halt to cashew trade. Later, cashew export picked up in mid-1950s, after the introduction of airtight tins infused with carbon dioxide, for extending its keeping quality. Subsequently, as the export demand

increased, new cashew processing plants were established outside Kerala, in Mangalore and Goa. To address the problem of international raw cashew importers, who started indulging in unfair trade practices, the Indian business leaders in cashew processing, formed a Cashew Syndicate, which also started purchasing RCN from the growers at pre-determined prices. To formalise this initiative, the Cashew Export Promotion Council (CEPC) was established in 1955, under the Commerce Ministry.

**Table 4: Grades of cashew kernels based on size and colour**

| **A. Classification based on colour of kernel** | | | |
|---|---|---|---|
| **Class** | **Commercial designation** | **Description** | |
| Extra | White | White, pale, ivory, pale, ash-grey, light yellow | |
| Class I | Scorched or Lightly blemished | Light brown, light ivory, light ash-grey, deep ivory, yellow | |
| Class II | Scorched seconds or Dessert | Light brown, amber, light blue, deep brown, deep blue, discoloured, black spotted, immature, blemished and stained kernels | |
| **B. Grades based on size of kernel** | | | |
| **Standard Grades** | **Maximum No. of Kernels / pound** | **Maximum No. of Kernels/ kg** | |
| W150 | 150 | 325 | |
| W180 | 180 | 395 | |
| W210 | 210 | 465 | |
| W240 | 240 | 530 | |
| W320 | 320 | 706 | |
| W450 | 450 | 990 | |
| W500 | 500 | 1100 | |

**Source:** ***Gupta, 2018***

In 1969, the Government of Kerala established the Kerala State Cashew Development Corporation (KSCDC) mainly to protect the interest of workers engaged in the industry. CEPC promoted cashew processing in all the other states where cashew was cultivated. Thus, many cashew processing units were established under the cottage industry in Kerala, Karnataka, Goa, Maharashtra, Andhra Pradesh and Tamil Nadu. In Kollam district in Kerala alone, there were over 600 cashew processing units (CEPCI, 2018). In 2016, there were 3940 cashew processing units across the country with a capacity to process 1.64 million tonnes of RCN, with an average installed capacity of 400 kg. The majority of the processing units were in Maharashtra (55.8%). However, the highest installed capacity was in Kerala (36.5%), followed by Tamil Nadu and Karnataka, as presented in Table 5. Out of these, about 60 per cent were automatic or semi-automatic units, while the rest were manual units which were very inefficient with higher rate of damaged kernels. However, as these units had made capital investments and obligation of engaging their workers, processing activity continued as long as the business was viable.

During the year 2008-09, the RCN production in India was 0.613 million tonnes, which was only about 50 per cent of the requirement by the cashew processing units. To meet the shortfall, 0.606 million tonnes of RCN was imported

from Africa (Chandrasekaran and Jeyakumar, 2014). The import of RCN during the next 8 years till 2016-17 is presented in Table 6. With growing import of RCN and competition by other countries, Indian cashew processing Industry started feeling the pressure. Due to the increasing cost of imported RCN and high labour cost contributed by inefficient processing units, many processing units were running at a loss. Out of 840 processing units in Kollam, 80 per cent had closed down, making 0.35 million people, mainly women, jobless. Hence, the challenge was to revive the viable units through modernisation and improve the skills of the labour engaged in these units to work efficiently.

**Table 5: State wise share of processing units and installed capacity in India in 2017**

| State | Processing Units (No.) | Share of Processing Units (%) | Installed Capacity (000 tonnes) | % Share of Installed Capacity | Average Installed Capacity (Tonnes) |
|---|---|---|---|---|---|
| Kerala | 432 | 11.0 | 600 | 36.5 | 1.4 |
| Karnataka | 266 | 6.8 | 300 | 18.3 | 1.1 |
| Goa | 45 | 1.1 | 50 | 3.0 | 1.1 |
| Maharashtra | 2200 | 55.8 | 50 | 3.0 | 0.0 |
| Tamil Nadu | 417 | 10.6 | 400 | 24.3 | 1.0 |
| Andhra Pradesh | 175 | 4.4 | 100 | 6.1 | 0.6 |
| Odisha | 350 | 8.9 | 120 | 7.3 | 0.3 |
| West Bengal | 30 | 0.8 | 8 | 0.5 | 0.3 |
| Chhattisgarh | 3 | 0.1 | 5 | 0.3 | 1.7 |
| N E States | 22 | 0.6 | 10 | 0.6 | 0.5 |
| **Total** | **3940** | **100** | **1643** | **100** | **0.4** |

**Source:** ***SFAC, 2018***

In 2006-07, India imported 0.593 million tonnes of RCN valued at Rs.18.116 billion, inspite of the introduction of import duty of 9.4 per cent during that year. There was a steady increase in the import until 2016, when price of RCN increased from USD 800 to USD 1800 per tonne. As the competitors in Vietnam and China were more efficient, the Indian Cashew Industry with increasing procurement cost and tax, could not maintain the profit margin and hence, started reducing the operation. The RCN import which was 0.96 million tonnes in 2015-16, had reduced to 0.65 million tonnes in 2017-18. The problem is likely to aggravate further as major African cashew growing countries are preparing to process at least 50 per cent of the produce locally. As 75 per cent of the Indian import of RCN was from Western Africa and 24 per cent from Eastern Africa (INC, 2018), the pressure on price rise is likely to continue further. It can be observed from Table 6 that Indian cashew import bill has been significantly higher than the export bill since 2011-12, because of higher price of RCN and increasing domestic consumption of cashew kernel. This indicates a bleak future for the cashew industry, unless suitable measures are taken to keep the business competitive and profitable. Hence, it is necessary to improve the yields of Indian cashew plantations and processing facilities on priority.

**Table 6: Import of raw cashew nut and export of cashew kernel and cashew shell liquid in India from 2006-07 to 2016-17**

| Year | RCN Import | | Cashew Kernel Export | | Cashew Shell Liquid Export | |
|---|---|---|---|---|---|---|
| | Quantity (MT) | Value Rs. Billion | Quantity (MT) | Value Rs. Bill. | Quantity (Tonnes) | Value Rs. Mil. |
| 2006-07 | 0.593 | 18.116 | 0.119 | 24.552 | 6139 | 102.9 |
| 2007-08 | 0.606 | 17.468 | 0.114 | 22.890 | 7813 | 119.8 |
| 2008-09 | 0.606 | 26.324 | 0.110 | 29.884 | 9099 | 260.6 |
| 2009-10 | 0.756 | 30.475 | 0.118 | 28.016 | 11227 | 276.2 |
| 2010-11 | 0.529 | 26.496 | 0.106 | 28.194 | 12051 | 337.7 |
| 2011-12 | 0.809 | 53.378 | 0.132 | 43.907 | 13575 | 594.6 |
| 2012-13 | 0.892 | 53.311 | 0.100 | 40.672 | 9192 | 298.4 |
| 2013-14 | 0.771 | 45.640 | 0.115 | 50.587 | 9480 | 306.1 |
| 2014-15 | 0.940 | 65.709 | 0.119 | 54.329 | 10938 | 558.1 |
| 2015-16 | 0.958 | 85.610 | 0.096 | 49.521 | 11677 | 575.9 |
| 2016-17 | 0.770 | 88.394 | 0.082 | 51.688 | 11422 | 440.0 |

**Source:** ***Nayak and Paled, 2018***

## Cashew production in India

After independence, agricultural development for food security was given high priority, but cashew development did not draw any attention, till the implementation of the 2nd National Five-year Plan during 1956–61. Under this Plan, it was proposed to increase the production of RCN from 60,000 tonnes to 80,000 tonnes in 1961, by expanding the area under cashew cultivation on the east and west coasts, in the states of Karnataka, Maharashtra, Andhra Pradesh, Odisha, West Bengal and Andamans, and to introduce in the central part of India (Planning Commission, 2012). In 1966, when the total area under cashew plantation was 0.24 million ha, producing 0.1 million tonne RCN per annum, with an average yield of 400 kg RCN/ha, the Government of India established the Directorate of Cashew nut Development with a mandate to boost cashew production. Over the next three decades, the Directorate initiated various activities to increase the area by three times and production by four times, with an annual growth of 4 per cent. Several State Governments led by the Government of Kerala, established the State Cashew Development Corporations to boost the cashew industry. State Forest Departments were directed to establish cashew on the forest and other Government lands along the sea coasts. Later, these plantations were transferred to newly formed corporations under the respective State Forest Departments. In all, about 26 per cent of the cashew plantations were on public lands. Farmers having barren lands along the sea coast and adjoining hilly terrains were also motivated to establish cashew, without any serious business plan. It can be observed from Table 7 that the area under cashew production was 0.464 million ha in 1980-81 which gradually increased to 1.04 million ha over 35 years. The yield of RCN also doubled during the same period, resulting in 416 per cent increase in total production as shown in Table 7. However, this yield is far below, Philippines and Vietnam.

**Table 7: Area, production and yield of cashew in India**

| Year | Area Million Ha | Production Million tonnes | Yield Kg/ Ha |
|---|---|---|---|
| 1980-81 | 0.464 | 0.185 | 399 |
| 1985-86 | 0.522 | 0.234 | 324 |
| 1990-91 | 0.532 | 0.295 | 555 |
| 1995-96 | 0.635 | 0.418 | 658 |
| 2000-01 | 0.720 | 0.450 | 625 |
| 2005-06 | 0.837 | 0.573 | 685 |
| 2010-11 | 0.945 | 0.653 | 653 |
| 2015-16 | 1.037 | 0.671 | 647 |
| 2016-17 | 1.041 | 0.779 | 762 |
| 2017-18 | 1.062 | 0.817 | 769 |

**Source:** ***Nayak and Paled, 2018***

Table 8 presents the state-wise status of cashew production in India. Out of 1.041 million ha in 2016-17, Maharashtra, Andhra Pradesh and Odisha, each shared around 18 per cent of the plantation area, while Tamil Nadu, Karnataka, Kerala and Goa shared 13.6, 12.3, 8.7 and 5.6 per cent areas respectively. Chhattisgarh, West Bengal and Gujarat have significantly lower area under cashew. With regard to cashew nut yield, Maharashtra topped with 1378 kg per ha, followed by West Bengal. The yield in other states ranged between 393 kg and 1140 kg, as against the national average of 762 kg per ha. It is a matter of concern that the average yield is significantly low in Andhra Pradesh, Odisha, Tamil Nadu and Karnataka, which are among the top five states with respect to area under plantation, thereby bringing down the total national production of RCN. Out of the total RCN production in the country, 33 per cent was contributed by Maharashtra, while Andhra Pradesh and Odisha contributed only 14 per cent and 12 per cent respectively, inspite of having similar acreage.

**Economics of cashew production**

Establishment of cashew plantations on under-utilised lands, particularly along the sea coast can be an excellent strategy to generate income for the local communities, prevent soil erosion and enrich the bio-diversity. There are vast stretches of idle lands along the sea coast and village forests which can be used for establishing cashew plantations. Cashew can be established with or without irrigation facilities, where the rainfall is above 750 mm per annum.

In Tamil Nadu, the average cost of establishing a new cashew plantation on coastal sandy lands was Rs. 8500 per hectare in early 2010s. Providing irrigation facilities, wherever water sources were available, cost an additional Rs. 1800. The plant population maintained in irrigated plantation was 169 while it was only 146 plants under rain fed conditions. The cost of various inputs for establishing cashew plantation is presented in Table 9. The average cost of establishing cashew plantation was around Rs. 10,000 of which 32.7 per cent was on manure and fertilizers, 23.3 per cent on land development, 11 per cent on weeding, 9 per cent on planting and 8.4 per cent on saplings (Loganathan *et al.,* 2016). The cost of establishment will be at least 3-4 times higher on hilly terrains due to high cost of land development. Hence, priority may be given to coastal lands for establishing new plantations. From the cost of planting material presented in Table 9, it seems that seedlings were generally used for planting. Use of grafted

plants of high yielding variety will be desirable, although the cost of establishment will increase by Rs. 2500 - 3000 per ha.

**Table 8: State-wise cashew area, production and yield in India (2016-17)**

| Sl. No. | States | Area 000 ha | % Share | Production 000 tonnes | % Share | Yield Kg/ha |
|---|---|---|---|---|---|---|
| 1 | Maharashtra | 186.20 | 17.89 | 256.61 | 32.93 | 1378 |
| 2 | Andhra Pradesh | 185.57 | 17.83 | 111.39 | 14.29 | 600 |
| 3 | Odisha | 183.32 | 17.61 | 93.90 | 12.05 | 513 |
| 4 | Tamil Nadu | 141.58 | 13.60 | 67.65 | 8.68 | 478 |
| 5 | Karnataka | 127.86 | 12.28 | 85.15 | 10.93 | 672 |
| 6 | Kerala | 90.87 | 8.73 | 83.98 | 10.78 | 962 |
| 7 | Goa | 58.18 | 5.59 | 32.66 | 4.19 | 561 |
| 8 | Jharkhand | 14.83 | 1.42 | 5.83 | 0.75 | 393 |
| 9 | Chhattisgarh | 13.70 | 1.32 | 9.33 | 1.20 | 681 |
| 10 | West Bengal | 11.36 | 1.09 | 12.96 | 1.66 | 1140 |
| 11 | Gujarat | 7.22 | 0.69 | 6.50 | 0.83 | 900 |
| 12 | Pondicherry | 5.00 | 0.48 | 2.16 | 0.28 | 432 |
| 13 | Tripura | 4.25 | 0.41 | 3.45 | 0.44 | 812 |
| | Others | 10.95 | 1.05 | 7.77 | 100.00 | 710 |
| | **India Total** | **1040.89** | **100** | **779.34** | **100** | **762** |

**Source:** ***Nayak and Paled, 2018***

**Table 9: Establishment cost of cashew plantation in coastal Tamil Nadu in first year**

| Sl. No. | Operations | Rain fed (Rs/ha) | Irrigated (Rs/ha.) | Average Cost in % |
|---|---|---|---|---|
| 1 | Land clearing | 2002 | 2304 | 23.3 |
| 2 | Digging of pits | 578 | 610 | 6.6 |
| 3 | Seedling and transportation | 723 | 820 | 8.4 |
| 4 | Planting, staking and mulching | 807 | 785 | 9.0 |
| 5 | Weeding | 916 | 1150 | 10.9 |
| 6 | Manures and fertilizers | 2736 | 3600 | 32.7 |
| 7 | Plant protection | 263 | 580 | 3.6 |
| 8 | Irrigation charges | 476 | 520 | 5.5 |
| 9 | Total cost | 8500 | 10369 | 100.0 |
| 10 | Average No. of trees/ha | 146 | 169 | 150 |
| 11 | Cost per tree | 58 | 61 | 59 |

**Source:** ***Loganathan et al., 2016***

The annual maintenance cost of cashew plantation in Coastal Tamil Nadu during 2000 to 2010 is presented in Table 10. The present cost of maintenance will be higher atleast by 50 – 100 per cent, due to high cost of inputs and labour. However, the data suggests that the major cost is on manure and fertilizers, followed by plant protection chemicals and weeding. Harvesting will start from the fourth year in case of plantations established from

seedlings and fruiting will be early by one year on grafted plants.

**Table 10: Maintenance cost of cashew plantations in coastal Tamil Nadu**

| Sl. No. | Operations | Yr. 2 Rs/ha | Yr.3 Rs/ha | Yr. 4 Rs/ha | Yr.5 Rs/ha | Yr. 6 Rs/ha | Yr. 7 Rs/ha | Yr. 8 Rs/ha |
|---|---|---|---|---|---|---|---|---|
| 1 | Seedling and transportation | 82.5 | - | - | - | - | - | - |
| 2 | Planting, staking, mulching | 25 | - | - | - | - | - | - |
| 3 | Weeding | 464 | 425 | 425 | 425 | 425 | 425 | 425 |
| 4 | Manure and fertilizers | 2987 | 3337 | 3700 | 3883 | 4101 | 4412 | 4701 |
| 5 | Plant protection chemicals | 736 | 913 | 929 | 1221 | 1386 | 1424 | 1502 |
| 6 | Harvesting | - | - | 104 | 176 | 225 | 288 | 385 |
| 7 | Total cost | 4295 | 4675 | 5157 | 5711 | 6136 | 6549 | 7013 |
| 8 | Cost per tree | 24 | 26 | 29 | 32 | 35 | 37 | 8 |

**Source:** ***Loganathan et al., 2016***

Considering the operations in 3 different locations namely Cuddalore, Ariyalur and Pudukkottai, the average establishment cost was Rs. 17177 for rain fed plantations and Rs. 20535 for irrigated plantations as presented in Table 11. Total annual cost was Rs.18022 and Rs. 21538 per ha for rain fed and irrigated plantations respectively. The average cost of maintaining a tree was Rs.123 under rain fed condition and Rs. 127 under irrigation. The yield of RCN under irrigation was 970 kg per ha as compared to 730 kg under rain fed conditions. This also reflected on the gross income which was Rs. 43,650 and Rs. 33,288 under irrigated and rain fed conditions respectively. The cost of production of raw cashew under rain fed condition was Rs. 24.7 while it was Rs. 22.2 per kg under irrigation. This confirms that the cost of production under irrigation is lower due to higher yield (Loganathan *et al.,* 2016). The Benefit cost ratio was 2.03 and 2.28 for rain fed and irrigated plantations respectively. The Internal Rate of Return (IRR) was 37.44 per cent and 42.05 per cent for rain fed and irrigated crops respectively.

In South Goa, the cost of establishing cashew plantation in 2017-18 was Rs. 63217 while it was Rs. 56220 in North Goa. The annual cost of cultivation was around Rs. 50000. These costs are significantly high compared to the cost in Tamil Nadu, which can be attributed to the increase in the cost of all the inputs over the last 12 -15 years and non-availability of labour in Goa. The farmers in Goa identified non-availability of good quality planting material, shortage of water for irrigation, attack of pests and diseases and non-availability of labour as their main constraints (Mundinamani *et al.,* 2018).

**Factors contributing to cashew production in India**

**Lack of incentives for establishing cashew plantations:** The growth rate in cashew production in India has been very slow due to several reasons. These include availability of land, quality of land, investment in establishment of plantation and maintenance, cashew varieties, type of planting material, crop husbandry practices and poor extension services. There were no serious efforts by the Government to promote establishment of cashew plantations by farmers. For instance, Kerala state started implementing the Kerala Land Reforms Act, 1967 in the 1970s. Under this Act, land ceiling of 6 ha on individual land ownership was introduced, but the area under plantations was exempted, which motivated many land holders to convert their land into

plantations. However, as cashew crop was not included in this list, an opportunity to expand cashew plantation was missed. The State Governments promoted many cash crops like rubber and oil palm by providing financial assistance but cashew was neglected. Ideally, cashew can be the main species for establishing greenery along the sea coast and the land owners in this region can be assisted to procure good quality grafted plants of good height to ensure low mortality and early bearing. Barren lands owned by absentee landlords, who have migrated to cities can also be brought under cashew plantation, by encouraging them to lease them out for cashew plantation, introducing suitable changes in the policy and by providing incentives.

**Table 11: Costs and returns of cashew production under rain-fed and irrigated conditions**

| Sr. No. | Particulars | Rain-fed Rs/h | Irrigated | Overall | % of Total |
|---|---|---|---|---|---|
| | Establishment Cost | 17177 | 20535 | 17878 | |
| | **Annual Fixed Cost** | | | | |
| 1 | Annual share of Establishment cost | 2101 | 2512 | 2187 | 11.8 |
| 2 | Depreciation cost | 314 | 540 | 352 | 1.9 |
| 3 | Interest on fixed capital | 1268 | 1080 | 1237 | 6.7 |
| 4 | Rental value of owned land | 2307 | 2320 | 2309 | 12.4 |
| 5 | Land cess | 122 | 125 | 123 | 0.7 |
| | **Sub Total 1** | **6112** | **6577** | **6207** | **33.4** |
| | **Annual Variable Cost** | | | | |
| 1 | Human labour | 3820 | 3705 | 3765 | 20.25 |
| 2 | Bullock power | 394 | 580 | 425 | 2.3 |
| 3 | Machine power | 819 | 1250 | 891 | 4.8 |
| 4 | Manure and Fertilizers | 4803 | 6229 | 5041 | 27.1 |
| 5 | Plant Protection chemicals | 1344 | 1497 | 1369 | 7.4 |
| 6 | Irrigation charges | - | 740 | 123 | 0.7 |
| 7 | Interest on working capital | 730 | 960 | 768 | 4.1 |
| | **Sub Total 2** | **11910** | **14961** | **12383** | **66.6** |
| | **Total cost** | **18022** | **21538** | **18589** | **100.0** |
| 1 | Average no. of plants per ha | 146 | 169 | 150 | |
| 2 | Cost per tree | 123 | 127 | 124 | |
| 3 | Yield (kg/ha) | 730 | 970 | 770 | |
| 4 | Gross income @Rs. 45/kg | 33288 | 43650 | 35035 | |
| 5 | Net income | 15266 | 22122 | 16446 | |
| 6 | Cost of production (Rs./kg) | 24.7 | 22.2 | 24.1 | |
| 7 | Output – Input Ratio | 1.85 | 2.03 | 1.88 | |

**Source:** ***Loganathan et al., 2016***

**Aging of plantations:** Age of the plantation has a significant influence on RCN yield. In 1995, out of 0.635 million ha of cashew plantation, 47.5 per cent were old, above 30 years, where the average yield was 440 kg/ha, while about 26.7 per cent area had young trees below the age of 15 years, with an average yield of 600 kg/ha, as presented in Table 12. It is essential to reestablish the old plantations

with grafted plants of high yielding varieties. It can also be observed from Table 12 that 74 per cent of the total plantation area is owned by private land owners while only 26 per cent area is owned by the Forest Department and Plantation Corporations. Establishment of new, high-density plantations, by uprooting old trees will need heavy investment to the tune of Rs.75,000 to 100,000 per ha and hence, suitable schemes should be developed to provide soft credit, good quality grafted plants, irrigation facilities and technical guidance to adopt good crop husbandry practices.

**Poor crop husbandry:** Traditionally, cashew was never considered as a high value crop in India, as the major business was dependent on RCN imported from Africa. In the past when cashew cultivation was promoted, farmers were advised to establish the plantation more for soil and water conservation, because neither was economics of cashew plantation known nor were suitable technologies developed to boost the production. Generally, the lands used for cashew plantation in India have been either infertile sandy lands along the sea coast or heavily eroded, denuded hilly lands, unproductive and unsuitable for growing other crops. Such lands needed to be developed through field bunds and terraces for soil and water conservation and to prevent inundation of salt water in the plantation. The plantations on Government lands were also established without any land preparation for harnessing rain water and without any irrigation facilities. Most of the plantations established before 1970s, were by planting seedlings of unknown genetic sources. These factors contributed to high mortality, lower tree density, slow growth, prone to major pests like stem borer and tea mosquito, delayed fruiting and lower yield.

**Table 12: Age wise yield of cashew plantations in India in 1995**

| Plantation Age Group | Ownership | Area | | Production | Yield |
|---|---|---|---|---|---|
| | | 000 Ha | % of Total | 000 tonnes | Kg/Ha |
| < 15 years | Private | 143.50 | 22.60 | 88.00 | 600 |
| | Forest / Corporation | 26.00 | 4.09 | 14.00 | |
| 15- 30 years | Private | 120.35 | 18.95 | 148.00 | 1035 |
| | Forest / Corporation | 15.80 | 2.49 | 38.00 | |
| >30 years | Private | 205.45 | 32.35 | 100.00 | 440 |
| | Forest / Corporation | 96.25 | 15.16 | 32.00 | |
| **Total** | **Private** | **469.30** | **73.90** | **336.00** | **720** |
| | **Forest / Corporation** | **165.70** | **26.10** | **84.00** | |
| **Grand Total** | | **635.00** | **100.00** | **420.00** | |

**Source:** ***CEPC 1997***

**Improved varieties and spacing:** Realizing the need for scientific support to boost cashew production, the Government of India had launched the All India Coordinated Spices and Cashew improvement Project in 1971. The research received further boost with the implementation of a World Bank-aided multi-State Cashew Project in the States of Andhra Pradesh, Kerala, Karnataka and Orissa from 1982-86. A National Research Centre for Cashew was established in 1986 at Puttur in Karnataka to increase the production and productivity of cashew, with 8 research centres in 8 cashew growing states in the country. These institutions have now selected high yielding cashew varieties for different

regions, as presented in Table 13. Final selection of varieties can be made on the basis of the yield per tree and size of the nut. Other recommendations such as use of grafted plants of 45- 60 cm height, produced from soft wood grafting, high density plantation by maintaining a spacing of 4 x 4 m instead of 8 x 8 m, application of recommended doses of manures and fertilizers, 1-2 irrigations at the time of fruit set, regular control on major pests, control of tree height by regular pruning, harvesting of fully ripe fruits and immediate separation and shade drying of cashew nut, etc. will certainly help in increasing the yield per tree and total production. Unfortunately, there is a wide gap between the Research Institutions, Agricultural Extension Department and farmers engaged in cashed production. This calls for a strong backward and forward networking, which has been missing to a great extent.

**Table 13: Superior varieties of cashew released by various institutions in India**

| Institution | Cultivars | Hybrid/ selection | Year of release | Yield (kg/tree) | Nut weight (gm) |
|---|---|---|---|---|---|
| RRS, Vridhachalam, Tamil Nadu | VRI (Cw)-5 | Hybrid | 2007 | 13.2 | 7.2 |
| RFRS, Vengurla, Maharashtra | Vengurla-2<br>Vengurla-7 | Selection<br>Hybrid | 1979<br>1997 | 24.0<br>18.5 | 4.3<br>10.0 |
| ARC, Mangalore, Karnataka | Ullal-2<br>Ullal-4 | Selection<br>Selection | 1984<br>1994 | 14.7<br>10.5 | 6.0<br>7.2 |
| NRC, Puttur, Karnataka | NRCC-sel-2<br>Bhaskara | Selection<br>Selection | 1989<br>2005 | 9.0<br>18.5 | 9.2<br>6.5 |
| ARS, Chintamani, Karnataka | Chintamani-2 | Selection | 2007 | 29.8 | 7.9 |
| CRS, Bapatla, Andhra Pradesh | BPP-8<br>Jagannath | Hybrid<br>Hybrid | 1989<br>2008 | 14.5<br>10.5 | 8.2<br>8.6 |
| CRS, Annkkayam & Madakkathara, Kerala | Kanaka<br>Priyanka | Hybrid<br>Hybrid | 1993<br>1995 | 19.0<br>16.9 | 6.8<br>10.8 |

**Source:** ***Kumar et al., 2012***

**Development of cashew value chain**

**Poor backward and forward linkages**

Even though India has made significant progress in agricultural production during the last six decades, thereby raising food grain production from 50 million tonnes in 1950 to 277.5 million tonnes in 2017-18, marketing of the produce has been the weakest link in agricultural development, which has heavily influenced the profitability of farmers. Realising the difficulties faced by the farmers in marketing their produce, the Government of India assured minimum support price for major food grains and even established procurement centres for a few important crops, where farmers could not sell their surplus produce in local markets. In the absence of a fair and efficient marketing system, neither the farmers can obtain a fair deal nor can the country boost its agricultural production. This holds good for cashew as well. Fortunately, the cashew industry in India started with processing and marketing. However, the production segment has been completely neglected.

Value chain is a network where all the stakeholders associated with the crop or commodity, share a common platform and

interact with each other with a goal of optimising the production and value addition. These are the intermediaries between the farmers and consumers. They include scientists, extension experts, development agencies and farmers' organisations, input producers and distributors, financial institutions and insurance agencies, traders, warehouse owners, transporters, processing establishments and marketing organisations. Local farmers' cooperatives, dedicated civil society organisations or Producer Companies can take the lead in coordinating the value chain platform, as value chain has to primarily protect the interest of farmers.

For effective functioning and inclusion of small farmers, producers' groups of 100 - 500 farmers or even more, preferably belonging to a homogeneous land holding and socio-economic category, may be formed for sharing inputs, technology, infrastructure, services to promote efficient production and marketing. This calls for a committed facilitator at the village level to provide hands-on technical guidance to individual farmers, while organising input distribution, credit facilitation, development of water resources, establishment of agro-engineering services and post-harvest management of the produce such as collection, cleaning, grading, packing and transportation of the produce to various destinations. With such an organisational set up either in the form of informal or registered groups or cooperatives, even small farmers can sell all the surplus produce without any exploitation by moneylenders and middlemen. With timely availability of inputs and technical guidance, these farmers can take up production of even high value crops and increase their crop yield and income.

The other reasons for poor price realization for RCN by small farmers in India were as given below:

1. Poor quality nuts, due to small size; rancid due to improper drying
2. Change in colour of the nut, brownish instead of greenish gray colour due to excessive drying under direct sunlight,
3. Lack of storage facilities and financial crunch compel small farmers to sell their produce immediately after the harvest, when the price is the lowest;
4. In remote villages where the area under cashew plantation is small, farmers are compelled to sell RCN at a low price as local traders are reluctant to buy;
5. Many farmers are not even aware of the prevailing price of RCN in international and domestic markets and hence they end up in unfair deals.

It is clear that inspite of the leadership in international cashew export market, India has not been managing the operations efficiently. The weakness can be observed in processing, procurement of RCN from farmers and production of nuts.

**Value chain for cashew nut in Odisha and Goa**

Since the development of the cashew processing Industry in 1960s, the processing agencies found it easier and cheaper to import RCN from Africa than to procure it directly from local farmers, thereby making it difficult for small scale cashew producers to sell their produce at a better price. In the absence of a well-developed marketing network, the village traders collected cashew from individual households or from the village market and sold it in the larger market, around the cashew processing units. As the farmers did not receive a remunerative price, there was no desire either to expand the area or to take good care of the plantation for increasing the production.

The processing units on the other side were not efficient, which resulted in poor

quality kernel production and reduction in their profit margin. Hence, they were not willing to pay a better price. This was a vicious cycle. For instance, in Odisha, during 2004-06, there were 117 cashew processing units spread over 13 districts, with a production capacity of 11046 tonnes per annum. Most of the units followed roasting method, which was labour intensive, with poor recovery of products, and poor control on the quality of the kernels. These units were able to operate only for five months in a year, using the domestic RCN. Some of them have tried to import RCN from Africa through brokers, but the capacity utilization has been very less, causing financial loss. The processing units sold their produce through the retailors in and outside the state. They neither had their own outlets nor any brand to sell their produce. They were also unable to export due to lack of proper packing facilities. The Cashew Processors' Association has been trying to improve the processing facilities, which calls for huge investments (Srivastava and Srivastava, 2018). They are also considering the possibility of importing African cashew nut at a low price but it may be difficult, as many African countries are developing their own processing facilities. Hence, a better option is to improve the local value chain by improving the processing facilities and efficient collection of RCN from growers by avoiding middlemen at several tiers.

In another study of cashew value chain conducted in Goa during 2008-07, it was reported that the area under cashew production was gradually increasing. Odisha had the highest growth of 4.80 per cent, followed by Kerala (3.51 per cent and Karnataka (1.93 per cent). With respect to RCN production, Karnataka had the highest growth of 5.70 per cent, followed by West Bengal (2.60 per cent) and Goa (2.40 per cent). In North Goa, 50 per cent cashew farmers sold their RCN to their own Cooperative Society, 31 per cent farmers sold it to two other cooperatives, 8 per cent farmers sold it to the processing units and only 7 percent farmers sold it to village traders. In South Goa, 58 per cent growers sold their RCN to two Cooperatives, 12 per cent sold to wholesalers, 6 per cent to village traders and 4 per cent to the processing units. The involvement of middlemen was minimum. This enabled recovery of a very good price between Rs. 142 and 151 (Mundinamani *et al.,* 2018). However, such an effective cooperative marketing does not exist in many other states, thereby requiring immediate attention.

**Cashew development by BAIF**

BAIF Development Research Foundation is a civil society organisation, engaged in promoting sustainable livelihood for marginal and small farmers in India through livestock and agricultural-based interventions. Promotion of tree-based farming on degraded wastelands was introduced in the 1970s, which generated income and employment for tribal families, while enriching the biodiversity and environment in the region. Rehabilitation of the tribal families of south Gujarat, who owned denuded hilly lands and struggled to cultivate staple food crops like paddy, finger millet, pearl millet and some legumes, with very low yield due to poor agronomic practices, was a challenge. Tillage activities during the rainy season accelerated soil erosion and denudation of the adjoining lands. As these families could not increase crop production, they were motivated by BAIF to cultivate mango and cashew crops, and provided financial support to meet the cost of establishment of the plantation. As most of them were marginal land holders, the project was limited to establishing plantation on 0.4 ha. Mango was a popular fruit crop grown in the region and hence, these tribal farmers were willing to grow mango. However, as the performance of mango was likely to be low in the absence

of irrigation facilities, BAIF wanted to introduce a hardier crop like cashew, which was again not commonly grown in Gujarat. Hence, grafted cashew plants of Vengurla variety were established on a small scale along with mango in some of the orchards.

After 3-4 years of comparative performance in Navsari and Valsad districts of Gujarat, BAIF assessed the suitability of cashew for these hilly terrains because of its ability to tolerate drought, lower maintenance cost, regular bearing, long shelf life and steady market. Hence, cashew cultivation was promoted systematically during late 1980s. The challenge was to empower illiterate tribal farmers, who owned less than 1 ha denuded land and without any financial resources, to grow an unknown crop which can start generating income from the second year instead of waiting for 3-4 years. Cashew was not commercially grown in Gujarat and hence no technical guidance and agricultural services were available from the Government of Gujarat. Fortunately, financial support to cover the cost of establishing the plantation was assured from KfW (German Development Bank). As the objective of the programme was to provide sustainable livelihood, BAIF adopted a suitable strategy of ensuring higher production and income, adequate to sustain their livelihood (Hegde *et al.,* 2003).

**Cashew value chain promoted by BAIF**

Figure 3 presents the role of different stakeholders in the cashew value chain. The producer company promoted by BAIF, VAPCOL, received the fresh or processed produce, packed it well after labelling it with the brand name, collected the orders from wholesalers, retailers and large customers and dispatched the consignment accordingly. The members of VAPCOL had close coordination with the central processing unit of BAIF, which received processed cashew from the cooperative processing units, inspected the quality and further processed it wherever necessary. After verification of the quality and grades, the final product was packed as per the prescribed standard and kept ready for dispatch to VAPCOL. At every village, Gram Vikas Mandal (GVM - Village Development Committee) was promoted by BAIF, who were also the members of the Processing Cooperative. These Mandals set up seasonal cashew collection centres in every village, where cashew growers, who are the members of the Organisation, brought RCN. The Committee stored the RCN at the village collection centre and forwarded it to the processing unit, at the earliest.

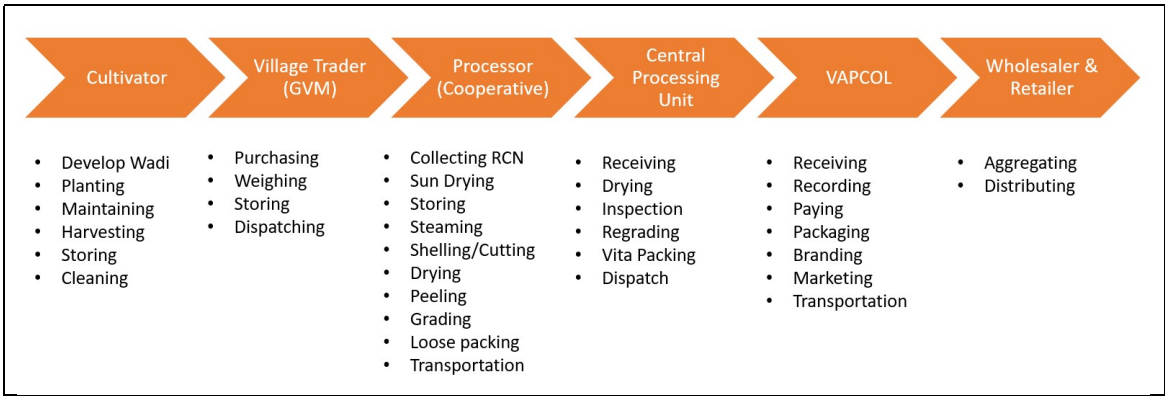
This arrangement of selling raw cashew nut was made known to every farmer through the cashew growers' groups. These farmers being first time cashew growers, were trained in nurturing cashew plants, soil and water conservation, plant protection, harvesting, timely separation of cashew nut from cashew apple, cleaning and drying of nut and use of cashew apple for direct consumption and processing for value addition. Most of the farmers brought their RCN to the GVM, as this was their own organisation and there was no alternate selling outlet either in the village or in the nearby town. However, in other cashew producing states, where cashew was grown by farmers on their own and there were no official RCN procurement centres, local traders collected cashew nut from farmers at their hamlets either by paying a very low price or exchanged it for food or other commodities of very low value. Hence, there was no incentive for small farmers to invest in inputs, required for increasing production. Even the well-to-do cashew growers sold the cashew nuts to local traders who in turn sent it to medium or larger traders in the areas where cashew processing facilities were operating. In this process, there were several intermediaries, reducing the profit share of farmers. With

the setting up of decentralized processing facilities, the number of intermediaries was reduced and farmers were able to bargain better.

**Strategy promoted by BAIF to improve cashew production**

1. Land survey and development of the land into small plots along the contour, to prevent soil erosion and to harness rain water;
2. Use of grafted cashew plants of elite varieties for establishing medium density plantation, with 7 x 7 m spacing;

**Figure 3: Cashew value chain developed by BAIF**




**Source:** ***Gupta, 2018***

3. Establishment of irrigation facilities, wherever possible to irrigate the orchard atleast in the initial years;
4. Introduction of good crop husbandry practices to facilitate better growth and yield;
5. Cultivation of inter-crops between cashew plants not only to generate additional income, but also to maintain the plantation in a healthy condition;
6. Appointment of field guides, who were local school dropouts trained in cashew cultivation, to visit all the orchards regularly and interact with each farmer to discuss about the activities undertaken and sort out the problems if any;
7. Bulk procurement of inputs, development of various infrastructure and services required for improving the production.
8. Promotion of micro-finance among group members and availing group loans from financial institutions.
9. Promotion of additional income generation activities and social development initiatives such as women empowerment, community health, education and literacy, developing pressure groups against social evils.
10. Series of People's Organisations such as Orchard owners' groups, consisting of 25- 30 families, village level planning committees, Block level Cashew producers' cooperatives with the leaders of the orchard owners' groups as representatives on the Executive Committee, etc were formed. The major role of these organisations was

facilitation for members to adopt good orchard management practices and participate in developing backward and forward linkages. Several sub-committees were promoted to coordinate health care, education and women empowerment activities. These producers' cooperatives organized collection of agricultural produce grown by the members and further graded processed and marketed them locally.

11. A Farmers' producer company 'VAPCOL' was established later by enrolling the cashew growers' cooperatives as members to process and market the produce.

**Strategy for improving profitability in cashew industry**

**Cashew processing**

Cashew being an international, high value cash crop, India has to compete with other leaders like Vietnam, Brazil and China in terms of quality and price. Hence, utmost care has to be taken to process RCN in an efficient way, with respect to size, colour, texture and taste. It has been demonstrated that mechanized processing, adopting the best technique of heating, can be labour efficient and least polluting, while yielding the highest percentage of unbroken kernels. Hence, the time has now come to consolidate the processing facilities with improved equipment and processing. Suitable credit facilities should be provided, at a competitive rate of interest to enable the local processing units to operate to their maximum capacity, competing with their international counterparts.

Suitable facilities should also be developed to process cashew nut shell liquid and cashew apple. There are many small-scale cashew processing units where the crude method of heating cashew nut, even by using cashew shell as fuel, is still in practice. While heating RCN and while burning cashew shell, very harmful smoke is released, polluting the surroundings. As this smoke is harmful, pollution-free processing must be adopted. As CNSL has good export demand, efficient processing will help to generate additional income, while preventing environmental pollution. Cashew apple is tasty and nutritious, which can be processed into juice, syrup, jam and alcohol. In the absence of processing facilities, cashew apple can also be fed to livestock. An economically viable processing plan should be developed to make best use of cashew apple.

**Procurement of raw cashew nuts**

Small cashew farmers are not aware of the prevailing price of cashew either in the local or international markets and there are no procurement centres offering a fair price. Hence, it will be ideal for the State Governments to organize cashew growers to form their groups/ associations and link with the reputed processers. Alternately, special weekly markets can be opened in cashew production clusters during the cashew harvesting season, where processers can directly participate in the purchase.

One good option will be to establish cashew producers' company where village level farmers' groups can be the members. The producer company can be the facilitator of the cashew value chain, to ensure backward and forward linkages. This company can be expected to professionally manage the business of procurement, processing and marketing of produce. These organisations will have the strength to negotiate with processors and retailers for better price. The Government of India has made provision for extending financial support to producer companies to cover the initial operating expenses. This opportunity can be encashed by small-scale cashew growers for better price realization.

To create better awareness among cashew growers about the cashew demand, supply and price fluctuations, the Directorate of Cashew and the Cashew Export Council may also take up the following initiatives:

1. Regular Market Survey on the demand and supply of RCN in international markets;
2. Provision of warehouse and credit facilities;
3. Suggested support price based on the prevailing price for imported RCN;
4. Offering suitable price to farmers by traders, based on the sample with a condition to deliver the agreed quantity within a stipulated period.

**Boost cashew yield and production**

Increasing RCN production through increase in the yield and plantation area should be an important goal of the Indian cashew Industry, which is most critical for regaining its leadership. For increasing cashew nut yield, there is scope in the following areas:

**Re-establishment of old plantations:** Plantations of 25-30 years age, should be monitored closely for the yield and trees less than 50 per cent of the average yield of 8-12 kg/ tree should be identified for replacement. If more than 50 per cent trees are poor yielders in the older plantations, it will be better to uproot all the trees and establish new plantation, with high density, at 4 x 4 m or 4 x 5 m spacing, using grafted plants of superior variety. While selecting the variety, it will be better to select a variety having large size nuts, as large size kernels fetch premium price. Even in the younger plantations, new saplings can be established between the older trees.

**Good management practices:** While establishing high density plantations, it is also necessary to adopt good orchard management practices, particularly to improve soil fertility and assured moisture supply during the critical stages of shoot development and fruit setting. Cashew is generally grown on sandy soils along the sea coast and on hilly slopes. These sites have to be treated differently.

The soils along the coastal areas are poor in nutrients and organic matter and high in sodium chloride with poor water holding capacity. As most of the coastal regions receive fairly good rains and the ground water table is fairly high, serious efforts should be made to improve soil fertility, reduce sodium chloride content and conserve moisture during the spring and summer seasons. Facilitation of in situ collection of rain water in the field and allowing it to percolate in the ground can help in draining the salt from the root feeding zone to a great extent. Rain water recharging will improve the ground water table. Surface drains can also be dug wherever necessary, to prevent waterlogging. In coastal areas, generally, the water table is high and no supplementary irrigation is necessary during spring season. However, in the areas where soil moisture is a serious constraint, 1-2 irrigations, preferably micro-irrigation may be provided.

Cashew plantations in the coastal areas are prone to inundation of sea water, resulting in suppressed growth and even in the death of cashew trees. High sodium chloride in soil prevents the intake of various macro and micro-nutrients by trees. Thus, efforts should be made to select cashew tree races, with have been thriving well on soils having high sodium chloride and other salts. Seedlings of these trees should be tested for their salt tolerance. Such genotypes can be used as rootstock to produce grafted plants for planted on salty lands. Genetic modification of cashew by

incorporating salt tolerant genes should also be undertaken to establish cashew on sodic and saline wastelands. Special techniques of nutrient management should also be developed to ensure availability of required nutrients to cashew trees.

With regard to cashew plantations on hilly lands, soils in general are shallow and prone to heavy soil erosion. These plantations often suffer from moisture stress during the spring season, at the time of fruiting. To address this problem, these plantations should have strong contour bunds, which can promote soil and water conservation. This may be further followed by mulching of the ground to prevent soil moisture loss. It is very difficult to find water resources to irrigate these plantations and hence, moisture conservation is the answer. However, watering the plants during the first few years will help in preventing plant mortality.

Cashew leaves are leathery, high in fibre, tannin and other phytochemicals. Decomposition of dried cashew leaves fallen under the trees, generally take more than a year. These leaves remain under the canopy, obstructing the percolation of the rain water in the ground. The leaves also release tannin and other chemicals in the soil, interfering with the absorption of nutrients by cashew tree. This problem should be addressed by developing a technique to shred the dried leaves on the site or to collect the litter, shred it and convert it into compost by treating with suitable microbes. The treatments can also address the decomposition of tannin and other phytochemicals. As the phytochemicals present in cashew leaf litter affect the intake of nutrients from the soil, special techniques such as placement of nutrient briquettes deep in the soil, application of soil amendments with nutrients, foliar application, etc. should also be introduced to boost the yield. In areas where rainfall is high, leguminous green manure crops can be grown during the rainy season, at least around the canopy to enrich organic carbon content in the soil.

**Flower induction:** It is well known that many plants can be artificially induced to flower by applying ethylene producing chemicals. In case of cashew, foliar spray of 10 to 50 ppm Ethrel, before flowering time has been effective in inducing flowering. The number of flowering panicles per square meter, number of perfect flowers per panicles and sex ratio across locations were better with Ehrel spray, atleast 3 weeks before the normal flower induction (Ghadage *et al.*, 2016). Generally, the flowering duration varied from 75 to 90 days but there was no impact of growth regulators on the duration. Foliar sprays of plant growth regulators had a positive and significant effect on the total number of perfect flowers and percentage of female flowers. This can be certainly tried where flowing intensity is low.

**Improvement in the size and quality of kernels:** As cashew kernels having larger size, in unbroken condition, will fetch the highest price, the aim should be to produce superior quality cashew nuts. Hence, preference should be given to varieties having large size cashew nuts. While developing new varieties, the aim should be to increase the kernel size along with the yield. It should also be possible to develop special nutrient management package, particularly the foliar application of micro-nutrients, such as calcium, boron, manganese and zinc, which play a very significant role in fruit set and nut development. Some of these micronutrients such as calcium can also help in improving the texture and hardiness of the kernel and reduce the brittleness. These nutrients are generally immobile in soils and hence, foliar applications are very effective. It is necessary to test the soils of cashew

plantations and assess the availability of various macro and micro-nutrients and fix suitable doses of nutrients. Adequate studies have not been carried out in the past about the role of micronutrients and their availability under different soil conditions.

**Plant protection:** Plant protection is most critical for maintaining the productivity of the plantations. Important pests and diseases of cashew are listed below (Govt. of India, 2014):

**Insect pests**

1. **Mosquito bug:** *Helopeltis antonii* Signoret: Causes heavy economic losses, affecting 30 - 60 per cent drop in the yield. Both nymphs and adult bugs suck sap from tender flushes of shoots and inflorescences.
2. **Stem and root borer:** *Plocaederus ferrugenius* L.: It is a serious pest which causes death of tree
3. **Leaf miner:** *Acrocercops syngramma* Meyrick
4. **Leaf and blossom webber:** *Lamida moncusalis* Walker
5. **Flower thrips:** *Rhynchothrips raoensis* Ramakrishna Ayyar: Adult nymphs damage inflorescence.
6. **Foliage thrips:** *Selenothrips rubrocinctus* Giard; *Rhipiphorothrips cruentatus* Hood; *Retithrips syriacus* Mayet: Adult nymphs damage lower surface of leaves.
7. **Mealy bug (*Ferrisia virata*):** Nymphs and adults suck tender parts of the plant
8. **Apple and Nut borer (*Thylocoptlia panrosema*):** Caterpillars attack the fruits and cause premature fruit fall.

**Diseases**

1. Dieback or Pink disease: *Corticium salmonicolor* Berk. & Broome
2. Damping off: *Phytophthora palmivora* (Butler)
3. Anthracnose: *Colletotrichum gloeosporioidesm* Penz. and Sacc.
4. Inflorescence blight: *Colletotrichum mangiferae* Kelker; *Phomopsis anacardii* Early & Punith
5. Shoot rot and leaf fall: *Phytophthora nicotianae* var. *nicotianae* Breda de Haan

**Control of pests and diseases**

The intensity of pests and diseases varies with the location and climatic conditions. Hence, based on the intensity, suitable control measures should be undertaken. General precautions to reduce the incidences of pests and diseases as recommended by ICAR, are presented below:

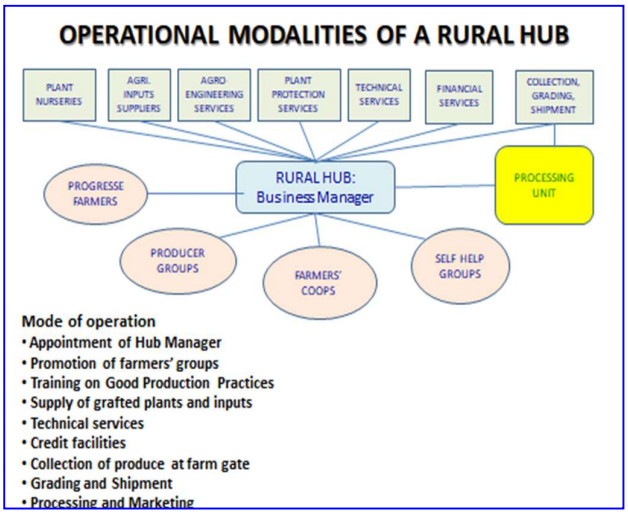
1. Selection of varieties' resistant/tolerant to major pests and diseases;
2. Selection of healthy planting material;
3. Treatment of planting material with pesticides especially bio-pesticides;
4. Maintain proper spacing;
5. Maintain good soil health, preferably by mulching and green manuring;
6. Good nutrient management, preferably by using manures and bio-fertilizers;
7. Controlled irrigation;
8. Regular monitoring of the field.

Depending on the recommendation, suitable pest and disease control measures must be carried out. Before using chemicals, it is necessary to ensure that no residue is left in cashew apple and nuts, to be able to meet the export regulations.

**Support for small farmers**

For small holders, apart from orienting them on good agricultural practices and providing them with infrastructural and financial support, there is also a need for hand holding, as they neither have self-confidence nor access to reliable resource agencies. They should be an important part of the Value Chain to enjoy a fair deal. To support small farmers, it is desirable to appoint village level field Business Coordinators / Managers, who can initiate action on behalf of small farmers, particularly for backward and forward integration. The manager based at the village or cluster level, depending on the volume of work, can coordinate procurement of inputs, arrange for various services, facilitate credit from financial institutions, provide technical guidance and also help in grading, processing and marketing of the produce, as presented in Figure 4. Such support can boost the confidence of farmers while increasing the crop yield and income. In the presence of the Business Manager, farmers need not negotiate with outside service agencies and marketing agencies directly.

**Fig. 4: Rural business hub for backward and forward integration**




The Business Hub can be operated by the Farmers' Organisations or Producer Company, and all the farmers will be the members of this organisation. The Business can organize various activities as listed in Fig. 4. There is scope for setting up startups to train unemployed youth to work as service providers with special skills and kits, under the Producer Company.

**Summary and recommendations**

Development of the Cashew Industry needs immediate attention of the policy makers, processors and farmers to remain competitive and profitable. There is scope to improve quality and profitability by adopting improved method of roasting and mechanized shelling of cashew nut. Agencies engaged in cashew processing, need financial support in the form of liberal loans with soft rate of interest. They also need support for establishing contact with reliable agencies to export to new locations. There is also scope for establishing cashew processing units in traditional cashew growing areas, particularly in African countries, which

wish to process atleast 50 per cent of their harvest locally.

Increasing cashew production is another important opportunity, by increasing the crop yield as well as by expanding the area under cashew plantation. Presently, about 75 per cent plantations are owned by farmers while the rest are owned by the Government. More than 50 per cent plantations are old plantations, aged between 35 to 50 years, established with seedlings of nondescript genetic base, spaced widely and maintained without any recommended crop husbandry practices. These plantations should be closely monitored for their performance and trees yielding less than 4-5 kg nuts per year, should be replaced with new grafted plants of good varieties. The spacing between the trees can also be reduced to increase the tree population. Good crop husbandry practices such as improving soil productivity and moisture content and efficient management of nutrients, pests and diseases should be promoted by Agricultural Extension Agencies to increase the yield of nuts. There is good scope to promote cashew cultivation along the sea coast as a profitable cash crop. Suitable schemes should be developed to enable small farmers and absentee land owners to establish cashew plantations on unproductive lands. To provide timely support to small farmers and to improve their production, value chain can play a significant role. With efficient backward and forward linkages and increase in RCN yield, cashew can be more profitable than many other crops, including mango and other plantation crops. This will also help India to restore its leadership in cashew.

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