Chapter 6

CASHEW PROCESSING INDUSTRY
6. CASHEW PROCESSING INDUSTRY

The cashew fruit is unusual in comparison with other tree nuts since the nut is outside the fruit. The cashew apple is an edible false fruit, attached to the externally born nut by a stem. In its raw state, the shell of the nut is leathery, not brittle. It contains the thick vesicant oil, CNSL, within a sponge-like interior. A thin testa skin surrounds the kernel and keeps it separated from the inside of the shell. The primary products of cashew nuts are the kernels which have value as confectionery nuts. Cashew Nut Shell Liquid (CNSL) is an important industrial raw material for resin manufacture and the shells can be burned to provide heat for the decorticating operation. The main commercial product of the cashew tree is the nut. In the main producing areas of East Africa and India, 95 per cent or more of the apple crop is not eaten, as the taste is not popular.

6.1 RAW CASHEW PROCESSING

The growing demand for kernels in the international market and the availability of cheap possessing labour (mainly of women), the required skills in processing are the important favourable factors for the rapid growth of cashew processing industry in India. Cashew processing industry in India flourished primarily because of the international market.

Cashew industries have a simple organisational structure and mostly under private management i.e. Proprietorship (63 per cent) or partnership (19 per cent). Since it requires a large amount of initial investment and running capital, most of the industries depend on commercial banks and state financial agencies for running capital.

About 62 per cent of the industries are categorised under "Manufacturer-cum-Exporter". This is primarily due to the encouraging export policy and low per capita consumption in India.
During off-season, in order to run the factory throughout the year, 50 per cent of the total factories import raw nut. The availability of raw nut in India is from March to June only. Inadequate supply of raw nuts and fluctuating price make the processors heavily dependent on the raw nut import from Brazil, West and East Africa and Ivory Coast.

Tiny processing units (up to 100 tons/year) and medium capacity processing industries (100-500 tons/year) account to 39 per cent and 42 per cent respectively. This is mainly due to raw nut shortage and financial constraints. Utilization capacity of most of the industries is below 50 per cent.

**Table 6.1 Indian cashew processing industry during 2000**

<table>
<thead>
<tr>
<th>States</th>
<th>Organised</th>
<th>Unorganized</th>
<th>Total</th>
<th>Capacity ('000 tons)</th>
<th>Processing Consumption ('000 tons)</th>
<th>Labour force ('000 no)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerala</td>
<td>375</td>
<td>23</td>
<td>398</td>
<td>500</td>
<td>193</td>
<td>210</td>
</tr>
<tr>
<td>Karnataka</td>
<td>164</td>
<td>8</td>
<td>172</td>
<td>60</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Goa</td>
<td>25</td>
<td>32</td>
<td>57</td>
<td>20</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>-</td>
<td>49</td>
<td>49</td>
<td>20</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>217</td>
<td>24</td>
<td>241</td>
<td>320</td>
<td>150</td>
<td>130</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>38</td>
<td>65</td>
<td>103</td>
<td>50</td>
<td>28</td>
<td>25</td>
</tr>
<tr>
<td>Orissa</td>
<td>-</td>
<td>33</td>
<td>33</td>
<td>20</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>West Bengal</td>
<td>-</td>
<td>45</td>
<td>45</td>
<td>10</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>819</td>
<td>279</td>
<td>1,098</td>
<td>1000</td>
<td>430</td>
<td>403</td>
</tr>
<tr>
<td>Through imports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>220</td>
</tr>
</tbody>
</table>

Source: CEPC, Cochin

It is significant that while the world over the industry has converted to mechanical conversion of raw cashews into cashew kernels, India has progressed with manual conversion. The advantages of manual conversion apart from lower cost are also better productivity. About 90-95 per cent of women force is employed in these industries at different stages of processing. The total strength varies in range of 50-400. Men labourers are mostly involved in drying, stacking, roasting, kernel drying and packaging. About 80 per cent of the total women workers are involved in shelling and peeling itself. Since,
both the processes are highly laborious, the wages are fixed by the government at different stages of operation and strictly followed. The labour cost, however, differs from state to state.

Nearly 1,100 processing units are at present in existence demanding a million tons of raw nuts (Table 6.1). The indigenous sources are able to cater to near about half a million ton only. Import continues to the tune of 0.2 million tones. Thus, only 60 per cent of processing capacity is at present getting utilized and 40 per cent of the existing capacity still remains unused. Indian production has reached 0.45 to 0.5 million tones with in a course of 4 decades only and the average growth in production has been near about 8-10 per cent per annum, whereas industrial growth during 20 years has been at the rate of 25 per cent per annum. The geometric growth of industries is not in any way commensurate with the production increase taking place in the country, with the result only the organized sector making use of imports alone are able to process nearly 0.5 million tones both for export and local consumption, while 30 per cent units under unorganized sector consuming nearly 0.1 million tones are unable to meet total use of the processing capacity. Heavier dependence on imports by organized sector is due to the growth of more and more small scale units under unorganized sector which are able to grab more of the local production within their vicinity itself. The organized sectors are mostly concentrated in Kerala, Karnataka and Tamil Nadu which have larger capacity for processing and large number of labourers engaged. On an average, not more than two third of and year these organized sectors, are able to function and in order to keep ht labour force engaged they are resorting to imports as well. The growth of the industry particularly the unorganized sector as small scale units concentrated in the region of production in one way; limit the availability of raw nuts for organized sector to take part in a substantial manner in exports. These units mainly cater to the internal market. In the earlier days cashew was processed only for export but now a days the situation has changed that the Indian consumption also has increased tremendously.

**Production technologies**

There are 4 types of production technologies now prevalent in India. They are:
1. Sun roasting: This was one of the earliest forms of roasting and is a home scale process. This practice is now prevalent in the South Arcot district of Tamil Nadu at a place called Panruti.

2. Drum roasting: It had been a custom prior to organised processing that cashew nuts were tossed into fire and the kernel was extracted after the outer shell burnt. A later evolution was the 'pan roasting' where a perforated metal container was placed with raw cashews over a fire and the burnt cashews were broken open. This worked into the drum roasting and modified drum roasting.

3. Oil bath roasting: oil bath roasting was an innovation in the late 30s and 40s when demand for CNSL grew. CNSL was required as friction material for brake and clutch lining was a strategic raw material during the second world war. This method found preference among major manufacturers in the world.

4. Steam process: the steam process was an innovation of the 80s. This process involves roasting by direct application of steam to dry nuts.

The next process is shelling which is done in 2 ways: by hand and by treadle operated partly manual and partly mechanical process called machine shelling. The next process, i.e., hot chamber involves transfer of heat to remove the moisture in shelled kernels. This is done both by convection as well as by introduction of hot air. Peeling offers considerable potential for introduction of technology. It is for removing the skin or testa. It is done by hand or by means of a palette. Grading is a visual process as it separates the grade of kernels by its size, colour and other characters. It is entirely done by manual labour. Packing requires removal of air from the container and introduction of an inert gas.

The standard specification for Indian cashew kernel is prescribed under the Export (Quality Control and Inspection) Act, 1963. The processors involved in export of kernels only follow the specification very strictly. A high degree of cleanliness is maintained in the grading section. The kernels are sorted out into wholes, splits, broken etc and the wholes are graded into different sizes on the basis of the number of wholes per pound, according to the specification. All the operations are done manually.
Overview of Cashew Nut Processing

Cleaning

Soaking in Water

Roasting

- Open pan Roasting
- Drum Roasting
- Hot Oil Roasting

Use ashes or gloves

Shelling

- Manual
- Mechanical

Expeller CSNL Extraction

Pre-grading

Drying

- Open Sun Drying
- Solar/furnace Drying
- High Volume Furnace Drier

Peeling

Grading

Packaging
6.1.1 Drum Roasting as Preliminary Process at Palasa in AP

Andhra Pradesh is emerging as an important cashew growing state in the country. Cashew is mainly grown in the coastal Andhra districts such as Vishakapatnam, East and West Godavari, which together account for 70 per cent of the area under cashew in the state. Cashew in Andhra Pradesh is grown on both forest and private lands. Forest land constitutes about one-third of the area during the mid 1980s and much of the expansion in the subsequent years seems to have taken place on private lands.

6.1.1.1 Cashew cultivation

Unlike the other cashew growing areas in the country, the growers in the Godavari districts are more price responsive. When the nuts price started to climb, the farmers rapidly brought new land into cultivation and shifted these to other crops when prices started declining. Cashew’s longer gestation period does not seem to deter such shifts. This could be due to the maximising drive of the enterprising migrant coastal Andhra farmer.

Table 6.1.1.1 Area under cashew cultivation in Andhra Pradesh (hectares)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Districts</th>
<th>1985-86</th>
<th>2000-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Srikakulam</td>
<td>9,295</td>
<td>18,571</td>
</tr>
<tr>
<td>2</td>
<td>Vijayanagaram</td>
<td>9,268</td>
<td>8,266</td>
</tr>
<tr>
<td>3</td>
<td>Vishakapatnam</td>
<td>8,352</td>
<td>29,540</td>
</tr>
<tr>
<td>4</td>
<td>East Godavari</td>
<td>12,169</td>
<td>33,583</td>
</tr>
<tr>
<td>5</td>
<td>West Godavari</td>
<td>18,906</td>
<td>42,702</td>
</tr>
<tr>
<td>6</td>
<td>Krishna</td>
<td>1,059</td>
<td>824</td>
</tr>
<tr>
<td>7</td>
<td>Guntur</td>
<td>528</td>
<td>97</td>
</tr>
<tr>
<td>8</td>
<td>Prakasam</td>
<td>2,792</td>
<td>761</td>
</tr>
<tr>
<td>9</td>
<td>Nellore</td>
<td>6,696</td>
<td>743</td>
</tr>
<tr>
<td>10</td>
<td>Cuddappa</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>Chittoor</td>
<td>6,016</td>
<td>126</td>
</tr>
<tr>
<td>12</td>
<td>Telengana Districts</td>
<td>3,053</td>
<td>10,041</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>71,815</strong></td>
<td><strong>145,315</strong></td>
</tr>
</tbody>
</table>

Source: Season and Crop Reports, various years, Government of Andhra Pradesh
Cashew is grown in the dry lands of the Godavari districts along with other dry crops (Table 6.1.1.1). One striking aspect of cashew cultivation in these districts is that the cultivation practices are rather intense. The crop is not left in the wild as is done in many other states. The land is ploughed at regular intervals, plants are fertilised, pesticide is sprayed as and when required and drip irrigation is installed in many farms. Another important characteristic of cashew cultivation in these districts is that it is not grown as a mono crop. It is part of a portfolio of many cash crops like oil palm, horticultural crops like mango, lemon etc.

These intensive cultivation practices ensure high yields. Most of the new plantations in the private sector are of high yielding hybrid varieties which start yielding more quickly than ‘traditional’ varieties. On an average, plantations in East and West Godavari districts have 50-60 trees. The annual yield from a one-hectare plot is about 20-25 bags of raw cashew (each bag weighing 80 kgs). Hired labour is engaged along with family labour to harvest nuts. Dried raw nuts are stored and sold when the prices are good.

6.1.1.2 Marketing of raw cashew nut
Traders from the nearby towns procure the raw nuts from the cultivators. They in turn sell the nuts to traders, processors or agents from Kerala. The presence of Kerala traders and processors is ubiquitous in Andhra Pradesh. Some small traders have a wide clientele of agricultural labourers who bring in small quantities of nuts (very often not exceeding a couple of kilograms), generally gathered by the labourers from the ground after the harvest is over. These nuts are of poor quality and receive low prices, but even then can represent a significant income for the agricultural labour households.

6.1.1.3 Cashew processing
There are 103 processing units in Andhra Pradesh accounting for 9.38 per cent of total cashew processing industries in India. Majority of the processing units are in Palasa region. About 66 per cent of cashew industries in Palasa region have a capacity utilisation between 0.64-1.44 tons per day. The average kernel percent recovery is calculated as 26 per cent at Palasa.
The first cashew processing unit was started at Mori of Rajahmundry in the 18th century. Afterwards, cashew units came up in Palasa and Vetapalem in the beginning of the 19th century. There was a rapid growth in Palasa region due to the easy availability of raw nuts from adjoining districts and the neighbouring states.

Despite the phenomenal expansion of cashew cultivation in the state, processing has not expanded at the same rate. The state’s annual output should be in the region of 150,000 tones of raw nuts. Only a tiny fraction of this seems to be processed in the state. Processing is reported only in two places: Palasa in Srikakulam district and Morie in East Godavari district. While Palasa has a few small scale processing units, units in Morie are cottage or household enterprises operated by about 200 cashew-processing families. As elsewhere, women predominate in the work force in shelling, peeling and sorting activities. Men usually act as transporters as the nuts have to be moved around for various sub-processes. Thus, processing in Morie is a scaled down version of the cluster-like activities in Panruti in Tamil Nadu. One crucial difference between these two regions is that apart from the scale of activity, the Panruti processors are closely linked to the export houses whereas Morie caters to the domestic market. Also while Panruti processors source raw material from elsewhere in addition to what is grown in their area, Morie processors process only a fraction of what is grown in their area.

The cashew sector in Andhra is interesting in that despite enormous expansion in area under cultivation and production of raw nuts, further value-addition activities have yet to gain momentum. The small processing capacity compared to the level of raw nut production indicates the huge latent employment potential that remains untapped in this state. It seems the main beneficiaries of such a huge raw nut production are the Kerala processors.

<table>
<thead>
<tr>
<th>Table 6.1.1.2 Details of cashew processing industries in Andhra Pradesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cashew factories in the State (registered)</td>
</tr>
<tr>
<td>Installed capacity of cashew factories</td>
</tr>
<tr>
<td>Utilised capacity</td>
</tr>
<tr>
<td>Total number of cashew workers</td>
</tr>
</tbody>
</table>
6. 1.1.4 Cashew industries at Palasa
At present, 68 processing units are functioning at Palasa, locally called 'Bhatti'. There are 73 management units that share the processing facilities that are mainly drum roasting and kernel drying with existing units. Nearly all the units here come in the category of tiny units based on total capital involved and power requirement. It has been estimated that all these units have an estimated capacity of 32,000 tons per annum, with a potential to generate employment for 4,350 persons. However, 78 per cent of total units are not functioning throughout the year due to insufficient financial support and less demand of cashew kernels in the domestic market from the region. Palasa Cashew Exporters Private Limited has started exporting cashew kernels from this region from 1983. At present, every year, cashew kernels worth around Rs 3.0-3.5 million are being exported. The region was declared as pollution affected area due to emission of smoke during drum roasting. Due to this, establishment of new cashew industries in this region has been discouraged. The government announced a subsidy of 20 per cent for infrastructure development to begin processing industry at the outskirts of Palasa.

6. 1.1.5 Procurement of raw nuts
Raw nuts are generally bought through commission agents from Mangalore, Rajahmundry and Orissa between March and May. East Godavari district provides 33 per cent of the total requirement of raw nuts. Floating and cutting tests are conducted for checking the quality of nuts in winter and summer respectively.

Different tests for raw nut procurement and pricing are:

**Visual test:** Size and colour of the nuts are tested for checking maturity.

**Floating test:** Some samples of about 5 kg are put into a vessel that contains water. Floaters are collected after stirring continuously and counted. The raw nut price is fixed on the basis of the percentage of floaters.

**Cutting test:** After gathering supplied nuts (5 kg) from different bags, they are mixed. Raw nuts of 1 kg are taken from the random sample cut open with the hand cutter. Good kernels are collected, based on the colour, wrinkles and rejects.
6.1.6 Drying and storage

Raw nuts are stored in gunny bags with 80 kg capacity in a warehouse. At the farm level, 'Gadher' structure is used for storing nuts. It is a bamboo bin that is coated with cowdung, cylindrical in shape and has a height of five feet with a diameter of 3 feet. This structure can be used for increasing the storage life of nuts from 8-10 months. Processors feel that nuts from hilly area can be stored for up to 2 years without spoilage in warehouse whereas nuts from the coastal areas can be stored for just 4-5 months.

In nut drying, about 8-10 per cent (dry basis) moisture content is lost in the process.

6.1.7 Drum roasting

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

6.1.8 Shelling

There are three ways of shelling. Mallet hitting through semi-automatic hand cum pedal operated cutter and semi-automatic single operation unit. Mallet/stone is required for shelling drum-roasted nuts.

Skilled women labourers are involved in the shelling section. Roasted nuts are tapped gently in the shelling section 2-3 times manually with the use of wooden mallets, and this impact force helps the nut to crack and the kernel is separated. The shelling percentage normally ranges from 26 to 30. The average shelling capacity is between 10-12 kg/labour/day and 92-95 per cent of wholes are recovered. Roasted nuts are mixed with ash so that skin damage against CNSL can be avoided. The out turn of wholes is taken into consideration for wage calculation.
6.1.9 Kernel drying
There are three different forms of kernel dryers that are used in general. They are:

Conventional 8 feet borma dryer built with brick and mud. The kernels are spread on wire mesh tray and subjected to hot air by putting in a chamber above the furnace.

Tunnel dryer, in which hot air produced outside is passed into the drying chamber by using tunnels. Heat utilisation efficiency is more.

Electrical borma dryers, in which both hot air temperature and flow rate are controlled automatically by thermostatic mechanism. Just 4 hours are required for drying 400 kg of kernels. It has 120 trays in 4 trolleys with holding capacity of 4 kg. Kernels are subjected to 70°C. Uniform drying and minimum supervision are the main advantages of this system.

In drum roasting method, generally the conventional system called Borma, which is built with brick and mud is used for kernel drying. The hot chamber capacity has been estimated at 450 kg kernels. Four bags of burnt shells are used as fuel. Drying is done for 10-12 hours and skilled male workers are engaged for the purpose. Tray positions are changed at regular intervals for facilitation of uniform drying. It has been estimated that 8-9 per cent (dry basis) drying takes place in this process.

6.1.10 Peeling
Peeling of dried kernels is done manually by using fingernails. The operational capacity ranges from 7-8 kg/head/day. There are two methods of wage system that are currently being followed, input and output basis. Under the input basis, only the wholes quantity is taken into consideration after peeling for wages. On an average, 70 per cent of wholes are recovered by this method. Preliminary grading of 7-10 grade is completed in this section. Those to be rejected are separated in the peeling section and graded as black baby bits, completely spoiled, white reject and difficult to peel.

6.1.11 Grading and packing
Graders segregate a total of 14 grades. Broken kernels are separated by manual sifting, based on their size. Material handling is done by using bamboo baskets due to the
lightweight and cheaper cost. Cleaned oil tins are used for filling cashew kernels after washing thoroughly. The inner side of tin is covered with polythene sheet for preventing spoilage. Flexible packaging is used to a limited extent, based on market demand.

6.1.12 Capital investment
In a cashew nut processing unit, the highest amount is invested on buildings (64.94 per cent), followed by machinery, equipment, (22.08 per cent) and land at an overall level. The big capital investment is due to provision of workplace for processing units, as it is labour intensive. (Table 6.1.1.3)

6.1.13 Processing cost
The overall cost of processing has been estimated at Rs 3,845 per ton of raw nut. As processing is a labour-intensive process, workers' wages are the main component in the total cost of processing comprising of 59.52 per cent. The proportion of interest rates is at 11.70 per cent. The cost of tins has been worked out at 13.56 per cent due to kernel packaging in tin containers as insisted upon by buyers. The expenses incurred on other items are the least.

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

Based on the data obtained from the survey of cashew nut industry at Palasa, Andhra Pradesh (Drum roasting- preliminary process), the profit analysis has been worked out as below:

Table 6.1.1.3 Investment pattern of the processing units

<table>
<thead>
<tr>
<th>Items</th>
<th>Amount (Rs)</th>
<th>% to total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>50,000</td>
<td>12.98</td>
</tr>
<tr>
<td>Building</td>
<td>250,000</td>
<td>64.94</td>
</tr>
<tr>
<td>Machinery and equipments</td>
<td>85,000</td>
<td>22.08</td>
</tr>
<tr>
<td>Total</td>
<td>385,000</td>
<td>100.00</td>
</tr>
</tbody>
</table>

192
Table 6.1.1.4 Cost of processing 36 tons/month

<table>
<thead>
<tr>
<th>Items of cost</th>
<th>Amount (Rs)</th>
<th>% to total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilities (Power, water &amp; fuel)</td>
<td>3,075</td>
<td>2.22</td>
</tr>
<tr>
<td>Packaging materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of tin</td>
<td>18,766</td>
<td>13.56</td>
</tr>
<tr>
<td>Cost of sealing</td>
<td>2,474</td>
<td>1.79</td>
</tr>
<tr>
<td>Wages</td>
<td>82,375</td>
<td>59.51</td>
</tr>
<tr>
<td>Salaries</td>
<td>1,500</td>
<td>1.08</td>
</tr>
<tr>
<td>Overheads</td>
<td>9,250</td>
<td>6.68</td>
</tr>
<tr>
<td>Interest on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working capital 18%</td>
<td>16,200</td>
<td>11.70</td>
</tr>
<tr>
<td>Fixed capital 10%</td>
<td>3,208</td>
<td>2.32</td>
</tr>
<tr>
<td>Depreciation on building &amp; machinery</td>
<td>1,579</td>
<td>1.14</td>
</tr>
<tr>
<td>Total</td>
<td>138,427</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 6.1.1.5 Out turn of kernels and sales realisation

<table>
<thead>
<tr>
<th>Total quantity of raw nut processed</th>
<th>36 tons/month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount (Rs)</td>
</tr>
<tr>
<td>Out turn of kernels and by products</td>
<td></td>
</tr>
<tr>
<td>Cashew kernel</td>
<td>1,620,335</td>
</tr>
<tr>
<td>Shells</td>
<td>31,500</td>
</tr>
<tr>
<td>Testa</td>
<td>3,960</td>
</tr>
<tr>
<td>Moisture loss</td>
<td></td>
</tr>
<tr>
<td>Rejects</td>
<td></td>
</tr>
<tr>
<td>Sales realisation</td>
<td></td>
</tr>
<tr>
<td>Cashew kernel</td>
<td>1,620,335</td>
</tr>
<tr>
<td>Shells</td>
<td>31,500</td>
</tr>
<tr>
<td>Testa</td>
<td>3,960</td>
</tr>
</tbody>
</table>

Table 6.1.1.6 Cost benefit analysis

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Cost (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>1,080,000 (88.64%)</td>
</tr>
<tr>
<td>Cost of processing</td>
<td>138,427 (11.36%)</td>
</tr>
<tr>
<td>Total cost of production</td>
<td>1,218,427</td>
</tr>
<tr>
<td>Total sales realisation</td>
<td>1,655,795</td>
</tr>
<tr>
<td>Profit</td>
<td>437,368</td>
</tr>
<tr>
<td>Cost Benefit ratio</td>
<td>1:1.36</td>
</tr>
</tbody>
</table>
Table 6.1.1.7 Proportion of different grades of cashew kernel at packing

<table>
<thead>
<tr>
<th>Grades</th>
<th>Quantity (kg)</th>
<th>Proportion (%)</th>
<th>Rate (Rs)</th>
<th>Total amount (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WW 210/230</td>
<td>5.4</td>
<td>1.42</td>
<td>230</td>
<td>1,242.0</td>
</tr>
<tr>
<td>WW240</td>
<td>26.3</td>
<td>6.90</td>
<td>210</td>
<td>5,523.0</td>
</tr>
<tr>
<td>WW285</td>
<td>102.3</td>
<td>26.85</td>
<td>197</td>
<td>20,153.0</td>
</tr>
<tr>
<td>WW320/340</td>
<td>49.4</td>
<td>12.96</td>
<td>187</td>
<td>9,237.8</td>
</tr>
<tr>
<td>Desert wholes</td>
<td>7.8</td>
<td>2.05</td>
<td>100</td>
<td>780.0</td>
</tr>
<tr>
<td>Splits</td>
<td>56.4</td>
<td>14.80</td>
<td>183</td>
<td>10,687.0</td>
</tr>
<tr>
<td>Butts</td>
<td>11.6</td>
<td>3.04</td>
<td>172</td>
<td>2,490.6</td>
</tr>
<tr>
<td>Butts mixed</td>
<td>26.7</td>
<td>7.01</td>
<td>162</td>
<td>4,325.4</td>
</tr>
<tr>
<td>3/4th split</td>
<td>57.1</td>
<td>14.98</td>
<td>155</td>
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</tr>
<tr>
<td>1/3rd split</td>
<td>13.0</td>
<td>3.41</td>
<td>120</td>
<td>1,560.0</td>
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<tr>
<td>1/8th split</td>
<td>6.0</td>
<td>1.57</td>
<td>90</td>
<td>540.0</td>
</tr>
<tr>
<td>Difficult to peel</td>
<td>5.86</td>
<td>1.54</td>
<td>20</td>
<td>117.2</td>
</tr>
<tr>
<td>Scrap</td>
<td>6.8</td>
<td>1.78</td>
<td>20</td>
<td>136.0</td>
</tr>
<tr>
<td>Spoiled</td>
<td>6.4</td>
<td>1.68</td>
<td>5</td>
<td>32.0</td>
</tr>
</tbody>
</table>

Table 6.1.1.8 Assumptions

- Raw nut processed per month @ 1.44 tons/day: 36 tons
- Shelling percentage @ 24 kg kernel / 80 kg raw nut: 30% out turn
- Moisture loss in kernel drying: 9% dry basis
- Cost of machineries i.e., Roaster, borma drier, weighing balance and miscellaneous: Rs 85,000
- Capital Investment (land and building): Rs 300,000

Table 6.1.1.9 Expenditure (Rs)

1. Processing cost
   - Drying raw nuts @ Rs 4.5 per bag: 2,025
   - Roasting charges @ Rs 7.35 per bag: 3,308
   - Fuel charges for roasting @ Rs 2.5 per bag: 1,125
   - Shelling @ Rs 3.5 per bag: 33,814
   - Kernel drying operator wages @ Rs 19.15 per 10 bags: 862
   - Fuel charges for borma @ Rs 60 per 18 bags: 1,500
   - Peeling @ Rs 4.25 per kg and Rs 2.00 for wholes and broken respectively: 29,766
   - Grader charges @ Rs 140 / head / day: 12,600

2. Packaging cost (Rs)
   - Tin cost @ Rs 22 per tin: 18,766
   - Sealing charges with material @ Rs 2.90 per tin: 2,474
   - Carton box and wrapping belt @ Rs 11 per box: At the cost of buyer
   - Total processing and packaging cost: 106,240
Table 6.1.1.10 Income (Rs)

<table>
<thead>
<tr>
<th>Item</th>
<th>Rs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale of cashew kernels</td>
<td>1,620,335</td>
</tr>
<tr>
<td>Cashew shell (25,200 kg @ Rs 1.25/kg)</td>
<td>31,500</td>
</tr>
<tr>
<td>Testa (495 kg @ Rs 8/kg)</td>
<td>3,960</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,655,795</strong></td>
</tr>
</tbody>
</table>

Table 6.1.1.11 Cost benefit analysis

<table>
<thead>
<tr>
<th>Fixed cost (Rs)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material</td>
<td>1,080,000</td>
</tr>
<tr>
<td>Depreciation of machines (10%) and building (20%)</td>
<td>1,579</td>
</tr>
<tr>
<td>Interest on capital @ 10%</td>
<td>3,208</td>
</tr>
<tr>
<td>Salary to staff</td>
<td>1,500</td>
</tr>
<tr>
<td>Interest on running capital (18%)</td>
<td>16,200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,102,487</strong></td>
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</tbody>
</table>

Operating Coast (Rs)

<table>
<thead>
<tr>
<th>Item</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing cost</td>
<td>106,240</td>
</tr>
<tr>
<td>Maintenance cost</td>
<td>4,250</td>
</tr>
<tr>
<td>Electrical charges</td>
<td>450</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>115,940</strong></td>
</tr>
<tr>
<td>Total expenditure</td>
<td>1,218,427</td>
</tr>
<tr>
<td><strong>Profit</strong></td>
<td>437,368</td>
</tr>
</tbody>
</table>

**Profit Percentage**

| Profit Percentage | 35.90 |

**Cost benefit ratio**

| Cost benefit ratio | 01:01.36 |

The tables from 6.1.1.3 to 6.1.1.11 shows the different types of cost and income involved in the cashew processing following drum roasting as a preliminary method which is mainly followed at Palasa of Andhra Pradesh. 60 per cent of the processing cost is wages as cashew processing is labour intensive. One kg of raw cashew nut yields 25-27 kg of cashew kernel. 89 per cent of total processing cost is raw material cost. Cost benefit ratio of raw cashew processing using drum roasting system is 1:1.36.
6.1.2 Oil Bath Roasting as Preliminary Process at Kerala

Kerala plays an important role in the Indian cashew sector. Kerala was the foremost state in the country for almost all aspects of domestic production such as area under cultivation, productivity and production of raw nuts. But in the last decade, the state has lagged behind in almost every aspect of cashew production.

6.1.2.1 Reasons for Kerala’s diminishing importance

The relative decline of the state’s primacy in cashew production can be attributed to two factors: (1) the dismal performance of the state itself; (2) the spectacular expansion of cashew cultivation in other parts of the country.

Despite most processing factories being located in South Kerala, most of the cashew is grown in the northern districts, especially Kannur and Kasaragod, where the biophysical conditions are particularly suitable. North Kerala is known for high productivity (590 kg per acre) and quality of the nuts it produces. Yet, despite favourable biophysical conditions, Kerala farmers have not engaged in intensive cultivation practices although the reasons for this are unclear. Many farmers, especially in the southern districts, have switched from growing cashew to other more lucrative crops such as rubber. Thus, the relatively low value of cashew has been an important reason for its decline in Kerala. An expansion of the area under cashew cultivation is difficult to achieve because only little waste land is available and because on better soils, cultivators tend to grow more remunerative crops than cashew. In southern districts, there is little land exclusively under cashew except for plantations owned by public sector corporations. Instead, cashew trees tend to be grown in mixed cropping plots as a part of farmers’ diversification strategies.

Other reasons for the decline of cashew cultivation in the state include the pronounced seasonality of the cashew production cycle, high sensitivity of yield to weather conditions, unattractive prices, land ceiling for cashew plantations (which existed until recently), senility of the trees, and the non-agricultural orientation of landowners.
Kerala farmers/households choose to shift out of cashew cultivation altogether despite the fact that unlike other crops, cashew is a high-value crop and both international and domestic markets have been expanding. Viewing cultivation as one node in the cashew chain immediately raises the possibility that the way the chain is constituted does not really give the Kerala cultivator/household sufficient incentives to concentrate on cashew cultivation, and there is little support for cultivators of cashew to ‘upgrade’ their activities.

6.1.2.2 Processing in Kerala
Kerala has the largest processing capacity in India, almost 50 per cent of a capacity of one million metric tones of raw nuts in 2000, followed by Tamil Nadu. It also exports the highest share of the country's cashew kernels.

Progress in this industry in the 1990s was against a backdrop of India’s growing liberal environment, both in terms of trade liberalisation and industrial delicensing coupled with a fairly steady growth in the production and exports of cashew kernels (after a sharp downturn between 1977-88). However, such an environment appears to have legitimised greater ‘informalisation’ of production and work arrangements in the processing sector in Kerala.

Kerala was among the first regions in the country after South Kanara district in Karnataka where cashew-processing units emerged. In the 1930s, the industry became concentrated in Quilon (now Kollam) in the former princely state of Travancore. Though initially foreign companies like Pierce Leslie and General Foods had given impetus to the export trade, very soon it came to be dominated by indigenous entrepreneurs with a few families. Most of the cashew firms were organised as proprietary concerns and to some extent as partnerships, an arrangement which continues even today; recent data shows that almost three-quarters of the private cashew firms are proprietorships and the rest partnerships.
Processing industries are also located at Trivandrum, Alleppey, Pathanamthitta and Thrissur districts. Many factories have moved to Tamil Nadu's Kanyakumari district due to problems such as labour, legislation and wage rates. Of the total number of industries, just 25 per cent are capable of running the factory all through the year, and their utilised capacity is in the range of 1,000-5,000 tons per annum. The Government of Kerala fixes the wages for labourers who work in different sections of industries. The workers also get a minimum bonus of 8.33 per cent as a motivating factor.

Table 6.1.2.1 Details of cashew processing industries in Kerala

<table>
<thead>
<tr>
<th>Number of cashew factories in the State (registered)</th>
<th>398</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed capacity of cashew factories</td>
<td>500,000 tons/day</td>
</tr>
<tr>
<td>Utilised capacity</td>
<td>193,000 tons/day</td>
</tr>
<tr>
<td>Total number of cashew workers</td>
<td>210000</td>
</tr>
<tr>
<td>Total quantity of raw cashewnuts required to provide full employment to the cashew workers</td>
<td>1,782,300 tons</td>
</tr>
</tbody>
</table>

6.1.2.3 State intervention

The poor earnings and inhuman working conditions in Kollam's cashew factories led to the emergence of trade union movements. The first union came into being as early as 1939, and subsequently, unions affiliated to different political parties, in particular the left-wing parties, gained considerable strength. However, the rise in trade unionism has not meant that labour issues are tackled from a gender perspective. Issues such as differences between male and female wages have not been given much attention despite the fact that women workers believe that they belong to the working class and also get involved in collective action.

State intervention has been very intense in the cashew processing sector in Kerala, largely in response to pressures from trade unions. Initially, the State intervened to enact protective legislation for workers and grant them minimum labour rights given the deplorable conditions in which they worked. In 1945, the government declared cashew workplaces as 'factories' even though they did not use power. This declaration gave employers considerable obligations including adhering to stipulated working hours and paying unemployment compensation, maternity benefit and employees' state insurance,
etc., especially if the factories were categorised as 'perennial' factories. Despite stiff resistance from factory owners, in 1956 the government declared cashew factories to be 'perennial'. Just prior to this, the industry was also brought under the purview of the Minimum Wages Act. Needless to say, the implementation of this legislation in the cashew industry threatened its cheap labour base; factory owners took a number of steps to evade implementation of the legislation: 'Sasonalising' employment by closing factories on a cyclical basis. Factories were declared as closed (on some pretext), but workers offered work on an informal basis in the factories on a "cottage processing" basis, that is, at half the minimum wage rates with no other benefits. Employing more and more workers for shorter periods, Underweighing employees' output, Under-registering the 'regular' workers, Falsely recording number of days worked, Resorting to 'cottage processing'

These steps resulted in rendering the workers, women workers in particular, as 'casual' workers and hence ineligible for most or all of the statutory benefits. These practices eroded workers' earnings considerably. Firstly, actual wages paid were less than the minimum wage, sometimes by up to 40 per cent, and secondly, there was a sharp reduction in the number of days worked in a year from almost year-round employment until the early 1950s to about 100 days a year by the early 1970s.

When the factories closing down one by one, the Government responded by banning cottage processing in 1967. So, factory owners shifted the cottage processing to the neighbouring state of Tamil Nadu. By 1967, twelve units had been set up in Tamil Nadu and by 1972 there were 107 factories, primarily located in Kuzhithurai (in the district of Kanyakumari).

However, a recent decline in the frequency of appointing minimum wage committees and the toning down of recommendations for fear of reprisal from the factory owners suggests a certain backtracking by the State from its earlier stronger stance. Since 1956, there has been steady erosion in subsequent governments' commitment to labour welfare and labour rights in the industry.
6.1.2.4 The entry of the public sector

In 1969, the Left Front government in Kerala set up the Kerala State Cashew Development Corporation (KSCDC). This was an attempt to make a political statement and also adopt a pro-labour stance. The operations of KSCDC initially spanned a wide spectrum of activities from channelling imported raw nuts through the Cashew Corporation of India (CCI) to distributing these nuts and subsequently to taking over and running the closed privately-owned cashew factories. KSCDC was able to distribute the imported nuts more equitably among the processors (distribution was no longer controlled by the largest processors), market the kernels, and most importantly, pay statutorily fixed wages and benefits to the workers employed in its factories. In a further attempt to increase raw nut availability for the factories in Kerala, the Government restricted inter-district movement of domestic raw nuts in 1975 culminating in the Monopoly Procurement Scheme of domestic nuts in 1977.

The KSCDC opened one factory in 1971 and then started purchasing or leasing factories, and by 1975, it had 34 factories with 30,000 employees (accounting for about one-quarter of the estimated work force in this sector). The initial years were successful for the Corporation, and it showed reasonable profits for its first ten years of operation despite paying full benefits to their workers. However, this success story no longer prevails. KSCDC has been incurring losses in recent years, and since 2001, the KSCDC factories have been closed.

What contributed to KSCDC's downfall is still unclear. There have been a number of allegations of corruption and mismanagement. It has also been argued that its failure was political, triggered by a change from a Communist-led to a Congress-led government in the 1980s. The government's inability to provide continuous employment has emboldened the private sector to justify the 'seasonal' nature of the industry and hence their inability to pay statutorily fixed minimum wages and other benefits legally due to workers in the industry.
6.1.2.5 The private sector

The private cashew processing sector is dominated by a few family groups with large factories. In the early 1970s one-third of cashew firms employed almost 90 per cent of the workers; on an average, there were about 700 workers per factory. Today, the industry is still controlled by later generations of the former ‘cashew kings’.

There are two types of processing organisation within the private sector: the factory (organised) and the household/cottage (unorganised). Since the banning of any form of cottage processing in the latter half of the 1960s, the practice continues on a clandestine basis, while cottage type processing on sub-contracting has re-emerged in Aluva and Mattanchery (Ernakulam district) and in some places in Kollam.

Today, there are 4 types in the organisation of processing activities in the private sector:
1. Owner himself undertakes the processing using his license, but attempts to casualise the work force
2. Owner leases the license to a lessee, and the lessee carries out the processing activity
3. Owner enters into a contract with a commission agent
4. Lessee enters into a contract with a commission agent

The 3rd and 4th are recent developments known as commission varuppu. Commission agents enter into a contract with either the owner or the lessee to process a certain quantity of nuts for a certain amount of money; this is also called 'toll processing'. These agents may be foreign agents or Indian agents. While one of the foreign commission agents stressed the fact that the commission given to the factory owners does allow for the stipulated wages plus benefits to be paid to the workers, the unions argue that the only way for the owner/lessee to increase his profit under this system is to squeeze the workers. Commission varuppu further dilutes the obligations of factory owners to workers, according to union leaders.

Simultaneously, the search for cheap labour has resulted in new factories being set up (some by the existing large processors) in new but poor and backward areas such as parts...
of Kuttanad where agricultural employment for women has declined sharply in recent years. It is these practices rather than a shortage of nuts that are likely to be leading to the decline in the number of days of employment in cashew factories.

Overall, the number of factories has continued to grow, and the pace of growth picked up in the 1990s. However, the number of days of employment per worker has been shrinking: it reached a low of 42 days in 1986 and in the first half of 1990s the number of working days in Government-run factories was only 13 days.

6.1.2.6 Procurement of raw nuts

Raw nut procurement is done in four ways, i.e., direct purchase from producers, purchase from local market, direct purchase from trade agencies and through imports. Mostly raw nuts of indigenous origin are procured from local markets located at Anchal, Paracode, Thamarakulam, Kadaikan, Kallara, Milimanoor and Kadambanadu. However, 60-75 per cent of total requirement of raw nuts is derived from imports. Visual, floating and cutting tests are conducted for finding out the quality of nuts and fixing prices by the processors. There are some reasons for import of large quantities of raw nuts such as tax exemption (4 per cent purchase tax), reasonable price and availability all over the year.

6.1.2.7 Drying and storage process

As soon as the nuts are brought to the processing industries, they are dried on a semi-finished floor for bringing down the moisture level to 8-9 per cent (safer level of moisture). Workers turn it frequently at regular intervals for uniform drying. Dried nuts are packed in gunny bags of 80-kg capacity and stacked in warehouses. Pesticide is applied after three months of storage for preventing insect infestation.

6.1.2.8 Oil bath roasting

In Kerala most of the processors follow drum roasting as preliminary process. Oil bath roasting is being followed, although there are modern technologies and other benefits, as the units face financial difficulties. In oil bath roasting, nuts are soaked in water for three hours and stored in silos after draining the excess moisture for three days. Soaked raw
nuts are passed from the silo into the oil bath tank, just above the belt conveyor and permitted to immerse fully in hot CNSL, which is maintained at 390 degree Fahrenheit. The total length is approximately at 12 foot and the belt conveyor rotates at the speed of 35 rpm. When the nut travels from inlet to outlet, it gets cooked and 70 per cent of total CNSL that is available oozes out. The roasted nuts are passed on to the centrifuge for removing adhering oil and it is conveyed to the shelling section through the bucket elevator. In this process, 25 bags of cashew shell cake are required as fuel for 6 tons/day and 4 labourers are required for the process. The temperature of CNSL oil, rpm of conveyor inside the tank and feed rate depends on the size, origin and moisture of raw nuts.

6.1.2.9 Shelling
Mallet hitting is still done in oil bath roasted units. The shelling rate is slightly less when compared with semi-mechanised shelling. Finger gloves are given to labourers so that they can avoid CNSL effect on hands. Castor oil is used while scooping out the intact kernels from the shell.

A mechanical sheller has been developed at the Mechanical Engineering Research and Development Organisation (MERADO), Kalamassery, Kochi. This has been done to get over the problem of drudgery and health hazard in the traditional system of cashew shelling by placing the nut on a concrete block and reducing the hard shell with wooden mallets. The decorticator can be mounted on a worktable, and the worker, sitting at the front, can operate it with the least drudgery. It is expected that the decorticator can shell 20-25 kg of raw nuts per worker in an 8-hour shift. Depending upon the capacity of the processing unit, the required number of decorticators can be used.

6.1.2.10 Kernel dryer
In Quilon region, different types of borma dryer are used. One of them is the '8' Borma, which is of conventional type. In this, kernels are spread on wire mesh trays and kept over the hot furnace. Utmost care must be taken by shifting trays regularly and controlling the fire under the hot chamber in order to avoid scorching of kernels. In the
tunnel Borma, blowers that are operated electrically are used for passing hot air into the drying chamber through tunnels. In this, flow rate and temperature of hot air can be controlled to a certain extent.

In Calicut region, the shelled kernels are dried up by using tunnel driers. Hot air is let into the drying chamber at the opposite ends for uniform circulation. The chamber is constructed with brick and mortar and has a total capacity of 8 tons. Cashew kernels are held in trolleys with trays and about 140 degree Fahrenheit is maintained in the chamber. Two labourers take part in the operation on shift basis, and it takes 10-11 hours to complete the drying. Ten bags of shell cake are used as fuel in the furnace.

6.1.2.11 Peeling

Women labourers are fully engaged in the shelling, peeling and grading processes. In these labour intensive processes, peeling of testa is done by fingernails and sharpened wooden sticks are used for removing skin of hard to peel kernels regardless of the method used for roasting. In the peeling section, the recovery of wholes is rated at 80-90 per cent. On an average, 8-12 kg cashew kernels are peeled per day per person. Initial grading of kernels takes place at this stage. In the peeling section itself, about 7-10 grades are graded. Labour wages are set at government approved rates and fixed at Rs 3.22/kg for whole kernels just for peeling.

6.1.2.12 Grading and packaging

In this section, there is a high degree of cleanliness. Workers are given apron and hair net. The grading that is done is based on size, colour, broken (split, bits etc). Twenty-three grades are sorted out at the grading section. Six workers with grading capacity of 45 kg/day are engaged in this section. Aluminium tables are used for spreading kernels and for segregation. Vita packing system is practised in most of the industries and CO2 gas infusion is done for avoiding microbial spoilage during shipment. Packing is done in tin containers of 25 lb/11.34 kg. A lot of companies have a tester for testing leakage.
After getting ISO 9000 and introducing Hazard Analysis and Critical Control Points (HACCP), importing countries have been following stringent quality standards for cashew kernels. The current system of tin packaging is bulky, and it is not easy to dispose off these tin containers. The Moulded Vacuum Packaging (MVP) system produces consistent rectangular blocks ranging from 500gm to 25 kg. This brings about a large and obvious improvement in quality production with benefits of transport, handling, display, stock point, etc. This also assists in saving the total cost that is spent on secondary packaging to a significant extent. MVP is pesticide free, does not contain preservatives and does not need irradiation. The vacuum barrier bag and cardboard box can be fully recycled. There is minimum movement during transport and handling due to the rectangular shape of primary packs. Removal of air and the use of gas flush can bring down rancidity and bacterial growth.

In secondary packaging, the block is introduced into outer boxes that can be closed and sealed on a standard automatic machine. This unit is a unique design, the first of its kind in the world. It is light, neat, sturdy and easy for transport. This does not result in any damage to the product that it packs and requires power of just 220 V A/c.

6.1.2.13 CNSL extraction
CNSL extraction is done by using expeller. The capacity of the expeller has been estimated at 7 tons of cashew kernels per day; 35 per cent of residual oil available after oil bath extraction is separated. Crude oil bath extraction is subjected to a high temperature of 420 degree Fahrenheit in big containers for five minutes. Oil is refined by chemical methods. Four labourers (men) take part in the operation. Feeding cashew shell to the expeller unit is automated through bucket elevator and belt conveyors.

6.1.2.14 Organisations
a The Kerala State Cashew Workers Apex Industrial Co-operative Society Ltd (CAPEX): The society has the primary aim of organising the cashew industry in the state, providing assistance to procure raw nuts, making sufficient funds available for processing and marketing of kernels and other items produced in the factory. CAPEX has
established about 10 factories in the state. These factories have generated employment for 6,000 workers in the region. These units are situated in Alleppey, Quilon and Trivandrum. Every day, on an average of 80 bags of cashew are processed. All these factories operate only for about 100 days in a year. All the factories follow the drum roasting method. Raw cashew nuts are imported and distributed in the lean period. Of the total kernel production, 60 per cent is exported.

b Kerala State Development Corporation (KSDC): The Corporation, a government organisation, was registered in 1969. The organisation has 34 cashew factories under it. There are 27 in Quilon, 3 in Alleppey, 2 in Trivandrum, 1 each in Thrissur and Cannanore. The processing capacity varies from 45 to 140 bags per day. These factories have provided an employment opportunity for nearly 23,841 workers.

6.1.2.15 Processing cost (Oil bath roasting - preliminary process)
Based on the data obtained from the survey of cashew nut industry at Tellicherry, Kerala (Oil bath roasting- preliminary process), and the profit analysis has been worked out as below:

Table 6.1.2.2 Cashew kernels grades and its proportion in processing (Nigeria origin)

<table>
<thead>
<tr>
<th>Wholes</th>
<th>Proportion</th>
<th>Splits</th>
<th>Proportion</th>
<th>Bits &amp; Pieces</th>
<th>Proportion</th>
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</thead>
<tbody>
<tr>
<td>WW210</td>
<td>2.10</td>
<td>SW</td>
<td>2.2</td>
<td>Chuli</td>
<td>0.01</td>
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<tr>
<td>WW240</td>
<td>2.71</td>
<td>SSW</td>
<td>6.81</td>
<td>DW</td>
<td>Nil</td>
</tr>
<tr>
<td>WW320</td>
<td>37.07</td>
<td>Butts</td>
<td>0.4</td>
<td>BW</td>
<td>0.08</td>
</tr>
<tr>
<td>WW450</td>
<td>17.18</td>
<td>Splits</td>
<td>6.01</td>
<td>DBW</td>
<td>Nil</td>
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<tr>
<td></td>
<td></td>
<td>LWP</td>
<td>14.51</td>
<td>DSW</td>
<td>Nil</td>
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<tr>
<td></td>
<td></td>
<td>SB</td>
<td>0.05</td>
<td>OW</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SS</td>
<td>0.15</td>
<td>WII</td>
<td>0.77</td>
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<td></td>
<td>SP</td>
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<td>DP</td>
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<td></td>
<td>SWP</td>
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<td>PII (L)</td>
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<td>DSP</td>
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<td>PII(S)</td>
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</tr>
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<td></td>
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<td></td>
<td></td>
<td>WBB</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>59.06</td>
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<td>37.66</td>
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<td>3.19</td>
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</table>
Table 6.1.2.3 Assumptions

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Values in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelling</td>
<td>30</td>
</tr>
<tr>
<td>Drying (in tunnel drier)</td>
<td>5</td>
</tr>
<tr>
<td>Husk/peel</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 6.1.2.4 Total processing cost of one-kg cashew

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Rs/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying of nuts (unloading, spreading, heaping, loading and stacking in godown) @ Rs 10/bag</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Hot oil bath-6 tons/day capacity</strong></td>
<td></td>
</tr>
<tr>
<td>Labour wages @ Rs 45/day (4 person)</td>
<td>0.03</td>
</tr>
<tr>
<td>Fuel charges @ 25 bags (40 kg/bag)</td>
<td>0.25</td>
</tr>
<tr>
<td>Shelling roasted nuts @ Rs 2.8/kg wholes + 27.7 DA/day</td>
<td>1.39</td>
</tr>
<tr>
<td><strong>Kernel drying in tunnel drier</strong></td>
<td></td>
</tr>
<tr>
<td>Labour wages @ Rs 60/day (2 person)</td>
<td>0.02</td>
</tr>
<tr>
<td>Fuel charges @ 10 bags (40 kg/bag)</td>
<td>0.1</td>
</tr>
<tr>
<td>Peeling @ Rs 3.22/kg + Rs. 27.7 DA/day</td>
<td>1.39</td>
</tr>
<tr>
<td>Grading @ Rs 19.27/day + DA</td>
<td>0.24</td>
</tr>
<tr>
<td>Packing @ Rs 24.67/day + DA (7 persons)</td>
<td>0.05</td>
</tr>
<tr>
<td>Tin Container @ Rs 16/tin and soldering cap Rs 0.5/tin</td>
<td>1.47</td>
</tr>
<tr>
<td>Infusion of CO₂ @ 500/tins/day and Rs 24/kg for cylinder (9 kg capacity)</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Total processing cost</strong></td>
<td>5.27</td>
</tr>
<tr>
<td>Raw material cost</td>
<td>30.00</td>
</tr>
<tr>
<td><strong>Total Process cost for 1 kg raw cashew nut</strong></td>
<td>35.27</td>
</tr>
</tbody>
</table>

The tables from 6.1.2.2 to 6.1.2.4 shows the different types of cost and income involved in the cashew processing following oil bath roasting as a preliminary method which is mainly followed at Kerala. The cost of processing one kg of raw cashew nut is around Rs 35.27. Out of which raw material cost is Rs 30 followed by packaging Rs 1.47, peeling Rs 1.39, shelling Rs 1.39, fuel charges Rs 0.35, grading Rs 0.24 etc.
6.1.3 Cashew Processing Industry in Karnataka

The West Coast of Karnataka is an important cashew growing and processing centre. In fact, Mangalore town is the birthplace of large scale cashew processing, which dates back to colonial times. However, the industry started moving to Kollam in Kerala in the 1930s due to less stringent labour laws in Travancore State.

6.1.3.1 Cashew cultivation

In Karnataka, cashew is predominantly grown in the hilly terrain along the coast, on private, forest and common lands. Cashew plantations originally planted as a soil conservation measure and owned by the Forest Department, have been handed over to Cashew Development Corporation, which owns about 27,000 hectares. As in other states, the Corporation invites bids for usufruct rights at the beginning of every season (November-December). Lease rights are for nearly six months (up to June).

In much of Karnataka, lack of proper irrigation and the rocky soil has hindered the cultivation of crops other than cashew. Most of the area is planted with cashew, which is now more or less a mono crop.

Plantations have not been raised in a very systematic way. The main objective seems to be more of creating proof of land occupancy, which may result in receiving land title. Nuts collected from adjacent plantations are used as seeds. Trees are not sufficiently spaced, and people do not know the different varieties or their yield potential. Consequently, yields are very low, just a kilogram of nuts per tree on an average. There is no scope for irrigation. The plants are neither fertilised nor treated with pesticides.

6.1.3.2 Marketing of raw cashew nuts

Peddlers collect the nuts in small quantities directly from the villages. They sell these consignments (some 8-10 kilograms) to small traders in the town, who in turn sell them on to the bigger traders who then sell them to the processors, either through commission agents or directly.
Some farmers supply small quantities of raw nuts to the village grocer in exchange for essential goods. During the lean season, many cultivators get essentials on credit from the grocer against the future harvest.

Unlike peddlers, small traders differentiate the nuts by their quality and variety. Poor quality and all-African nuts are offered at a lower price. However, when small traders sell to the big traders, low and high quality nuts are cleverly mixed and sold, which gives the small trader a higher margin.

The small traders play a crucial role in local livelihoods since the cashew season coincides with the off-season in agriculture when no other employment is available. Being able to sell cashew during this time provides valuable cash for cultivators.

6.1.3.3 Cashew processing

About 57 per cent of the cashew processing industries in Karnataka are situated in Dakshina Kannada district with a capacity ranging from 101-500 tons per annum. The steam boiling method of raw cashew conditioning is being followed as recovery of kernel in this method is better compared to other methods. CNSL (Cashew Nut Shell Liquid) is derived by the expeller method, and this is followed in a very few industries. Most of the processing industries in Dakshina Kannada are managed privately, single ownership/proprietorship (10 per cent) or partnership (81 per cent).

In Karnataka, about 52.5 per cent of the industries supply processed kernel to the domestic markets while 39 per cent export kernel as an end product. Cashew nut shell extraction takes place in 8.5 per cent of the industry, and no processor does value addition in bulk quantity.

The total employee strength of a factory is in the range of 100-400. Mostly, men labourers are engaged in drying, stacking, steam boiling raw nuts, kernel drying and tin packing of kernels. About 80 per cent of total women employees are engaged in shelling and peeling. Labourers are confirmed at government approved rates. Bonus and provident
fund are the two motivating factors and uniform, medicine, fan in working place, canteen etc, are other facilities available for employees.

The small-scale processing units are spread across three districts of the region. Each unit has the entire infrastructure required for processing. The owners of these small-scale units have considerable financial clout. These small units have the capacity to process 30-50 bags of raw nuts a day (compared to the big units which average 100 to 150 bags a day). Another indicator of the financial strength of these units is their ability to procure raw nuts during the season and store them for about 4-6 months. In this sense, these units are different to those in the Panruti region of Tamil Nadu. The scale of operation in Panruti is much lower and they operate collectively as a cluster. The small-scale units in Karnataka are independent entities who sell their produce directly to the international or domestic market while processors in Panruti sell their produce to exporters/export houses.

Most of the small-scale units are located in villages so as to get a steady supply of labour. Workers are paid slightly more than market wages so as to retain them and train them. Production level increases after 3 or 4 months and stabilises after 6 months, at which point workers are paid piece rate wages; workers usually don't receive any statutory allowances. The techniques of raw nut processing are very similar to Panruti region, the only difference being is the use of electrical humidifiers in Karnataka.

Interestingly, many small processors sell the processed kernels in the domestic market, usually through agents. Kernels from locally procured raw nuts are in great demand, especially in Delhi and Mumbai markets, although Ahmedabad is emerging as a bigger market than Mumbai. Prices received on the domestic market are much better than the export market, even though processors who supply kernels to the domestic market do not get low interest rate export credit, import licenses etc.

Only 22 per cent of the industries are functioning throughout the year while the rest of the industries are operational for just 6-8 months, which depends on the availability of raw material, financial constraints, shortage of power and labour.
Table 6.1.3.1 Details of cashew processing industries in Karnataka

<table>
<thead>
<tr>
<th>Details</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cashew factories</td>
<td>172</td>
</tr>
<tr>
<td>Installed capacity of factories</td>
<td>60,000 tons/day</td>
</tr>
<tr>
<td>Utilised capacity</td>
<td>25,000 tons/day</td>
</tr>
<tr>
<td>Total number of cashew workers</td>
<td>25000</td>
</tr>
</tbody>
</table>

While processing in Mangalore city has stagnated or even declined over time, in the hinterland (e.g. Udupi and North Canara districts where cashew is extensively grown) processing is very vibrant and growing.

6.1.3.4 Reasons for the stagnation of processing in Mangalore city and the shift to the hinterlands

1. Labour militancy and shortage of labour. Mangalore has a long history of labour movement; while statutory benefits and other financial compensation are fully paid to the workers in Mangalore city, such payments are not made in the newly emerging processing areas. This in turn means that more and more units find their way to the 'non-problematic' regions and away from the Mangalore area. Though wages are paid as piece rates, working hours are long in the rural units. On the other hand, any extension of working hours in Mangalore has to be compensated financially. This is one reason why units have migrated to or are started in the hinterland.

2. Procuring raw nuts during the season can be highly speculative. However, the rural units can procure raw nuts as and when they want. The cost of inventory is much less and the risk of fluctuating prices is minimal for these rural units. When local raw nuts are unavailable, imported nuts are readily sourced.

3. The small operators in the rural areas have better control over logistics and quality. Since the processors are located where cashew is grown, they can ensure proper drying of the collected nuts and can procure nuts from specific growers who take care of the raw nuts, and since they know most of the growers in the region, deferred payment for raw cashew is quite common.
6.1.3.5 Raw nut procurement

One of the major hurdles for processing is non-availability of sufficient supply of raw materials at standard prices. Availability of financial resources during the time of procurement ensures raw material in stock for operating the industry to full length of their capacity. Some raw nuts are imported from other countries that grow cashew.

Harvested nuts are dried under the sun immediately after procurement. Turning of nut at regular intervals is done to ensure uniform drying. The dried nuts are filled in gunny bags of 80-kg capacity and stocked in godown. Few industries in Mangalore indicated the application of pesticide after three months of storage to avoid insect infestation.

Most of the industries fully depend on indigenous nuts and procurement is in the range of 100 to 5000 tons per annum. About 51 per cent of the industries come under the category of 100-500 tons per annum; 20 per cent of units are capable of procuring 501-1000 tons per annum and 12 per cent of industries are procuring 1000-5000 tons per annum raw nuts. 19 per cent of the industries have the capacity of producing kernels upto 25 tons per annum. 36 per cent of the industries' annual kernel production is in the range of 26-100 tons per annum and 30 per cent of the industries are capable of producing kernels in the range of 101-200 tons per annum. In the normal course, kernel yield will be in the range of 20-25 per cent of the raw nuts of Indian origin. The reduction in kernel recovery is due to supply of immature and deteriorated nuts. Raw nut procurement and pricing is done based on visual test, floating test and cutting test.

6.1.3.6 Drying and storage

Drying of harvested nuts is done on a cemented yard under the sun. This brings down raw nut moisture content and prevents spoilage at the time of storage. Excessive moisture attracts insects and creates conditions for mould growth. The duration of drying under the sun varies from place to place, which will depend on climatic conditions. Raw cashew nuts are dried immediately after procurement for two or three days. Soon after drying, the nuts are filled in gunny bags and stacked in godowns. The drying process continues at the time of storage in a dry climate. However, under conditions of high
humidity, nuts can take up moisture till they come to the point of equilibrium. Due to this problem, the method of storing raw cashew nuts in, soils and building dump of nuts with a wall of cashew nut bags all round, is not prevalent in the region.

6.1.3.7 Steam boiling

Under the steam boiling process, a cylindrical drum with a hopper on the top for feeding raw cashew nuts is used. A boiler is used for generating steam and is sent to the drum through a pipe at the bottom. The pipe is connected to a perforated central stem and laterals inside the drum. A steam gauge is fitted with a valve for controlling pressure to the steam pipe connecting the steam generator and drum. Cashew shell cake is used as fuel and it requires about 50 kg of cake to steam boil a batch of 320 kg of raw nuts and this costs Rs 1.50 per kg.

The crucial parameters, i.e., steam pressure and duration, vary from industry to industry due to various factors such as variation of the origin of raw nuts, capacity and efficiency of boiler, skill of a labourer, etc. Nearly all the factories follow the steam boiling method as preliminary conditioning method. However, the production capacity varies from unit to unit. Baby boiler of 300-320 kg per batch is used by many industries.

6.1.3.8 Shelling

A hand-cum-foot operated cutter is used for shelling. The nuts are placed one by one between two blades and cut to the depth of the shell. A hand lever is used for breaking open the shell. Another labourer separates the opened nuts and shells. Due to the tiring nature of shelling in this method, the labourers exchange positions. The output of two workers ranges from 50-100 kg raw nuts per day. The average production is in the range of 11-25 kg per day per pair. Partial mechanisation of shelling and steam boiling results in release of shell oil that can affect workers’ hands. One must be careful during cutting, as to avoid injury to labourers during the process. Just two labourers are needed for shelling 80-kg steam boiled nuts.
6.1.3.9 Drying

After separation from the shells, the kernel is dried to bring down the moisture and loosen the adhering testa. The nuts are placed in trays with wire mesh bottoms and loaded into chambers that are built with either brick or metal. The trays are arranged in a trolley and in turn, put inside the chamber. The drying chamber gets hot air from the generator where shells, after extracting CNSL, are burnt as a source of heat. The kernels inside the chamber are put through varying temperatures and require highly skilled labourers for avoiding scorching of kernels. Positions of trays are changed at regular intervals of time for maintaining uniform heating. The positions of trays are changed for the first 6 hours of drying after every 30 hours. The drying percentage in borma dryer has been worked out at 4-5 per cent.

The borma dryer is not designed properly at present. Heat utilisation from the cross flow dryer is higher when compared with the conventional type, and it has the benefits of uniform kernel drying and lesser time. Processors cannot switch over to cross flow dryer from the poorly designed borma dryer due to cost constraints.

6.1.3.10 Peeling

Peeling takes place after drying the kernels in borma/cross flow dryer. The kernel shrinks away from the testa that becomes brittle and can be removed easily. Usually, peeling is done manually and is a labour-intensive process. The estimated capacity differs from 4 kg to 12 kg per person for eight hours per day. The first kernel drying, i.e., 4-7 grades, is also done in this section. Wages are set on the basis of whole kernels that serve as a control for careful work. The average peeling capacity is in the range of 6-10 kg per day.

6.1.3.11 Re-humiditation

This is essential for preventing excessive breakage by handling and transport after final grading. Kernels are kept in a high humid room for a few hours till they come back to a moisture content of 5 per cent lb (maximum limit).
6.1.3.12 Grading
Grading is done according to specifications laid down by the Cashew Export Promotion Council of India. More than 25-30 grades are sorted out for domestic market and export. Grading is done manually. Cleanliness is maintained in this section to a great extent. Different grading lists are available for export and indigenous supply of kernels. Grading of whole kernel is based on counts, i.e., the number of whole kernels per pound. The main groups are white wholes, that are sub-divided into counts 200/210, 220/240, 300/320, 400/450 and 500/520, Butts-wholes with small pieces chipped off, white splits-kernel halves, LWP (Large White Pieces) of size over 60 mm, SWP (Small White Pieces) of sizes < 40 mm, scorched grades showing some discolouration due to over roasting, shriveled or spotted or dessert kernels.

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

6.1.3.13 Packing
Vita packing system is followed in about 80 per cent of the industries. Tin containers of 25 pound (11.34 kg) capacity are used for packaging kernel, and packed tins are then labeled as per grades across the lid by using special temper adhesive. These tins are packed in carton boxes and are bound by nylon strapping for the purpose of exports. Standard markings are printed on the carton. These include brief description, name of packer, gross and net weight etc. In a kernel-filling machine, 4-6 tins are placed on a vibrating platform, while filling by a chute. Blowers that are provided across the chute remove dust and kernels with less weight. The tins are vaccumised and flushed with CO$_2$ with the help of VITAPACK machine and sealed afterwards. The use of CO$_2$ brings down oxidative rancidity and also assists in checking leakage. Any leakage in filled containers can be detected by the hollow sound that comes out while tapping the sides of the tin. Tin tester is also used for checking airtight packing by dipping in water.
Flexible Packaging (Moulded Vacuum Packaging) with nitrogen as inert gas is a better method for bringing down the heaviness and incurs less cost of packing. Very few factories have this facility in addition to the vita packing system in this region. MVP system produces consistent rectangular blocks that range in size from 500 gm to 25 kg. This is a big improvement in quality production with the advantages of transport, handling, display, stock count, etc. The vacuum barrier bag and cardboard box are fully recyclable. The rectangular shape of primary packs ensures that the movement is minimum during transportation and handling, providing the maximum protection to the contents. The removal of air and gas flush bring down the incidence of rancidity and bacterial growth.

6.1.3.14 CNSL extraction
The expeller (15 HP) method is followed for CNSL extraction. After extracting oil, it is transferred to the boiling unit where it is subjected to 100°C for 4 hours for evaporating moisture and cooled for 10-12 hours in settling tanks. On an average, 5-6 barrels of CNSL are extracted every day, in a well-developed industry. Each barrel is of 200 litres. About 200 ml of crude CNSL can be derived per kg of shell and the quality is checked by chemical method. It is sold at the rate of Rs 12 per kg of oil.

6.1.3.15 Processing cost

Table 6.1.3.2 Processing cost

<table>
<thead>
<tr>
<th>Processing stages</th>
<th>Steam boiling (Manglore) Rs/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying raw nuts</td>
<td>0.15</td>
</tr>
<tr>
<td>Preliminary roasting (Labour + Fuel)</td>
<td>0.18</td>
</tr>
<tr>
<td>Shelling roasted nuts</td>
<td>1.28</td>
</tr>
<tr>
<td>Kernel drying (Tunnel drier) (Labour + Fuel)</td>
<td>0.19</td>
</tr>
<tr>
<td>Peeling</td>
<td>1.26</td>
</tr>
<tr>
<td>Grading</td>
<td>0.57</td>
</tr>
<tr>
<td>Packaging</td>
<td></td>
</tr>
<tr>
<td>Wages + Container + soldering + Infusion of CO2</td>
<td>1.53</td>
</tr>
<tr>
<td>Total</td>
<td>5.16</td>
</tr>
</tbody>
</table>
6.1.4 Preliminary Findings in the Cashew Industry from -Tamil Nadu, Maharashtra and Orissa

6.1.4.1 Tamil Nadu

In Tamil Nadu, cashew growing is mainly concentrated in South Arcot, Pudukottai, Sivaganga and Kanyakumari districts. The only processing facilities in Pudukottai region are owned by the Vijayalaxmi Corporation (VLC) Group of Kollam, Kerala. Much of the produce is sold to processors in Kollam or Panruti (in Tamil Nadu).

6.1.4.1.1 Cashew cultivation and processing in Pudukottai-Sivaganga

The decline in private cultivation compared to public cultivation seems to be primarily related to deep bore well technology. When water is struck, farmers abandon cashew cropping as uneconomical. This may well be true in the short-term, but evidence from elsewhere shows that water mining does not last long, and there are many instances of farmers reverting to previous cropping patterns once the underground water is nearly exhausted. Private cashew cultivation occurs on land which cannot support other crops.

However, there is a well-developed market network to collect raw nuts from the growers. Very small growers, those owning 2 or 3 acres, sell their raw nuts to peddlers the day they are harvested. The peddlers take the collected nuts (about 10-15 kg a day) to the big traders in town. Larger cultivators sell the raw nuts directly to the bigger traders in the towns. They wait till prices are good, but this can often be a gamble.

Forest Department cashew plantations

In this region, the State Forest Department is a far bigger player in cashew production than individual cultivators. Planting cashew trees on barren land in the state forests is very common in India. Tamil Nadu Forest Department embarked on cashew plantation initially as a soil conservation measure. The commercial value of these plantations grew in significance when the price of raw nuts shot up over the past decade or so. Since then, the department has floated a separate corporation, Tamil Nadu Plantation Corporation (TAPCON), to deal with commercial forestry of cashew and other commercial forest
products. The cashew plantations operated by the TAPCON in this area are scattered over a vast area. The size of each plantation also varies.

The Corporation generally does not involve itself in cashew harvesting, instead auctioning the usufruct rights every year. The successful bidder can collect raw nuts between January and May for that particular year. Though the process of collecting the nuts from TAPCON-run plantations looks simple and transparent, the actual process is very complex. Successful bidders have to pay a sum to the local community. In return, the village community pledges that the members of the village community shall not collect the usufructs and extend full cooperation to the contractor. Once the deal is struck, the contractor can bid with the forest department (TAPCON) and secure his seasonal right. The money collected by the community is spent as decided by the community panchayat. In Pudukottai and Sivaganga region, such community funds are generally spent on the annual village festival and very rarely put to other uses.

Secondly, the role of traders in the auctioning of Corporation plantations is very crucial. The investment involved in such deals is huge, beyond the combined resources of the conglomerate of individuals (generally 5 to 6) who form a partnership and bid for the plantations. Big traders contribute the rest of the money. In turn, the traders get 36 per cent interest for the money that they advance; and the entire raw nut collection has to be sold to the trader at a price fixed by him. Invariably, the price quoted by the trader would be lower by about 20 per cent than the price that prevails in the market.

Third is the role of politicians. The local functionaries of the ruling party influence the auction and bid for a price. They also seek a share in the profit and on many occasions own the bid by proxy. However, even for such functionaries, approval by the village community is very essential. From the brief description above, we realise that the complex nexus between traders, politicians and officials of the TAPCON seems to control the entire process.
Harvesting of cashew in the corporation plantations

The successful bidder employs local workers to do most of the harvesting. Usually five women per hectare are paid a cash wage of Rs 30/- per day to collect the nuts. After three days of drying, the nuts are packed and are ready for sale. Each worker is able to collect about 15-20 kilograms of raw nuts at the beginning of the season. Once the plantation is handed back to the Forest Department, the locals (usually women and children) are free to collect the remaining nuts, if any, from the plantation, which they may sell to the peddlers. These nuts are known as ‘Saruha Kottai’.

Role of traders

Traders are mainly from the Chettiar caste and are involved in three different ways: as direct procurers of raw nuts, as commission agents and as traders of imported nuts. Some traders act as intermediaries between the cashew processors (mainly in Kollam, Kerala) and cashew growers. The processor who appoints the trader as his agent provides the capital required for procurement and transportation. The agent in turn uses his knowledge and contacts to procure the required quantity and quality of raw cashew from the region for which he is paid a commission.

As mentioned earlier, there are not enough raw nuts grown in India to meet the processing capacity. Some traders from this region also trade in imported nuts and sell them in small quantities to the processing houses in South Arcot, Kanyakumari districts of Tamil Nadu and sometimes also to Karnataka and Andhra Pradesh processors. But in terms of scale, this is very small compared to their domestic trading activities. No big processing unit is present in this place. There are about eight small-scale processors who process about 10 kg of raw nuts on the roadside and sell them to travellers on the main road between Thanjavur and Pudukottai towns.

6.1.4.1.2 Cashew cultivation and processing in Panruti Region (South Arcot District)

In this region, growing conditions and availability of irrigation are similar to Pudukottai and Sivaganga region. However, cashew plantations are so dense and contiguous in this region that many provide hideouts for outlawed Tamil Nationalist groups.
Private cultivation
There are a number of villages where cashew is the single most important crop. Cultivation is more intensive with periodic ploughing, plant protection during the flowering season and watering the trees during summer months. Therefore, yield is higher (around 2000 kilograms of raw nuts from one hectare of land). Panruti nuts yield about 24 kilograms of kernels. Another crucial fact to note is that cashew processing is a major activity in many Panruti villages.

Family labour is predominantly used for harvesting the nuts, although in larger plantations hired labour is also engaged. Demand for labour is so high during harvest season that both men and women are employed unlike in Pudukottai region where only women harvest the nuts.

Because of their better quality, raw nuts from Panruti fetch slightly more than the market price. Raw nuts are sold in small quantities to the local processors and peddlers. Bulk quantities are sold to the export houses in Panruti. Large plantation owners retain their stock for sale during the off-season for a higher price. The system of advance payments by traders to the growers is not very common in Panruti region.

Forest Department cashew plantations
There are vast plantations owned by the Tamil Nadu Plantation Corporation in the Panruti region. The procedure of auction-cum-tender for usufruct rights is the same as in Pudukottai.

Processing in Panruti: a cluster approach to processing
Of great interest in Panruti is the cluster of small-scale cashew processors that has evolved in the region. As in Kerala, local nut production is not sufficient to feed the existing processing units. Processing and export depend on local supplies only for about three months in a year. Raw nuts are therefore procured from other states and countries (about a dozen of them) at various seasons. The export houses are the main conduits through which the external procurement of raw cashew happens. It is very important to
note that though the export houses procure raw cashew nuts from the domestic and the international market, most do not have their own processing facilities. It is reported that there are hundreds of small processing units located in the villages surrounding Panruti town. They tend to be owned by the cashew farmers. Yet, clearly their cashew harvest alone can hardly suffice for the facilities that they own.

Viewed superficially, these small units appear to be satellite units of the export houses. These small processors own their produce almost entirely. They employ wage labour to supplement family labour. They sell the final product to whoever they like, but this does not mean that they are absolutely independent entities; they are part of a network of small processors linked to one or two export houses. Each export house has about 40-50 such small processors in their network. The export house scouts for the raw cashew both in the domestic market and in the international market on behalf of all the processors in its network. When the price and the quality of the nuts are known, the information is disseminated to all the processors. If it is agreeable, then the export house places an order for the procurement of raw nuts. Sourced raw nuts are divided into smaller lots. The individual processors buy the raw nuts from the export house. The contract ends there. The processing units process the raw nuts on their own, sort them and bring them back to the same exporter or to any other export house.

The small processors also procure raw cashew from the domestic market through their agents. Three or four small processors join together and share a lorry load of raw nuts that are imported from Kerala, Karnataka, Andhra, Maharashtra or Goa. The processed kernels are then sold to the export houses. Cashew processing in Panruti mostly uses the Mangalore method of steam cooking and not drum roasting.

Social organisation of processing in Panruti region
The most striking aspect of cashew processing in Panruti is the small scale of operation. A thatched shed where women workers sit and shell the raw nuts is the only infrastructure that many processors own. It is basically an extension of their houses. All other services are hired in every village.
This small-processor-dominated activity allows surpluses generated through processing to be spread more evenly across many players. It also generates valuable employment for local people. Combining cashew growing with processing can generate employment almost throughout the year.

Only women are employed for shelling, and they also predominate the peeling section. Each worker can shell about 30 kilograms of nuts in a day, and workers are paid on a piece-rate basis of about Rs 5 for every three kilograms of nuts shelled. This goes up to Rs6/- during heavy seasons. About 20 kilograms of kernels can be peeled by one worker in a day and she is paid Rs5 for every 2 kilogram of kernels peeled. Skilled women workers are employed for grading and can grade 80 kilograms of kernels in a day. They are paid Rs 70 per bag.

Labour is scarce and commands an advance, especially during harvest. These villages attract a considerable number of workers from other villages where processing has not been taken up in a big way. All such migrant workers are agricultural labourers and during the busy season in agriculture, they stay in their villages. During this period of time, processing activity slows down considerably.

**6.1.4.2 Maharashtra**

The total area under all horticultural crops in Maharashtra State is 1.28 million hectares. Of this, the share of cashew nut is 0.15 million hectares (Economic Survey of Maharashtra, 2002-2003). The main cashew cultivation area is located in the Konkan region, which is on the coast of Arabian Sea in Western India. Cashew is mainly grown on the hills where it was introduced to conserve soil.

In 1957, the regional agricultural university—Konkan Krishi Vidyapeeth—launched a programme to promote cashew cultivation as a commercial crop, and since 1970, cashew growing has been promoted through various development schemes like Social Forestry, Employment Guarantee Scheme, Waste Land Development, and Horticultural
Development. Between 1974 and 2002, the area under cultivation in the state has increased by 178 per cent (Economic Survey of Maharashtra, 2002-2003).

**Collection system**
As most cashew growers are small holders, they collect the raw nuts themselves. This is usually done by the women, who go around the orchards as and when necessary. Then growers either sell directly to the local market or to processors or agents. The marketing season starts from the middle of March. A few processors make advance payments to growers through their agents who are generally local traders. Thus, the grower commits the entire produce to the agent well in advance of the harvest at a price expected to prevail during the harvest season.

**Processing**
Traditionally, cashew nut has been used for home consumption and processing was not a commercial activity. It is known as “kaaj paadaney” in local parlance. The “kaaj paadaney” process consists of roasting cashew nuts in a perforated wok, which is cooled by pouring water. The wet nut is then crushed with stone. The colour of the roasted cashew kernel is slightly brownish. This type of processing is unique to Maharashtra.

In Maharashtra, factory production is merely a systematic co-ordination of manual processing. Women constitute 95 per cent of the work force involved in the shelling/cutting, crushing, peeling and grading processes. There are 49 factories and 250 small units in the state, all of them located in Sindhudurg district of Konkan region. Of the 250 small units, 200 were run under the Prime Minister’s Rojgar Yojana (a rural employment program funded by the Union Government of India) and were closed down within four months of operation. At present, only 50 small units are in operation; 45 of these process cashew nuts while five process the cashew apples. The existing cashew processing units in Sindhudurg district have been classified according to industrial category on the basis of processing methods used, processing capacity and employment.
Table 6.1.4.1 Types of cashew processing units in Maharashtra

<table>
<thead>
<tr>
<th>Category of factory</th>
<th>Number of factories/units</th>
<th>Approx. nuts required per unit/per month</th>
<th>Number of employees/unit (approx.)</th>
<th>Duration of processing &amp; employment days</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>16</td>
<td>25 tones</td>
<td>&gt; 100</td>
<td>8-11 months</td>
</tr>
<tr>
<td>B</td>
<td>33</td>
<td>3 tones</td>
<td>80-100</td>
<td>6 months</td>
</tr>
<tr>
<td>C</td>
<td>45</td>
<td>1 tones</td>
<td>5</td>
<td>10 months</td>
</tr>
</tbody>
</table>

Source: Cashew Journal

Category A units use the ‘boiler method’ for processing. They all have large capacity boilers, more than 100 employees, and according to industrial category they are big processors (Table 6.1.4.1). These units collect raw nuts from agents and cater to the international and domestic markets. These factories claim that the available local nuts are insufficient and process nuts imported from Africa from mid February. The African raw nuts are cheaper than local nuts. In Maharashtra, the peak cashew season is from March to May. In this period, these factories procure nuts through the local agents. They then mix the local and African varieties and build a stock that lasts them throughout the year.

Category B factories have been present in the interior villages of Sindhudurg for generations. These units have an initial investment of approximately Rs one million and are run from temporary structures/tin sheds. They use the drum roasting process as opposed to steam cooking and usually employ 35-40 people, mostly local women, on a daily wage basis. Their job involves crushing, peeling and grading. Around 3-4 men are employed specifically for roasting and loading, and they earn around Rs 3000-Rs 4000 per month. These units are run only between mid-March and December.

Category C factories have been in operation since 2002. Encouraged by a local NGO, the National Bank for Agriculture and Rural Development (NABARD) and the Agriculture Department, they are run by unemployed young people who have been trained by NABARD and the Agriculture Department. After completing the training, the young people started the processing units with an initial investment of Rs 50,000 of their own money. The State Government gave them a subsidy of Rs 25,000 to buy assets. Forty-five
registered home-based units are being run successfully in this way. Each unit processes one metric tone of cashew per month and sells shelled, graded cashew under the “Gopuri” brand, with a local youth group lending a helping hand in its marketing. These units grade cashew kernels and sell them separately while using the lower grade cashew to make cashew modak and cashew katri (sweets) as by-products. Due to the good performance of these units, the Madhyavarti Zilla Kharaydi-Vikri Sangh (a marketing organisation), has agreed to give them financial support in the form of loan at 12 per cent for a 10-month period up to a maximum of Rs 0.3 million.

There are five cashew apple processing units run by women’s self help groups in a few villages of Kankavali taluka. These units process cashew apple to make jelly, pickle, squashes etc. and sell them locally.

According to the small-scale entrepreneurs, cashew nut production in Sindhudurg district is high, yet only a small quantity is processed while most of the nuts go to other states such as Kerala and Goa for processing. Maharashtra produces good quality cashew and has the capacity to process it. With better financial support, more small units would become viable. It was also felt that if the marketing system currently in operation expands, then the raw cashew that is currently leaving Sindhudurg would be retained for processing.

6.1.4.3 Orissa

As in all the other states, cashew cultivation in Orissa started mainly as a soil conservation measure. The state has a long coastline (nearly 500 kms) which is buffeted by storms and cyclones, particularly during the volatile North East monsoon. Cashew plantations were developed all along the coast as a natural barrier against storms and cyclones. The government also developed cashew plantations in Western Orissa where the terrain is generally hilly. Cashew was planted extensively here to prevent the loss of topsoil. Today, cashew plantations are found in 22 of the 30 districts in the state. As in many other states, the land formerly operated by the Soil Conservation and Forest Departments was handed over to the Orissa Cashew Development Corporation in 1980.
With the transfer of plantations to the Corporation on a long-term basis, common land that was initially to be used for the public good, i.e. for soil and moisture conservation, is now being exploited commercially by a public corporation mainly to generate revenue for the State. Of note is that local people, mostly the landless, had encroached on this land to farm it for subsistence food. Once the commercial value of the land rose (with the increasing demand for cashew), this encroachment was dealt with legally, and these poor cultivators were evicted despite the fact that these people depended on these lands for their survival.

Despite the fact that Orissa has vast tracts of cashew plantations, much of the plantations are old and poorly maintained. Though the Corporation and Forest Departments have been implementing schemes to rejuvenate the old plantations by planting high-yielding breed grafts, the coverage is very limited. Poor cultivation practices in both public and private plantations result in very low yields. While some areas have natural limitations (the hilly terrain of Western Orissa is acutely drought prone and yields are low), there is huge scope to increase yields in the coastal plantations. Some individuals who have planted new varieties and are using good cultivation practices manage to get a yield of around 8 kilograms of raw nuts from one cashew tree.

There is little processing activity and few facilities. Official figures suggest that altogether there are 33 processing units in the state. Only 15 of these function throughout the year, the rest are seasonal.

Orissa remains predominantly a producer of raw cashew. Andhra traders procure almost the entire produce and take it to Andhra for processing (although the Northern Coast is the domain of Bengali traders). The traders go round the villages during the beginning of the season and pay an advance for the raw nuts. The traders play a significant role in the deals between the contractors and the Corporation.
6.2 CASHEW APPLE AND CASHEW NUT SHELLS

6.2.1 Cashew Apple

6.2.1.1 Cashew Fenny Extraction in Goa

Goa is the only place in India where cashew fenny is being distilled for the last four centuries or more. Other than its own apple, Goa gets cashew apple from Maharashtra depending on demand.

There are 54,000 hectares of area under cashew cultivation in Goa. Cashew apple production is estimated at 20,000 tons. There are 54 processing units in Goa. Forty percent of the state production is consumed locally and 50 per cent is sent to other states and 10 per cent is exported.

Total supply of fenny in Goa is around 60,000 liters on an average whereas the demand is only 20,000 liters. Fenny is being allowed to take to other states if one gets the import permit, and fenny is also exported to other countries like the Gulf and Australia. The Government of Goa earns more than Rs 6 million annually from this.

6.2.1.1 Fenny preparation

The cashew apple is left to ripe fully on the tree, and when it falls down, the grower collects the fruit and separates the fruit from nut. The juice content in a cashew apple is 70 – 75 per cent. All the fruits are put in one place and pressed by the legs or with the help of screw press so that juice is collected.

The apple from which the juice is extracted is used again to collect some more juice. Weight is kept on the squeezed apple and the juice that comes at this stage is called cashew neera. This neera is also being consumed as a beverage.

Fresh cashew apple is available during the cashew season from March 15 to first week of June, and fruit is collected during about 3 p.m. daily. If there is more demand the juice is taken out immediately, if not juice is taken once in three or four days.
The juice that is collected from screw press or leg pressing is kept for 3 to 4 days in a big vessel where it gets fermented.

After fermentation of the cashew apple juice, they put it in a big copper vessel which has an approximate capacity of 45-50 liters.

The juice or alcohol that is collected in the bottle is called “URRAK”. Usually out of 45 liters of cashew apple juice only 20 liters of Urrak will be extracted. The left over in the copper vessel is thrown out as waste.

The alcoholic content in this Urrak is 45-50 per cent and this cannot be kept for a long period as its shelf life is only 3 months. Therefore the Urrak is again put in the copper vessel and mixed with cashew apple juice at 2:1 ratio. The above mixture of Urrak and juice is heated again wherein the output is cashew fenny with an alcoholic content of 75-80 per cent. From 30 liters of Urrak and 15 liters of cashew apple juice 18 – 20 liters of fenny is extracted.

If one wants pure fenny, the ratio of Urrak and juice is changed (2.2:0.8) so that the alcoholic percentage can be increased. From 20 liters of cashew apple juice one can get one liter of fenny.

Some of the bottling companies go for filtration of fenny before bottling them. There are also companies which use additives to reduce the smell. The bottling companies also store the fenny for 1 to 1.5 years, as the aged fenny will have more taste and value.

Fenny is used as a healthy drink, used for medicine purpose for stomach disorders, etc. Medicinal roots are added to the fenny and taken as drink.

6.2.1.1.2 Cost and pricing of fenny

Fixed Cost
It is a low investment industry. The capital investment includes, big copper vessel that
costs Rs 5000, steel vessel for condensation that costs Rs 1000, pipeline with a coil of aluminium that costs Rs 1000, storing bottles and vessels that cost Rs 1000, barrels for storing the juice costs Rs 2500 (five vessels) and at field level the pressing arrangement require Rs 6000 to 8000.

**Raw material requirement**

Fruits from 5 hectares of land are the minimum requirement and it is purchased at the rate of Rs one per kg. Other costs involve firewood, license charges and excise duty.

**Formalities for getting the license**

The area is notified for extraction of alcohol/fenny from cashew apple from the state government. The excise department conducts auction for the land, and the highest bid will be given the permission for extraction of fenny for a period of one year.

**Manpower**

For an area of five hectares 2 workers are needed per day to collect the cashew fruits. For distillation and other purpose 1 worker is needed per day during the season (60 days) and 1 labour is needed for extraction purpose for a period of 60 days.

**Pricing**

Actual cost of fenny extraction is Rs 20 to Rs 25 for 750 ml. The extractor sells the fenny for Rs 35 to the wholesalers and the wholesalers filter and bottle the fenny in their own brand name and price it at Rs 80 to Rs 125 for 750 ml.
6.2.1.2 Other Products of Cashew Apple

Cashew apple can be used for preparation of various products. About 50-60 per cent raw juice with 9-10 per cent soluble solids can be obtained from cashew apple. The cashew apple contains 87.5 per cent moisture, 11.6 per cent of carbohydrate and 0.2 per cent protein. Cashew apple is one of the richest sources of vitamin C (0.26 per cent) and minerals. Cashew apple weights 8 times more than its nut.

6.2.1.2.1 Collection of fruits

Most of the constraints are at the primary post-harvest stages and at different levels of transportation and handling of cashew apples before food technology for product development could be applied. Plucking or collecting the fruits at the shortest falling distance by using hooks and nets has to be considered as this itself adds to the quality of cashew apple products manufactured. Though initially it appears expensive for hand or mechanical picking, this has to be encouraged because of the long-run overall yield of the utilizable fruits quantity.

6.2.1.2.2 Storage of cashew apples

Maximum storage cannot be possible by cold storage as there are other more competitive fruits wait-listed for cold storage room all over the country. Cold storage by indigenous methods, for pre-cooling and rack storage can be suggested before further processing.

6.2.1.2.3 Cashew apple products

6.2.1.2.3.1 Different forms

6.2.1.2.3.1 a Fresh apple products

Traditionally fresh apples can be processed into ready-to-serve products locally, i.e., wherever collection is made to avoid transport cost for processed fruits, e.g. cashew apple juice, wine and fruit cocktails blended with other locally available and seasonal fruits. Fruits like watermelon, pineapple and other under exploited fruits like mango and wood-apple can be selected for preparation of acceptable beverages, syrups and squashes (Vaidehi et al. 1990).
6.2.1.2.31 b Cashew pulp products
Cashew pulp can be stored for later use with natural preservatives. Products like halwa, toffees and candies should be encouraged with the use of pulp at larger scale. Garnishing with dry fruits including cashew nuts adds taste and makes these products more attractive and marketable.

6.2.1.2.31 c Dehydrated cashew apple powder
Dehydrated cashew apple powder with and without juice can be used in various value-added products. Several recipes have been prepared with the use of 10-30 per cent cashew apple powder, which are wheat laddu, set dhahi, masala biscuits, sweet and masala doughnuts, sponge cake, steamed kadabu, tomato cashew apple powder soup, cashew apple powder koftas, chocolates, nutrimix, sweet and hot bread spread etc..

6.2.1.2.32 Unfermented products of cashew apple
6.2.1.2.32 a Cashew apple juice:
The juice can be extracted with screw press, basket press or by simple hand pressing. The extracted juice is strained through muslin cloth which is clarified by adding 1.4gm of PVP (Polyvinyl Pyrolidone) per litre of juice and stir the mixture for two minutes after which it is strained again through muslin cloth. Add sugar according to taste and boil the juice. It has the characteristic aroma and flavour of cashew apple. The finished product may be chemically preserved by using sodium benzoate at the rate of 0.05gm per hundred ml. The mixture should be poured into well-sterilised bottles. Cork air-tight with crown cork and store in a cool dry place.

6.2.1.2.32 b Cashew apple syrup:
Extraction of juice and removal of astringency are done in the same way as the pre treatment of juice. Add sugar at the rate of 1-1.25 kg for every litre of juice. 20-22 gm citric acid per litre and 0.08 per cent sodium benzoate are added to the juice. Dissolve sodium benzoate in a small quantity of water before adding to the mixture. Mix all ingredients thoroughly and keep it as such for three to five hours so that clear syrup forms a separate layer which can be easily siphoned. Bottling can be done as described for
juice. The bottle should not be completely filled, leaving some space at the top before heating over the water bath. Keep it in cool dry place. Dilute the syrup five times its volume with plain water for use as fresh drink.

6.2.1.2.32 c Cashew apple jam:
Cashew apple must be thoroughly cleaned by washing with water. Immerse the apple in 3 per cent salt solution for three days to reduce the tannin content. The fruits are steamed for 15-20 minutes at 0.7 to 1.05kg stem pressure. Then the apples are crushed and mixed with 750gm sugar per kg of apple and boil it. A pinch of citric acid is added towards the end of the cooling process to improve the taste. Store it in well-sterilised jam bottles.

6.2.1.2.32 d Cashew apple candy:
Just as in the case with jam, cleaned apples are first immersed in a 3 per cent salt solution. The next day, drain out the salt water and steep the fruits in fresh salt solution and repeat the process for a third time. Remove the salt water and add potassium metabisulphite (625mg/kg) and keep in this solution for another two to three days. The apples are then thoroughly washed in water. Keep them in a perforated crate made of aluminium or stainless steel and blanched in boiling water for five minutes, followed by steam in a pressure cooker for five minutes at 0.35 kg pressure. The apple should not be very soft. Candy processing is then carried out as usual, starting with a 30-degree Brix syrup containing 0.1 per cent citric acid and 500 mg potassium metabisulphite per kg of apple. Pour the syrup over the apples until they are completely submerged. Keep the fruits immersed in the syrup by placing stainless steel, wooden or glass disc. Cover the container with lid and keep it as such for one day. Next day, the syrup is taken out and sugar is added to the same syrup for raising the concentration upto 35 degree Brix. Syrup is again boiled for about ten minutes and pour back over the apples. Repeat the process daily, raising the sugar content by 5 degree Brix each time for the coming three days and then raise the sugar content by 10 degree Brix each time for the sixth and seventh day i.e., the final strength of the syrup is 70 degree Brix. Keep the apple for 8 to 10 days in the syrup for complete absorption of sugar. Remove the syrup and dry up the apple, which can be stored in screw capped glass jars in a cool dry place.
6.2.1.2.32 e Canned cashew apple:
Cashew apple is treated in boiling 0.5 per cent NaOH solution for five minutes followed by peeling and rinsing in water and a subsequent treatment for about five minutes in boiling 0.2N solution of H₂SO₄. Wash the apple thoroughly to remove the sticking peel pieces and steam them for about five minutes. The fruit should not become very soft. This is followed by washing in water. The undesirable portions are trimmed off and place the apples in well sterilised cans. Pour hot sugar syrup of 40 degree Brix over the fruit in a can and halt it over water bath. Seal the can and cool under running water without contamination and store in dry and cool place.

6.2.1.2.32 f Cashew apple chutney:
Wash the cashew apple after three days of salt treatment just as jam preparation. Remove the undesirable portion and slice them. Chutney is prepared as usual using 1 kg sugar, 1 onion, 30 gm ginger, 1 teaspoon each cumin seed, pepper, cardamom, cinnamon and coriander powder, salt to taste and 20 ml glacial acetic acid for every 1 kg of fruit slice. Tie all the powdered spices in a clean thin piece of cloth. Make syrup of sugar by adding equal quantity of water. Add the sliced apples, chopped onion, grated ginger, vinegar and salt to it. Drop the slice bag in when the mixture begins to boil. Boil the mixture until it is sufficiently thickened and store in sterilised jars.

6.2.1.2.32 g Cashew apple pickle:
Raw green fruit is washed, sliced and kept in 5 per cent salt solution. Drain out the salt solution in the second day and pour fresh 5 per cent salt solution. Repeat the process the third time. On the fourth day, remove salt water and pickle is then prepared in the usual way using 50gm chilli powder, 100ml gingelly oil, 20gm fenugreek powder, 100gm asafoetida, 5gm turmeric powder, 10gm garlic, mustard powder, a pinch of sodium benzoate and salt to taste for every 1 kilogram of sliced apple. Gingerly oil is boiled in a suitable vessel. Asafoetida dissolved in hot water is added to the boiling oil. Powdered turmeric, fenugreek, chilli, mustard are added to it. Add cashew apple slices after a thorough stirring. Finally add citric acid, salt and sodium benzoate dissolved in hot water. Mix all ingredients well. Transfer the pickle into clean dry glass jar and store.
6.2.1.2.33 Fermented products from cashew apple

6.2.1.2.33 a Cashew apple juice can also be used for preparing vinegar:
Raise the Brix of the juice to 15 degree by adding sugar. Cool and inoculate the juice with pure strain of yeast, *sacharomyce scerevisiae* or brewer's yeast for alcoholic fermentation. Keep it as such for 4 to 5 days and mix with one third mother vinegar. Keep it in a wide-mouthed clay pot for 15 days. Filter and pasteurise the same, which is having 5-6 per cent acidity and can compare well with commercial vinegar.

6.2.1.2.33 b Cashew wine:
Kerala Agricultural University has developed methods for producing four grades of wines such as soft, medium, hard and sweet. Wine fermentation will complete within 15-30 days depending on the grade of wine. Ageing can be done in wooden cask or glass vessel. Minimum period of ageing is 6-12 months. Longer ageing will give good quality wine. Sweet wine is prepared by adding sugar syrup, preferably cashew syrup, before bottling; 9 liters of wine can be obtained from 10 liters of cashew apple juice.

Cashew wine is essentially the product of fermentation of hexose sugar of cashew apple juice by intact yeast cells to form ethyl alcohol and carbondioxide. Method is standardised for producing wine from cashew apple (Patent No. 196/MAS/82). Fresh, crisp, tight and fully colour-developed cashew apples are used for preparing cashew wine. The steps involved in the preparation of cashew wine are collection, washing and extraction, detanning, fermentation, filtration and ageing. Different grades of wine except soft wine involve one more step of adding sugar. Fermentation can be completed within a period of 15-30 days based on the grade of wine. Stirring at 1-day interval for the first 7 days and keeping the fermentation vessel in cool dry place are important. Ageing can be done in wooden case or glass vessel. Minimum period of ageing is 6-12 months. Longer ageing may give good quality wine. Sweet wine is prepared by adding sugar syrup, preferably cashew syrup, just before bottling. Clear and sparkling wine can then be bottled. Ten liters of cashew apple juice is required to get nine liters of cashew wine. Based on the alcohol percentage and sweetness, wine is graded into 4 types such as soft, medium, hard and sweet.
6.2.1.2.33 Cashew liquor:
The steps involved in the production of cashew liquor are; Collection, Washing, Extraction of cashew apple, Detanning, Fermentation, Distillation and Ageing process. One liter of cashew liquor is obtained from 8 liter of cashew apple juice. Acidity has a negative influence on the quality of cashew liquor. Passing the distillate through inert clay like benetonite, raises the pH and reduces the acidity. Pleasant smell of cashew was found to be agreeable to all, which could be obtained by keeping the liquor in wooden cask. It also gives colour to the produce mainly due to the dissolution of phenolic present in the wood.

6.2.1.2.4 Opportunities
Cashew juice with mild powder spray dried at a given percentage of juice from 10-15 per cent results in excellent quality products. This could be utilized in reconstituted milk shakes, ice-creams and flavoured dhahis. Frozen desserts and dairy confectionery opens an excellent avenue for cashew apple utilization.

The Rheological properties like Farinography and Amylograph of the products at 10, 15, 20 per cent with wheat flour blend shows the powder is best suited for cookies, buns and confectionery products, which shows a comprehensive baking industry and dairy industry set up along with cashew apple industry for better utilization of this crop and more efficiency in the industrial set up.

In optimization of juice, concentration and spray drying has a lot of scope for further use in various dietary confectionery. The constraint here is capital investment for spray drier equipment by the entrepreneurs in villages where cashew is grown. Needless to say that technical expertise and multiple uses of machines are a must for an year-round profit, to be undertaken in rural areas or in urban centres, but it is possible to utilize the equipment for variety of other agro-based products alternately during non availability of cashew apple during off season.
6.2.2 Cashew Nut Shell Liquid

6.2.2.1 Cashew nut shell liquid
Cashew Nut Shell Liquid is a by-product of the cashew industry. It is an effective replacement for scarce and expensive petrochemicals. The nut has a shell of about 1/8 inch thickness, inside which is a soft honeycomb structure containing a dark reddish brown viscous liquid, which is the pericarp fluid of the cashew nut. This liquid is called as Cashew Nut Shell Liquid.

CNSL is a versatile industrial raw material with diverse uses in friction lining, paints and varnishes, laminating and epoxy resins, foundry chemicals and as an intermediary of chemicals. The residue after extraction of Cashew Nut Shell Liquid is a shell cake, which is very useful fuel and a substitute for firewood.

Distillation of CNSL under reduced pressure gives Cardanol. Cardanol has its applications in production of oil soluble resins, varnishes, enamels, paints for surface coating, electric insulating and impregnating compositions, lamination resins, Cardanol resins in printing inks, rubber chemicals and insecticidal and pesticidal compositions. The residue is rich in Cardanol and is generally known as Residol, which is conveniently used in the preparation of friction dust for brake linings.

Cashew Nut Shell Liquid (CNSL) can be considered as a potential natural source of monomers for polymer production. The innumerable industrial applications of CNSL are based on the fact that it lends itself to polymerisation by various means.

In the search for the cost-effective modern materials, CNSL and its products have a significant role to play. Being renewable, it offers much advantage over synthetics. Its versatility stems from its innumerable applications in many areas. Recent research has shown that the constituents of CNSL possess special structural features for transformation into specialty chemicals and high value polymers. This involves a value addition and the chemical transformation provides 100 per cent chemically pure products. Thus CNSL offers vast scope and opportunities for the production of specialty chemicals, high value products and polymers.
6.2.2.2 Methods of CNSL extraction

CNSL is a liquid or oil that is extracted from cashew shell using different methods. There are three types of oil extraction methods, they are

**Hot type (kiln method):**
The shell is subjected to high temperatures of 200 – 250°C, which results in disruption of the shell structure and oozing out of the raw oil. The recovery of CNSL is around 30 per cent and the normal production capacity is around 200 kg/day. Small traditional processors who handle small quantities and cannot afford other methods usually adopt this method.

**Cold type (expeller method)**
It is widely adopted method for CNSL extraction across the globe. The shell is compressed using pressure where in the oil is expelled from the shell. The CNSL yield from this type of extraction is around 25 to 28 per cent.

**Solvent extraction**
This method of CNSL extraction is very costly and very few processing units have adopted this method. Petroleum solvent (hexane) is generally used to extract CNSL. But as CNSL is a low priced product, it is not a financially feasible option.

6.2.2.3 Supply of cashew nut shell liquid

6.2.2.3.1 Quantity of production
Cashew Nut Shell Liquid constitutes of Anacardic acid (71.7 per cent), Cardol (18.7 per cent), Cardanol (4.7 per cent), novel phenol (2.7 per cent), and two unknown minor ingredients (2.2 per cent). Cardanol also known as card - phenol is manufactured from CNSL where it is present in the form of Cardanol and Anacardic acid.

CNSL is a by - product of cashew processing industry, extracted from the cashew shell after separating the kernel. The shell from oil bath roasting and steam boiling method contains 10 and 24 per cent of CNSL respectively. However the shell from drum roasting method does not yield CNSL. Unfortunately most of the processors in the country adopt
this method. Drum roasting (65 per cent processors) is followed in Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal. The latest method of steam boiling (28 per cent) is practised in Karnataka, Goa and Maharashtra, while few industries (7 per cent) are still following outdated method of oil bath roasting.

6.2.2.3.2 Gap in CNSL production

India's raw cashew availability for the year 2003 – 04 is around 867,510 tons, of which 481,850 tons is from domestic production from different producing regions and 385,660 tons is from imports. This 0.87 million tons of cashew is processed by different methods viz., drum roasting, oil bath and steam boiling, if all the cashew processors in the country adopt steam boiling method then there is potential for production of 146,000 tons of CNSL per annum in India. However the current production is only around 32,047 tons, which is hardly 22 per cent of the potential production.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw nuts available for processing</td>
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</tr>
<tr>
<td>Domestic production (000 tons)</td>
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<tr>
<td>Imports (000 tons)</td>
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<td><strong>Total (000 tons)</strong></td>
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<tr>
<td>Shell Availability (000 tons)</td>
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<td><strong>Potential CNSL production (000 tons)</strong></td>
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<tr>
<td>Current CNSL production (000 tons)</td>
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</tr>
<tr>
<td>Gap (%)</td>
<td>-78.1</td>
</tr>
</tbody>
</table>

*Note: Shell - 70% of raw cashew, CNSL - 24% of shell*

6.2.2.3.3 Reasons for under utilization of production potential

- The recovery of CNSL varies from one method of cashew kernel processing to another. Adoption of steam boiling method among the cashew processors is very limited from which the CNSL recovery is highest. Some of the units also use both drum roasting and oil bath alternatively depending upon price realisation for the nut or CNSL.
- Cashew processors are not able to shift from current processing method to steam boiling due to the established infrastructure, additional investment required for
shifting, labour problem and also the consumer preference for kernel from a particular 
method. These reasons vary from state to state; for example in Andhra Pradesh 
especially in Palasa region shift from drum roasting to steam boiling is being hindered 
by labour problems due to the perceived ill effects on health if they are made to cut 
open the boiled cashew. In Kerala the raw cashew nut processors currently processing 
by drum roasting method are willing to shift to steam boiling as they are aware of the 
additional income that can be obtained from CNSL production. The main constraint is 
funds required shifting from the current method and the importers’ preference for 
kernel obtained by a particular method of processing.

- Lack of initiatives from the government to shift the method of processing from drum 
roasting to steam boiling, even though drum - roasting method pollutes the 
surrounding environment.

6.2.2.3.4 Production centers of CNSL and its products in India

India is producing around 32,000 tons of CNSL, 5,300 tons of Cardanol and 360 tons of 
Recidol; CNSL is the raw material for production of Cardanol and Recidol. The 
extraction of Cardanol from CNSL varies from 75 to 78 per cent depending on the 
process adopted; the residue obtained in the process is nothing but Recidol.

The main producing centers of CNSL in India are Dakshina Kannada, Uttara Kannada 
and Udupi districts of Karnataka, Kollam region of Kerala, Goa, Vengurla of 
Maharashtra, Pondicherry and Panruti of Tamil Nadu, Andhra Pradesh and Orissa

<table>
<thead>
<tr>
<th>State</th>
<th>Regions</th>
<th>Quantity (tons/annum)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CNSL</td>
<td>Cardanol</td>
<td>Recidol</td>
</tr>
<tr>
<td>Karnataka</td>
<td>Mangalore, Uttara Kannada, Udupi, Kundapura</td>
<td>12650</td>
<td>900</td>
<td>10</td>
</tr>
<tr>
<td>Kerala</td>
<td>Kollam</td>
<td>9290</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>Palasa</td>
<td>1300</td>
<td>2600</td>
<td>350</td>
</tr>
<tr>
<td>Goa</td>
<td>Goa</td>
<td>2450</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orissa</td>
<td>Bhubaneswar</td>
<td>1500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>Panruti</td>
<td>3600</td>
<td>580</td>
<td>360</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>Vengurla</td>
<td>1250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Delhi</td>
<td></td>
<td></td>
<td></td>
<td>1225</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>32040</td>
<td>5305</td>
<td>360</td>
</tr>
</tbody>
</table>

Table 6.2.2.2 Production of CNSL, Cardanol and Recidol  Source: CEPC
6.2.2.3.5 Seasonality in CNSL production

Seasonality is not observed in CNSL production as most of the processors in the country alter the production cycle in such a way so as to produce the liquid throughout the year. During the months from February to April nut availability for liquid extraction is met by domestic production while during May to October availability is met mainly through imports. During rest of the months, processors use the stored shell.

6.2.2.3.6 Profile of CNSL producers in the country

Refer Annexure A.1

6.2.2.3.7 Main problems faced by the CNSL producers

- Insufficient raw material
- Shifting demand
- Inconsistency in profitability
- Machine break down due to iron pieces and stones in the shell
- Availability of the produce is not known and hence the price fixation is according to whims and fancies of the buyer.
- Trading activity is not organised and hence the quantity traded at a particular point of time is not known.
- The producers do not know demand for the produce, which is the main draw back resulting in sales at lower prices.
- Further processing of CNSL requires huge investment.
- Very few large producers are in the business of export of the produce and keeping up the quality expectation of the importer and timely deliver of the required produce in required quantities is a constraint.

6.2.2.4 Consumption of cashew nut shell liquid

CNSL and its products have their applications in many industries and the consumers of CNSL for various purposes are spread all over the country. The majority of the end user industries of CNSL are spread over parts of north India especially in the big cities. The major value added products from CNSL produced in the country are Cardanol, CNSL
resins, Recidol and many other high value products. Manufacturers of Cardanol are one of the important consuming sectors of CNSL.

6.2.2.4.1 State wise consumption of CNSL

In the country Andhra Pradesh (29 per cent) is the largest consumer of CNSL followed by Tamil Nadu (26 per cent) and Delhi (22 per cent) as the value addition of CNSL in these states is more. The consumption of CNSL in other states is about 23 per cent.

<table>
<thead>
<tr>
<th>State</th>
<th>Quantity (tons/annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CNSL</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>7440</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>6650</td>
</tr>
<tr>
<td>Delhi</td>
<td>5600</td>
</tr>
<tr>
<td>Karnataka</td>
<td>1500</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>1460</td>
</tr>
<tr>
<td>West Bengal</td>
<td>1185</td>
</tr>
<tr>
<td>Gujarat</td>
<td>500</td>
</tr>
<tr>
<td>Goa</td>
<td>200</td>
</tr>
<tr>
<td>Kerala</td>
<td>120</td>
</tr>
<tr>
<td>Orissa</td>
<td>40</td>
</tr>
<tr>
<td>Others</td>
<td>1100</td>
</tr>
<tr>
<td><strong>Total domestic consumption (A)</strong></td>
<td><strong>25795</strong></td>
</tr>
<tr>
<td><strong>Exports (B)</strong></td>
<td>6250</td>
</tr>
<tr>
<td><strong>TOTAL Domestic production (A+B)</strong></td>
<td><strong>32040</strong></td>
</tr>
</tbody>
</table>

6.2.2.4.2 Consumption centers of CNSL

Consumption of raw CNSL is very less and the raw CNSL is used to produce many products viz, Cardanol, Recidol, resins, friction dust and so on. The consumption of CNSL is in different forms and varies from one industry to other. The major industries consuming CNSL are paint and varnishing industry (50 per cent), automobile industry (35 per cent) and lamination industry (10 per cent). The consumption by local users as boat varnish, thatch roof paint etc., is very less accounting for 5 per cent.

Out of 32,000 tons of CNSL produced in the country, around 7,100 tons is used to produce about 5,300 tons of Cardanol, 6250 tons is exported and remaining 18,750 tons
is consumed within the country. The domestic use of CNSL in raw form is very less (500 tons) as boat varnish, thatch roof paint and so on, while remaining 18,750 tons of CNSL is used for further processing into various end products which are consumed by paint and varnish industry, automobile industry and lamination industry.

The producers of Cardanol can be either CNSL producers further processing CNSL into Cardanol or procurers of CNSL from different sources, as it is their basic raw material. Cardanol produced is mostly exported and some of it is also consumed as paint or varnishes for wooden boats and thatch wood.

6.2.2.4.3 Profile of CNSL consumers in the country

Refer Annexure A.1

6.2.2.5 Substitutes of CNSL

The usage of the friction dust would increase though non-asbestos material is available due to lower price of friction dust made from CNSL. The main reason attributed for this increase is the increase in the production of automobiles every year and CNSL being the cheapest source of friction dust material.

CNSL is further used in the manufacture of phenolic resin. Phenolic resin is manufactured by addition of hexamine into CNSL and heating the content when the boiling point is reached. The resin is ready for sale after mixing it with turpentine oil and resin in the ratio of 30:70. This resin mixture is used in paint manufacture directly by addition of the coloring material. The color of the resin makes it non-usable in light colored paints thereby restricting the usage to the manufacture of dark colored paints. The high reactivity of Cardanol to form gel-like substance in paints also restricts the usage of Cardanol in paint manufacture. There are other industries in which the usage of CNSL is picking up. The other sectors that use the CNSL are Bakelite, friction dust, lamination and moulding.

The usage of the CNSL has been increasing due to the lower prices of CNSL resin when compared to the other substitutes like castor or linseed oil. There are other substitutes in
the market for this resin. One of the substitutes is pretrich, a petroleum resin manufactured by IPCL. The small - unorganized players which form the bulk of the industry procure from the large players.

The price of the CNSL per kg is around Rs.15.00, with a variation of Rs.2 during the peak and lean seasons. The manufactured resin is sold at Rs.24 per kg. The other overheads in manufacture of the resin would be around Rs.3 per kg. The trade between the extractor of CNSL and the users of CNSL is direct without any brokers.

In Mumbai region the major substitute for CNSL is in manufacture of redoxide for engine oils. Engine oil is available at a price of Rs.10 per kg while the CNSL is available in the market at 13 to 15 per kg. This is forcing most of the small paint manufacturers to switch from CNSL to waste oil.

Thus, though CNSL based resin and artificial (petro - chemical) based resin are substitutes, in practical sense they have separate usage as of now for different product categories. It is not economical to use CNSL resins in light colour paints and but it is economical to use the same in red - oxide paints.

6.2.2.6 Marketing channels
Marketing of the produce is very important and crucial. The producers are motivated to take up further production, only if the earlier production is sold out profitably. Effective marketing lies in identifying the person/company requiring the produce/products and delivering it on time to the right person. This is possible only through identification of appropriate marketing channels.

6.2.2.6.1 Marketing channels for CNSL
Around 80 per cent of the CNSL produced in the country is consumed domestically, which is used for further processing into different forms by the end user industry. Marketing of CNSL in the domestic market involves very less number of intermediaries resulting in better price realisation for the same quantity and quality traded.
The distribution of CNSL is through their own network, the marketing of CNSL is mostly by direct marketing. The company agents who are located in different parts of the country send the requirement to the company and the producers respond to that requirement. The CNSL producer sells the produce directly to the company representatives where it is processed for value addition, some part of which is exported and remaining sold in the domestic market.

CNSL exports are mostly direct from the large producers/companies to the importing countries, procured by respective company agents in different countries.

**Fig 6.2.2.1 Marketing channels for CNSL**

**Channel 1**

Producer → Company Representative → Company for further processing → Export → Domestic Industry

**Channel 2**

Producer → Export

**Channel 3**

Producer → Pain industry, Automobile industry, Boat varnishers, Upcountry markets

**Channel 4**

Small producers → Local collecting agents → Company representatives → End users

6.2.2.6.2 Marketing channels for value added products of CNSL

In India there are large number of manufacturers of CNSL products spread throughout the country. These manufactured products are mostly used in domestic industries and only around 10 per cent of the production is exported to different destinations outside the country.
Marketing of CNSL products is also mostly direct marketing from producers to the end user industry. However, there are some commission agents also acting as collecting agents of CNSL and selling the same to the end users who are into value addition of CNSL. There are only a few commission agents in this field handling a very minimal quantity of the produce.

There is no frequent shift in buyers and the market is almost steady both for CNSL and CNSL products. The demand shift is almost negligible, as the requirement of the produce by different end users is stagnant.

Fig 6.2.2.2 Marketing channels for value added products of CNSL

Channel - 1

Producer of cardanol, CNSL resins & residol — Company representatives

Channel - 2

Producer of cardanol, CNSL resins & residol — Commission agents — Company representatives

Channel - 3

Producer of cardanol, CNSL resins & residol — End user: Paint industry, Automobile industry, Brake lining industry others...

Channel - 4

Producer of cardanol, CNSL resins & residol — Exporters

6.2.2.7 Trade aspects

6.2.2.7.1 Domestic market

On receipt of the purchase requisition from its customer, the CNSL manufacturer negotiates with its buyers for price, payment terms and other conditions. The goods are mainly traded on cash basis. Some trade also takes place on credit basis with the credit period varying from 30-90 days depending on the relationship with the customers. On successful completion of negotiation, the suppliers arrange for transportation by trucks. The product is usually packed in 200 kg Net. M.S.Drum.
6.2.2.7.1 b Major problems encountered in the course of domestic marketing are as follows:

- Unhealthy competition among buyers and sellers
- Trading activity is almost maintained secret among the sellers
- As CNSL is stored in drums it requires lot of space to store
- Loss due to leakage is prevalent
- Lack of steady and regulated market for these products
- The marketing system is not standardized and there are no standard terms of trade
- Industrial users are prone to ask for credit up to 60-90 days which usually gets extended further. This reduces the liquidity of the supplier and results in higher cost.
- Storage in drums for longer period may result in decarboxylation and self polymerization of CNSL. This results in corrosion of drums.

6.2.2.7.2 International market

6.2.2.7.2 a Main destinations

USA

Indian manufacturers/exporters have their agents in USA who solicits bids from importer/users of CNSL in USA. These offers are transmitted to their principals in India. If the business materialises, the agent in USA is entitled for a commission of 2 - 2.5 per cent of the invoice value for his services. The buyer of CNSL in USA after signing the sale contract opens an irrevocable banker’s letter of credit (bill of landing) in favour of the seller. Upon affecting the shipment of the lot so sold, the shipper/seller presents the documents to his bankers in India along with the letter of credit and he gets full payment from the Indian banks upon the strength of the letter of credit.

Japan and other countries

Generally, CNSL is sold directly to the buyers in Japan and other countries and no agent is involved in these dealings. The buyer after accepting the offer of the seller makes payment through banks negotiating the documents, including the bills of landing.
Shipments
Japan mostly imports CNSL in bulk quantities. At a time, a ship carries 300/350 tons of CNSL in ship tanks; this is also true for shipments to USA. Shipments to England are also in bulk but the ship tanks are bigger (500/700 tons). All other shipments are in barrels containing 200 kg of net CNSL.

6.2.2.7.2 b Problems encountered in the course of international marketing:
The international marketing scene of CNSL is dominated by competition from Brazil. Brazil known for its quality supply has taken a major share of the Indian market especially in USA and West European market.

In the field of competition to Indian export, Brazil is followed by East African countries like Mozambique, Tanzania etc. forcing the Indian manufacturers of CNSL to move from Green Grass Lands (West Europe) to Land of the Rising Sun (Japan) and the Land of the Hermits (Korea)

6.2.2.7.2 c The reasons for the stiff competition by Brazil and East African countries can be attributed to the following points:
• Freight charges:
This is the major factor affecting the hold of the Indians in the international scene. Since Brazil and East African countries are nearer to USA and Europe, freight charges on export of CNSL is very less compared to the Indian freight charges. The difference in Indian and Brazilian freight rates to USA amounts to approximately around US$200 per ton of CNSL. Because of lower freight charges Brazil is able to sell CNSL at a lower price than that of Indian exporters.

• Time factor:
The time factor also plays a lead role in exploiting the Indian manufacturers. As Brazil is nearer to USA and Europe, the CNSL can be sent to these countries within 8-10 days where as it takes about 40 days from India.
6.2.2.8 Exports of cashew nut shell liquid and its products

6.2.2.8.1 World trade

Cashew nut shell liquid is being exported since a long time. Brazil is the largest player in the global CNSL market having the domestic production of around 40,000 tons annually. India stands second followed by Vietnam. The major designations are spread throughout the world. North America is the largest importer and imports about 50,000 tons, followed by Asia with about 33,000 tons.

Table 6.2.2.4 World CNSL imports during 2003-04

<table>
<thead>
<tr>
<th>Destinations</th>
<th>Quantity (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>30000</td>
</tr>
<tr>
<td>South America</td>
<td>8000</td>
</tr>
<tr>
<td>Europe</td>
<td>9000</td>
</tr>
<tr>
<td>Asia</td>
<td>33000</td>
</tr>
<tr>
<td>Total</td>
<td>79000</td>
</tr>
</tbody>
</table>

Source: Trade Source

World supply position and proximity of countries govern exports markets of CNSL, as freight charges increase with distances. India’s exports to western countries are hampered by freight charges as Brazil, Mozambique supply CNSL at cheaper rates due to lower freight charges incurred by them in transit. India is in a comfortable position only with respect to Japan and Korea.

6.2.2.8.2 Indian trade

In the World trade of CNSL and its products India faces tough competition from Brazil, Vietnam and other CNSL producing countries with respect to price, quality and proximity. The exports of CNSL and its products from India has increased from 265 tons in 1998 - 99 to more than 8,000 tons in 2003 – 04 and the value has increased from 1.1 million rupees to 10.45 million rupees. Indian exports in the year 2003 – 04 is around 6,250 tons of CNSL, 2,000 tons of Cardanol and 124 tons of Recidol.

Earlier CNSL and its products were exported through Mumbai, Chennai, Calicut, Mangalore and Cochin. However from 2002 - 03 exports were witnessed only from
Cochin and Mangalore. Out of the total quantity of 8350 tons exports of CNSL and its products from the country, Cochin port accounted for 90 per cent while Mangalore accounted for 10 per cent of the total exports.

Companies exporting CNSL and its products have changed over the years. M/s Golden Products contributed for more than 10 per cent of the total exports from the country during 1998-99 and 1999-00. However the company’s contribution during 2000-01 and 2001-02 was negligible. M/s Vijayalakshmi who entered the CNSL export trade during 1999-2000 and have grabbed the major share. Currently during 2003-04 the company is contributing more than 60 per cent of the exports from the country. M/s Satya Cashew had a major share of 75 per cent in the total exports during 1998-99 while currently share has declined to 5–10 per cent. However the company has now entered into exports of valued added products of CNSL.

The major export destinations are USA, Canada, Japan, Korea, and European countries. Around 64 per cent of the exports is to USA from Cochin port followed by European countries accounting for 17 per cent of the exports mostly from Chennai and Cochin port. The exports to Republic of Korea and Japan account for 11 and 3 per cent of the total, respectively from Mangalore and Cochin ports.

6.2.2.8.3 Reasons for less exports of CNSL

India has great potential for exporting CNSL and its products. Due to certain reasons India has not been able to export CNSL and its products to its fullest potential. Some of problems faced in export of CNSL and its products are:

- Stiff competition from Brazil manufacturers who due to mechanised system are able to produce CNSL of better quality. Due to their geographical proximity to the US market (largest buyer of CNSL in the world) Brazil is able to sell CNSL at cheaper price than India. The freight and other charges being higher, the Indian CNSL manufacturers are not able to compete with Brazil.

- The shipment for international market is bulk in nature and therefore large quantities of CNSL is required for single shipment. It is difficult for any single manufacturer to be able to supply this large quantity. Moreover, if a manufacturer stocks for
international requirements he will lose the opportunity to sell in the domestic market.

- Quality is an important factor to be considered for a good exporter. There is no quality consistency among the manufacturers. Once a cargo is rejected because of poor quality, it is very difficult to get back those international buyers.

### 6.2.2.9 Research on CNSL and its products

Cashew is an everlasting product at least as long as the cashew tree is there; similarly CNSL is a product, which will exist along with cashew. The research on CNSL focuses on broad range uses of this product. Even though other substitute products are available, CNSL has gained a great deal of demand in the world market, as production of this is pollution free, environment friendly and most important is the fact that CNSL is a renewable resource. Research on Cashew Nut Shell Liquid dates back to 1960's in India. The research in this aspect is done by the various Central Research Organisations located in different parts of the country. The major Research Organisations that have done research on CNSL or are currently doing research are:

- Regional Research Laboratory (RRL), Trivandrum
- National Chemical Laboratory, Pune
- Indian Institute of Chemical Technology (IICT), Hyderabad
- Ravenshaw College, Cuttack
- Indian Institute of Technology (IIT), Kharagpur

However, among these organisations RRL, Trivandrum is actively continuing research on CNSL based products and its uses funded by various industries (M/s Sundaram Brakelinings, M/s Vijayalakshmi Cashews, M/s NICO Corporation) and Government Organisations (Department of Science and Technology, New Delhi, Cashew Export Promotion Council, Indian Space Research Organisation).

IICT, Hyderabad is not doing any research any more due to lack of funding agencies, but had done research on applications and properties of CNSL during 1970's. They have expressed their willingness to do research for any organisation on request.
Regional Research Laboratory (RRL), Trivandrum

Regional Research Laboratory (RRL), Trivandrum has developed many new and innovative speciality polymer products and processes from natural resources like Cashew Nut Shell Liquid (CNSL), which possesses the following unique properties as indicated by Indian Standard Specifications IS:840 (1964).

Table 6.2.2.5 IIS specification for CNSL

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity at 30°C</td>
<td>0.95 - 0.97</td>
</tr>
<tr>
<td>Viscosity at 30°C (cps)</td>
<td>550 max</td>
</tr>
<tr>
<td>Moisture (% by wt)</td>
<td>1.0 max</td>
</tr>
<tr>
<td>Matter insoluble in toluene (% by wt)</td>
<td>1.0 max</td>
</tr>
<tr>
<td>Loss of weight by heating (% by wt)</td>
<td>2.0 max</td>
</tr>
<tr>
<td>Ash content (% by wt)</td>
<td>1.0 max</td>
</tr>
<tr>
<td>Iodine value gms of I₂ per 100gm</td>
<td></td>
</tr>
<tr>
<td>Wij's method</td>
<td>250 min</td>
</tr>
<tr>
<td>Catalytic method</td>
<td>375 min</td>
</tr>
<tr>
<td>Polymerisation time - Time in min - max</td>
<td>4.0</td>
</tr>
<tr>
<td>Viscosity</td>
<td></td>
</tr>
<tr>
<td>at 30°C (cps)</td>
<td>30</td>
</tr>
<tr>
<td>after acid wash</td>
<td>200 min (at 30°C) (cps)</td>
</tr>
</tbody>
</table>

Note: min - minimum, max - maximum, I₂ - Iodine

Source: RRL, Trivendrum

Some of the novel process developed by RRL to manufacture value added multi-purpose resin called "Anorin" and their derivative products from CNSL are: Process know-how for manufacture of Anorin - 38 used as wide spectrum flame retardant for plastics and elastomers and thermoset flame retardant resin for composites; Anorin - 35 used as thermoset flame retardant resin for brake linings and composites and adhesive in wood and plywood; Long life low fade friction material possessing improved thermal stability based on modified CNSL resin; Anor dust also called friction dust from Anorin – 35 which is low fade friction modifying material with improved thermal stability for use in brake linings; Anorin – 44 which is wide spectrum flame retardant for plastics and elastomers and thermoset flame retardant resin for composites; Low smoke flame retardant EVA cable material; Cardanol and conversion of Recidol into friction dust; A transparent resin from CNSL. (The technology transfer of each of the above-developed products is available at RRL, Trivandrum at stipulated cost)
CNSL and its distilled product viz., Cardanol are the important sources of raw material that possess structural properties, which can be profitably processed into industrially useful products. The Anorin series viz., Anorin - 35, 38, 44 and 53 are multipurpose resins made by phosphorylation or bromination reactions by adding phosphorus or bromine into CNSL. These resins can be used as wide spectrum flame retardant and adhesives in composites and brake linings. However, Anorin - 53 can be used as wide spectrum flame - retardant resin only. Anorin - 35, 38 and 44 are made as pre - polymers, which can be processed into thermoset products by eliminating certain in - process hurdles such as blooming, migration and leachability that are generally associated with flame retardants. Maximum storage life of most of these pre - polymers is six months beyond which it becomes a lump and unstable.

Flame - retardants are generally used in additives or reactive materials to control flammability of polymers. It is estimated that about 500 to 1000 tons of flame - retardants are consumed every year worldwide to protect life and materials. Conventional flame - retardants have many limitations like: Inorganic flame retardant gets leached out by water and migrates to the surface during storage; Organic flame retardant like chlorinated paraffin bloom while in use; Brominated flame retardant, which is a recent development, is very expensive; A specific flame retardant is required for a specific application ruling out universal application.

Such limitations are overcome by use of wide spectrum flame retardant. Polymer compounds possessing hydrophobic and hydrophilic groups in the same molecules are supposed to be compatible and mixable with wide spectrum polymers. When flame retardant groups are introduced into molecular structures of polymers, the resultant materials exhibit properties like non - migrating and water insolubility in addition to cost effectiveness. For example, long chain hydrocarbon phenols such as CNSL are uniquely found to possess all such properties.
9.2 CNSL Products

CNSL

- Heat treatment
  - Treated CNSL
    - Vacuum distillation
    - Phosphorylation & Polymerisation
      - Bromination
        - ANORIN 53
          - Flame retardant for plastic composites etc.
        - EVA + Additives
        - FRLS EVA Cable
    - Phosphorylated CNSL, Prepolymer (ANORIN 53)
      - Bromination
        - ANORIN 44
          - Flame retardant, Ablative
    - Adhesive,
      - Friction dust,
      - Brakelining,
      - Concrete leak proofing,
      - Foundry core oil,
      - Multifunctional additive for NR

- Cardanol
  - Liquid crystalline polymer,
    - Acrylic coatings,
    - Dopants for conducting polymers etc..

- Residol
  - Friction dust,
  - Epoxy resin,
  - Plasticizer
CASHEW KERNEL & ITS PRODUCTS