CHAPTER – I
DESIGN AND EXECUTION OF THE STUDY

1.1 INTRODUCTION

Coconut is one of the most valuable gifts of nature to mankind. The every part of a coconut tree has its own use or applications. It is generally called “Tree of Heaven”, “Tree” of Abundance”, “Tree of Life” and kalpavriksha”.

Historically, in the medieval period the coconut was known as Nux indica, the Indian nut, during the same period it was also referred as Nargil tree, “the tree of life”. Western literature mentioned the Malayalam name “Tenga” for the coconut palm which related to Tamil ‘Tennai’ and believed to have been introduced from Sri Lanka. Its geographical dispersion around the world was aided by waves of sea, travelers migrating and trading between homeland countries and even to more distant Islands, from Asia to American coasts. Botanically, the coconut palm is a monocotyledon and belongs to the order Arecaceae, family Palmae and the specie is known as Cocus nucifera Linn.

Since ancient times, coconuts are ceremonially associated with workship of Gods and Goddess in Hindu religion. Its antiquity in Indian mythology is well established from its mention in Kishkinda kand and Coconut Tree Aranya kand in Valmiki Ramayana. References also have been mentioned on coconut in Raghuvamsha of Kalidasa and Sangama literature. Coconut, in its natural form, decorated with gold or silver formed a part of offerings on many religious occasions and social gatherings. The coconut is a benevolent crop and a perfect gift to mankind. It has during the span of history represented not only the source of food, beverage, oil seed, fibres, timber and health products but also
associated with magic, mystery, medicine and omen in the life of people. The coconut palm tree provides clothing, utensils and dwellings and therefore, remains an important source of earning livelihood to the inhabitants of the coconut producing states in costal areas. The inhabitants therefore, affectionately eulogized the coconut plant with reverence as “Kalpavriksha”, because of its manifold virtues. Even today the omen and mystery of coconut symbolism appears in day to day life of people and therefore this nature’s most precious gift continue to be explored, scientifically, economically and artistically in the world traditions to adorn coconut.

Among the oilseed palm trees, coconut palm hardly needs any emphasis on its multi-utility significance. The economic importance of this tree crop is evident from the fact that it is grown in more than 90 countries across the world in an area of 14.231 million hectares producing about 57.514 billion nuts or 10.52 million tonnes of copra. However, Philippines, Indonesia, India and Sri Lanka account for 78 per cent of the area and production.

India ranks third on world coconut map and in recent times became the largest producer of coconut with the production of 16.9 billion nuts from average under plantation of about 1.89 million hectares. Even though India is among the largest producer of coconut with a distinction of having the highest productivity of 7779 nuts per hectare as against 3630 nuts per hectare in Indonesia and 3859 nuts per hectare in Philippines, the per capita annual availability of coconut estimated to have been 10 nuts only which is quite low compared to 222 of Philippines, 145 of Sri Lanka and 55 nuts of Indonesia.
The most important and economically valuable produce of coconut palm is its fruit popularly known as ‘nut’. It is made up of an outer exocarp, a thick fibrous fruit coat known as husk; underneath lies the hard protective endocarp or shell. Lining the shell is a white albuminous endosperm or ‘coconut meat’ and the inner cavity is filled with a clear sweet refreshing liquid called ‘coconut water’. The kernel of a matured nut is the most precious product used for edible purpose. The dried kernel or copra is the richest source of edible oil and a by-product coconut oil cake, a source of vegetable protein used as an ingredient for livestock feed. The shell as such is used for fuel purpose, shell gasifier as an alternate source of heat Coconut fruit energy, making handicrafts, ice-cream cups and other commercial products like shell powder, shell charcoal and activated carbon. The husk yields fibres, which is converted into coir and coir products viz., coil carpets, coir geo-textile, coir composite, coir safety belts, coir boards, coir asbestos and coir pith. Coir pith a secondary by product obtained during defibring process is used as soil conditioner and mending all types of soils. The spongy nature of pith helps in disintegration of clay soil and allows free drainage. Its sponginess helps to retain water and oxygen and also prevents loss of vital nutrients from soil.

The food processing sector has not paid due attention to diversification and value addition to coconut, coconut products and by products. The coconut processing therefore traditionally remained confined to copra production, oil extraction, manufacturer of desiccated coconut, coir and coir products.

Even though, India is the third largest coconut growing country in the world, its contribution to international market remains insignificant. Inspire of the slow growth in coconut industry, all round efforts made for integrated development of coconut sector in the areas of production,
processing and marketing after establishment of a statutory body, the Coconut Development Board, by the Government of India in the year 1981, are appreciable. During past two decades the coconut plantation crop has received ample research and development attention in the country and the result of these consorted efforts are well exhibited in terms of increase in area, production and productivity of coconut in the country. In view of the changed scenario in the coconut sector, it was felt necessary to revise the report on production and marketing of coconut and make fresh appraisal of the changing pattern of coconut production, trade and its ancillary industries.

Coconut servers as a veritable source of food and drinks to millions of people in the tropics. The coconut crop is gaining significance as a fibre crop, beverage and a medical crop. It is a traditional plantation crop grown in India for the last 3000 years

The coconut Palms (Cocos nucifera Linn.) is supposed to be one of the five legendary Devavrikshas and is known as Kalpavrikshas-the all giving tree-in Indian classics. All part of the coconut palm are used in some way or another in the daily life of the people of the coconut growing countries in the world. Its fruits is called lakshmi phai and is used in social and religious functions in India irrespective of whether coconut palm is locally grown or not.

Coconut is grown in more than 86 countries worldwide, with a total production of 54 billion nuts per annum. India occupies the premier position in the world with an annual production of 13 billion nuts, overtaking Indonesia and the Philippines, the other two prominent coconut-growing countries.
The coconut palm is a versatile tree crop, grown can match coconut palm in its versatility. It provides nutritious food and a refreshing drink, oil for edible and non-edible uses, fibre of commercial value, shell for fuel and industrial uses, thatch, an alcoholic beverage, timber and a variety of miscellaneous products for uses as domestic fuel. The palm is amenable to both plantation and homestead management and it can be either a major crop or a minor one in a homestead grand of mixed crops. While responding favorably to scientific management, the palm also tolerates negligent farming to a certain extent. Thus, it can adapt to the divergent farming situations and management practices that are prevalent in the different agro-climatic regions.

The coconut palm exerts a profound influence on the rural economy of the many states where it is grown extensively and it provide sustenance to more than 10 million people. The export earnings derived by India from coconut are around Rs.3000 million, mainly through the export trade in coir and coir goods. The processing and related activities centered on the crop generate employment opportunities for over two million people in India. The contribution of coconut oil to the national edible oil pool is 6%. In addition, the crop contributes Rs.7000 Crores annually to the Gross Domestic Product (GDP). It is no wonder coconut culture is spreading even to non-trational belts that were, until recently, considered unsuitable for the purpose.

In India, coconut is cultivated mainly in the costal track of Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Orissa, West Bengal, Pondicherry, and Maharashtra and in the islands of Lakshadweep, Andaman and Nicobar. Of late, coconut cultivation has been introduced to suitable location in non-traditional states including Assam, Gujarat, Madhya Pradesh, Rajasthan, Bihar, Tripura, Manipur, and Arunachal Pradesh and in the hinterland regions of the coconut growing states.
Kerala in the main coconut growing state with an area of 10.20 lakh hectares and production of 5910 million nuts, followed by Tamil Nadu (3.20 lakh hectares and 3716 million nuts), Karnataka (2.87 lakh hectares and 1493 million nuts) and Andhra Pradesh (0.95 lakh hectares and 780 million nuts). These four southern states together account for 90% of the total production in the country.

The productivity too, India ranks number one among other coconut growing countries in the world. The average productivity of coconut in the country is 6898 nut per ha. Among the four major coconut growing states, Tamil Nadu has the highest productivity (11 620 nuts/ha), Andhra Pradesh has productivity of 8296 nuts/ha, followed by Kerala (5793 nuts/ha) and Karnataka (5204 nuts/ha).

There are mainly two varieties of coconut: tall and dwarf. In addition, hybrids of various combinations have also evolved. The tall cultivar is extensively grown throughout India, while the dwarf is grown mainly for parent material is hybrid seed production and for tender coconuts. The tall cultivar grown along the east cost is called East Cost Tall.

Benaulim is the tall variety in Goa and coastal maharashtra. Laccadive Ordinary, Laccadive Micro, Tiptur Tall, Kappadam, Komadan and Andartian Ordinary are some of the tall varieties grown in the country and chowghat Dwarf Orange, Malayan Yellow Dwarf and Malayan Orange Dwarf are some of the dwarf cultivars grown in India. Gangabondam is a dwarf type grown in certain tracts of Andhra Pradesh. Many hybrid combinations of tall and dwarf cultivars that have evolved also grown in the country.
Coconut possesses the unique characteristic of allowing any crop combination in the inter-spaces. A well-spaced coconut garden provides adequate inter-spaces where it is possible to grow a variety of crops, both seasonal and perennial. When annuals or seasonal crops are grown in coconut holdings it is designated as inter-cropping; when perennials are grown it is called mix cropping. A combination of inter-crops raised together are referred to as a multi-stored cropping system.

In widely spaced gardens the shade from the coconut palms is not intense enough to prevent the growth of other crops. During the pre-bearing period, especially up to three years after planning, the entire area could be made use of because of the negligible shade effect. As the palms grow there is a progressive increase in the shade coverage produced by the crown for up to 20 years. Depending on the age of the palms and canopy coverage suitable crops, or a combination of crops, could be selected for growing in the gardens. The common inter-crops that could be grown during the pre-bearing or the early stage of the growth palms are pineapple, banana, groundnut, chilies, tapioca, sweet potato and other root crops. In addition, cocoa, pepper, cashew, fruit trees could be grown as mix crops.

Coconut crops are susceptible to various disease and pest attack. The major pests to coconut in India and rhinoceros beetle, red palm weevil, leaf-eating caterpillar and rats and major disease are root wilt, Thanjavur wilt/ganoderma, tatipaka, but root, leaf root, stem bleeding and crown chocking. Of these, root wilt, prevalent in Kerala, is century old disease. Effective control measures are yet to be developed for root wilt disease in kerala; Thanjavur wilt/ ganoderma disease in Tamil Nadu and Karnataka; and titapika disease in Andhra Pradesh. However, the disease can be kept under control by adopting the recommended of practices.
Of the total production of coconut, about 5% is consumed in the tender form for drinking purposes. The rest is utilized as mature nuts for household and religious and for the production of edible copra, milling copra and desiccated coconut. Coconut oil production in the country is nearly 4.5 lakh tones. Of this 40% is consumed for edible purposes, 46% for toiletry uses and 14% for industrial uses.

The emphasis given by the Coconut Development Board to evolving technologies for the development of new value added products has yielded result and this product diversification and by-product utilization has recently gained momentum. Various research programmers sponsored by the board through the existing research institutions in the country, have led to the development of new technologies for the manufacture of coconut cream, spray dried coconut milk powder, preserved and packed tender coconut water and coconut water based vinegar. Commercial production units have started in various part of the country with the technologies developed so far.

The research on coconut in India is being carried out by the institutions under the Indian Council of Agricultural Research and the State Agricultural Universities located in different coconut growing states. Research on post harvest processing of coconut is also undertaken by the institutions under the CSIR. The board has a programmer to sponsor research on post harvest processing of coconut through such research institutes. The institutes under the Coir Board mainly undertake the coir research.
Coconut development programmers in India are mainly carried out by the coconut Development Board, which was established in 1981. The board’s schemes are either implemented directly or through the Development of Agriculture/Horticulture of the states and union territories. The state governments also implement their own programmer to suit the local needs. The board functions under the administrative control of the Ministry of agriculture, Government of India with the Chairman as the chief executive. The coconut Development Board Headquarters is in Kochi in the state of Kerala and in order to implement and monitor various developmental projects, the board has established field offices in various part of the country.

Coconut is a crop with unique features. Owing to its versatile uses, the demand for coconut and its products has been on the increase. The crop is spreading fast even to the interior tracts and the north and northeastern parts of the country gaining national acceptance. Having already attained the premier position in the world, Indian’s thrust now shall be to exploit the wealth potential of the crop in all respects. Moreover coconut is an eco-friendly crop which permits coexistence of multi-species plants. It enriches soil fertility in association with other crops and is quite amenable to organic farming if appropriate intercrops are grown in the inter-spaces. Due to multifarious uses, the future of the crop is very bright irrespective of the locations where it is grown in the world.

The coconut industry is one of the country’s major pillars in employment generation and foreign exchange earnings. However, local production problems, the expansion in coconut hectare of neighboring countries, and recent developments in biotechnology research on other
competing crops that have high lauric oil content might affect bits long
term sustainability and viability. In a highly liberalized global trade
environment, innovation and creativity in the country’s coconut industry
are needed for survival (Boceta, 1997). The Asian and Pacific Coconut
Community (APCC) is an intergovernmental organization organized in
1969 under the aegis of the United Nations of the Economic and Social
Commission for Asia and the Pacific (UN-ESCAP). The APCC has 17
coconut producing member countries accounting for over 90% of world
coconut production and exports of coconut products.

The APCC (Asian and Pacific Coconut Community) member
countries include: (Federated States of Micronesia, Fiji, India, Indonesia,
Jamaica, Kiribati, Malaysia, Marshall Islands, Papua New Guinea,
Philippines, Samoa, Solomon Islands, Sri Lanka, Thailand, Tonga,
Vanuatu and Vietnam. Jamaica is an associate member of the APCC
(Asian and Pacific Coconut Community)

1.2 COCONUT MARKETING IN TAMIL NADU

Coconut (cocos nucifera) is one of the most important crops grown
in the humid tropics. More than 11 million farmers, mostly smallholders
with low income grow the palm in 90 countries. More than 80% of the
total world production comes from the Asia-pacific countries. Coconut
prices in Tamil Nadu, the third largest coconut producing state in the
country, are expected to rise by around 10-15% in the coming months due
to short supply and festival demand. According to the latest report
released by the Domestic & Export market Intelligence Cell (DMIC)
attached to Tamil Nadu Agricultural University (TNAU), farm level price
in Tamil Nadu would increase to Rs. 5-5.5 per nut during August-
September and the price is likely to move up further to Rs. 5.75-Rs.6 per
nut in October-November. The price outlook has been given as per the survey conducted in Pollachi (Tamil Nadu), a major coconut market in the country. The demand-supply gap in the Indian coconut market has widened as coconut area in Kerala has been shrinking in the past few years, trade sources said. Kerala tops in coconut production in the country with an area under cultivation of 0.87 million hectare.

1.3 COCONUT MARKETING IN THANJAVUR

The state government has constructed a coconut marketing complex at Pattukkottai in Thanjavur district at a cost of Rs. 4 Crores. The complex incorporates a drying yard, rest room for farmers to stay, a godown, shops for farms to sell coconut, a quality control wing, an administrative block, canteen and parking spaces and emerged as a full-fledged marketing complex. The complex constructed on 20 acres of land at Ponnvarayankadu near Pattukkottai. The coconut marketing complex is a boon for the farmers of Thanjavur area.

The Thanjavur district, coconut is cultivated on 68,000 acres by nearly 75,000 farmers. Two lakh farm laborers are also involved in coconut cultivation and production. The coconut farmers have been facing the problem of fluctuation in price for both the nut and copra, lack of facilities for converting the nut into copra and lack of storage facilities. The complex may help them in solving these problems. The complex provides a solar drier and machine drier facilities to the formers. The state government is procuring copra from the formers through Co-operatives. Pattukkottai Agriculture Produce Co-operative Sales Society is procuring copra from the farmers now. Identity cards have been issued to them. Now the farmers can sell their produce at the coconut marketing complex.
1.4 USE OF COCONUT

Major coconut production in the country primarily is in demand from consuming states for traditional products viz., matured nuts, tender coconut water, coconut oil, desiccated coconut, oil cake and coir products. Nearly 90 percent coconut production is directed for traditional use in domestic markets. The most important traditional commercial product traded in the country has been the coconut oil. Therefore, the demand and supply of this single coconut product determines the price of raw coconut. Moreover, the market share of coconut oil both in domestic and export market is declining due to tough competition, especially from palm and soybean oil prices.

The cost of production of the traditional coconut products in the country has been so high that price-wise, the Indian coconut product are less competitive in global market. Its contribution to export market has therefore been in significant except the coir and coir product.

In India, product diversification of coconut was accelerated in late nineties due to sustained efforts made by Coconut Development Board by employing technology development through reputed Research Institutions in the country. The marketable value added products includes packed tender coconut water, coconut milk and milk based products, coconut chips, coconut based dairy products, desiccated coconut, coconut water based products, snowball-tender-coconut, vinegar, coir based products, coconut shell and coconut wood based products. Other products, which are being subjected to research and development, are organic food, oleo chemical, bio-diesel, bio-lubricant and cosmetics.
The Government of India, through the Coconut Development Board made strategic efforts and motivated entrepreneurs industrialist and artisans to exhibit their products in national and international trade fairs and exhibitions, to get better access to up country markets. Coconut shell and wood based products viz. handicrafts and utensils certainly have aesthetic utility and value. It has been observed that these products have good demand for export too.

In the development process of coconut, about 12 months Plate – 18 period lapses between the emergence of inflorescence and complete maturity of the fruits and at one point of time palm carry 12 or more bunches of coconut at successive stages of development, each representing growth interval of about a month. In the development process the fruit reaches it maximum size normally in the 6 months and filled with nut water throughout this period. The water of tender coconut is technically called as liquid endosperm. The kernel starts forming Packed Tender Coconut water as a thin soft layer in 6 months and increases in its hardness and quantity till the end of maturity. With the increase in thickness of kernel the internal cavity gets reduce in size and decrease in quantity of nut water as the nuts ripen. The chemical composition and volume of nut water changes during maturation. The coconut water plays an important role in bio-synthesis of fat in the kernel and also the development of the germination of the nuts.

The water of tender coconut is the most nutritious, wholesome beverage that nature has provided. It has calorific value of 17.4 per hundred gms, with the normal PH between 4.9 and 5.2.
Sugars are important constituents of tender coconut water found in maximum concentration of about 5 to 5.5 percent in early months of maturation and slowly reduces to 2 percent at the stage of full maturity of nuts. In early stages of maturity glucose, fructose and sucrose are found in the coconut water. In the fully matured nuts approximately 50 percent of total sugar is sucrose.

The tender coconut water contains most of the minerals such as potassium, sodium, calcium, phosphorous, iron, copper, sulphur and magnesium. The tender coconut water being rich in potassium and other minerals is of immense the rapeutic value as di-uretic and is considered curative for hypertension. It is rich in vitamin C (ascorbic acid) content and other vitamins of ‘B’ group.

The snow tender kernel of tender coconut is a delicious dessert. Traditionally, the kernel of tender coconut is sometimes consumed after drinking the water by the consumer or else the ball is thrown away. The tender coconut water along with tender coconut kernel without husk is produced and named as snow ball tender coconut.

Coconut water can be converted into vinegar by using vinegar generator assembly which comprises a feed vat, an acidifier and a receiving vat for collection of vinegar. The mature coconut water consisting of about 3 per cent sugar content is concentrated to 10 per cent level by fortifying with sugar. The fortified coconut water is then fermented by inoculating the solution with *Saccharomyces cerevieae*. After alcohol fermentation is completed for about 4-5 days, the clear liquid is siphoned off and inoculated with mother vinegar containing aceteobacter bacteria. Vinegar is used as preservative in pickle industry and flavouring agent in many food products. It has been reported that the natural coconut vinegar enjoys consumers Preference over synthetic vinegar when available in the market.
1.5 COCONUT MILK:

Coconut milk is a product extracted from the endosperm or kernel of coconut and constitutes into an emulsion of coconut oil in water, stabilized by proteins and probably by some iron found in oil water interface. The coconut milk has a pleasant sweet and agreeable flavor. It is an ingredient in many household culinary viz., fish, shell-fish, meat, poultry and vegetable dishes confectionaries, sweets and as substitute of dairy cream in beverage type milk, evaporated sweet condensed milk, cheese, yoghurt and many other types of preparation.

The Central Food Technology Research Institute, Mysore, has developed the technology for commercial production of spray dried coconut milk.

The product is developed from the matured coconut kernel after removing the moisture content of the kernel through osmotic dehydration using various osmotic pressures techniques. The dehydrated coconut chip in ready-to-eat form can be used as snacks.

1. Fresh Dry Processed / Wet Milling Route – Involves de-shelling the coconut meat manually or by machine – splitting and slicing the de-shelled meat – washing – grinding or wet milling – drying the particulates coconut meat – extracting the oil using screw type press to produce virgin coconut oil. Virgin coconut oil and food grade medium fat coconut flakes. The flakes are ground to produce coconut flour.
2. Fresh Dry Processed / Desiccated Coconut Route – The processed involve all the steps desiccated coconut viz., de-shelling, paring, washing, grinding blanching and drying except sulphite treatment and then extracting the virgin coconut oil using screw type press.

3. Fresh Dry Processed / Graded Coconut Route – It involves splitting the nut grating – blanching and drying the coconut meat and extracting the virgin coconut oil using screw type press.

4. Low Pressure Oil Extraction or Intermediate Moisture Content Method – It involves splitting the nut – grating the meat to find particles – drying to the level of moisture content of 10 to 12 per cent of extracting the virgin coconut oil using a manually operated press.

<table>
<thead>
<tr>
<th>Contents of Virgin Coconut Oil</th>
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<tbody>
<tr>
<td><strong>Total Fats</strong></td>
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<tr>
<td><strong>Sturated</strong></td>
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<tr>
<td><strong>Mono-unsturated</strong></td>
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<td><strong>Poly- unsturated</strong></td>
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<tr>
<td><strong>Lauric Acid</strong></td>
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<td><strong>Myristic Acid</strong></td>
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<td><strong>Caprylic Act</strong></td>
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<td><strong>Palmatic Acid</strong></td>
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### Coconut products and By-products:

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<tr>
<th>Sl. No</th>
<th>Principal Edible Product</th>
<th>Products by Products and Value Added Products</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Products from Inflorescence SAP.</td>
<td>(i) Sugar/Jaggery (ii) Beverage(Boiled Sap) (iii) Toddy (fermented Sap) (iv) Coconut Wine (v) Neera( Fresh Sap) (vi) Vinegar (vii)</td>
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<tr>
<td>2.</td>
<td>Immatured coconut kernel in Syrup</td>
<td>(i) Coconut Jam (ii) Puddings / Ice cream</td>
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<td>3.</td>
<td>Matured Coconut</td>
<td>(i) Desiccated Coconut (ii) Partially De-fat Coconut Powder (iii) Rosted Coconut Paste (iv) Coconut Chips (Sweetened Chips) (Sliced Coconut) (v) Ball Copra (vi) Cup Copra (Coconut flour) (vii) Coconut yoghurt / Ice cream (viii) Fresh Coconut gratings (ix) Dehydrated edible coconut meat (x) Coconut oil / Virgin Coconut oil</td>
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<td></td>
<td>Products from coconut milk</td>
<td>(i) milk powder (Dehydrated Milk) (ii) Coconut milk / Syrup (iii) Coconut spread / Cheese (iv) Coconut honey/ candy (v) Coconut skim milk beverage (vi) Sweetened Coconut skim milk blend (vii) Coconut protein (viii) Low/ High fat coconut jam (ix) Virgin Coconut oil</td>
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<td>4. Production from Coconut Water</td>
<td>Tender Coconut</td>
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<tr>
<td></td>
<td>i) Tender coconut water</td>
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<td></td>
<td>ii) Tender nut coconut water &amp; Coconut meat shake</td>
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<td></td>
<td>iii) Canned or pouchd tender coconut water</td>
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<tr>
<td>Matured Coconut</td>
<td>i) Coconut Water concentrate (Syrup) as flavored beverage on dilution</td>
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<tr>
<td></td>
<td>ii) Carbonated / Non carbonated coconut water</td>
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<td></td>
<td>iii) Nata-de-coco</td>
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<td></td>
<td>iv) vinegar</td>
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<td></td>
<td>v) Toddy</td>
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<td>5. Coconut Oil</td>
<td>i) Edible oil</td>
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<td></td>
<td>ii) Bio diesel / biofuel</td>
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<td></td>
<td>iii) Industrial oil</td>
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<td></td>
<td>iv) Cosmetics</td>
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<td>6. Virgin Coconut oil</td>
<td>i) Dietary oil</td>
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<tr>
<td></td>
<td>ii) Body Oil (Skin Can)</td>
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<td></td>
<td>iii) Body Cream / Lotion / Shampoo</td>
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<td>iv) Soap</td>
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<td></td>
<td>v) Pharmaceuticals</td>
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<tr>
<td></td>
<td>vi) Nutraceutical Products</td>
<td></td>
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<tr>
<td>Non Edible Products</td>
<td>i) Coir, Coir foam, Rubberized foam</td>
<td></td>
</tr>
<tr>
<td>1. Coconut Husk</td>
<td>ii) Coir Carpets / Mattresses</td>
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<td></td>
<td>iii) Coir Geotextiles</td>
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<td>iv) Coir Composite</td>
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<td>v) Coir pith briquette</td>
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<td>vi) High value Coir products safety belts</td>
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<td></td>
<td>vii) Coir Boards, Coir asbestos</td>
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</tbody>
</table>
2. Coconut Shell
   i) Charcoal
   ii) Activated Charcoal
   iii) Shell powder
   iv) Shell handicrafts
   v) Ice cream & beer cups
   vi) Shell gasified for alternate heat energy.

3. Coconut palm Wood
   i) Furniture
   ii) Doors
   iii) Panels (Wall & Floor)
   iv) Handicrafts

4. Coir Pith
   i) Organic Manure
   ii) Ornament plant growing pot
   iii) Coir pith briquettes
   iv) Coir chullah

1.6 COIR:

India is the largest producer of brown coir fibre and its production has been steadily increased during the last five years. Coir is one of the important natural, golden color, hard fibres extracted from the husk or fibrous mass (mesocare) covering the coconut. It is of great commercial interest and falls under the category of industrial hard fibres such as hemp, abucca, henequen etc. Coir has certain unique qualities, such as resistance to spoilage due to moisture and dampness. Coir fibres possess remarkable, durability to withstand physical strength and hence it is a renewable resource for manufacturing various floor covering and other coir products. In India coir fibres is extracted from coconut husk after retting in saline water and also by deploying mechanical method using fibre extracting machines. Mechanical extraction of coir fibre requires dry husk and is widely used in coconut growing states in the country owing to better realization of coir fibre, cost effectiveness and overall inadequate retting facilities. The white fibre sector has become stagnant over last few years, whereas the export requirement is mainly of white fibres products.
The coir industry is mainly concentrated in the coconut producing states viz., Kerala, Karnataka, Tamil Nadu and Andhra Pradesh in southern region and Orissa in the eastern region. The industry’s strength lies in the export oriented coir products manufactured in the country. It has been reported that there were 6531 functional coir processing units in the country. Out of which 5124 units in Kerala, 217 units in Karnataka, 262 in Tamil Nadu, 265 in Andhra Pradesh, 100 in Orissa, 75 in West Bengal, 5 in Maharashtra, 6 in Pondicherry and 3 in Goa. Consequent upon mechanization in coir processing sector in Kerala, production of brown fibre has increased many folds. A new retting process using coir ret, a bacterial culture developed through research by coir board has become popular in Karala. The fibre is called green husk fibre which is mixed with white fibre to make coir yarn and other products.

1.7 COIR PITH

Coir pith commonly known as coconut peat is the by-products of coir industry, which was hitherto considered as a waste material. Coir pith is converted in to briquettes for the purpose of easy transportation. It is easily composed to be used as an organic manure and soil ameliorant. ‘Pith plus’ a product developed by the Coir Board in collaboration with Tamil Nadu Agri University, is supplemented with urea is added to coir pith to make the manure.

1.8 COCONUT SHELL PRODUCTS

The coconut shell can be converted into very useful industrial products like coconut shell charcoal, activated carbon and coconut shell powder which have a market all over the world especially in Japan, South Korea, France, United Kingdom and USA. Coconut shell is a by-product of the coconut industry. It has been estimated that ever one to seven million tones of coconut shell could be salvaged per annum in the country but very small quantity of coconut shell is processed into useful products.
1.9 STATEMENT OF THE PROBLEM

Coconut is one of the traditional, prominent perennial crops associated with heritage, culture and economy of India for the last 3000 years. It is preferred and cultivated by all the categories of farmers irrespective of their land holding and economic and social status. Moreover coconut is closely coupled with the daily foodstuff of millions of people around the world. Amidst huge production and demand, coconut suffers with the bottlenecks of low level of production technology, high degree of pest and disease, land fragmentation, obsolete irrigation system conventional arrangements in marketing, unstabilized price; lack of proper financing institution etc.

Therefore there is a need to trace the evolution of coconut forming, describes botanical biology, variety of coconut trees, proper pest and disease control nutritional and health aspects of coconut, medicinal and industrial use of coconuts and its by-products and trends in coconut area and production in Tamil Nadu. Moreover it examines the production and marketing practices of coconut farmers and their perception about the present market functionaries, Marketing practices of market functionaries and it offers suggestions to surmount the existing marketing problems.

1.10 NEED FOR THE STUDY

The production and marketing scenario of coconut in the country has witnessed a phenomenal development, particularly in the field of production such as development high yielding dwarf varieties of crossbred coconut palm, traditional, non-traditional, commercial and industrial coconut product, it was decided to study the current status of developments that have taken place on production and marketing front of
coconut and its products in the country. Therefore, a fresh survey on production and marketing of coconut and coconut product in Tamilnadu was undertaken. This thesis makes an attempt to study the present scenario of coconut industry and the problems faced by the producers and traders involved in the marketing process of coconut and to focus on the inadequacies prevailing in the marketing system of coconut and coconut product in the country.

1.11 OBJECTIVES OF THE STUDY
The following are the main objective of the study

➢ To study the marketing practices followed by the coconut growers in the study area.
➢ To identify the overall performance of coconut production.
➢ To analyse the cost and return of marketing of coconuts.
➢ To examine the problems and prospects of coconut marketing.
➢ To offer suggestions on the basis of findings.

1.12 RESEARCH DESIGN
Methodology used in this study is of both qualitative and quantitative. However, participatory approaches were used for gathering information that was used in guiding the survey and enriching analysis and interpretation of the survey results. Both cases were simultaneously utilized to collect the required information. A simple cross-section survey design was applied to the collect the data, where households of the formers in the projected areas were given an equal chance of being selected for the survey.
1.13 SAMPLING

The validity of any research is based on the systematic method of data collection and analysis. The present study uses both primary and secondary data. The primary data have been collected from the formers cultivating coconut and their problems involved in the coconut marketing in the Thanjavur delta region. The size of the sample was 320 farmers.

1.14 PRIMARY DATA COLLECTION

The primary data for the study were collected through the questionnaire. The researcher met the formers and collected the required data from them. Published information from journals, newspapers, newsletters and websites were also obtained. The researcher interviewed 400 farmers in Thanjavur district, the respondents those who have given complete information were chosen for the study. The respondents those who given incomplete information were not included in the study.

1.15 SECONDARY DATA COLLECTION

- The secondary data are gathered from reference books, reports, journals, newspapers, other Ph.D., theses, internet and etc. in order to provide the academic theories.

- Secondary data used to support with the primary data, are collected from the chosen study on Indian coconut industry

1.16 POPULATION

The farmers in the Thanjavur district have been chosen as the population. The samples were drawn from this population.
1.17 FRAME WORK OF ANALYSIS

In order to study the farmers view in coconut marketing problems encountered by them, the questionnaire consisting of the 5 point rating scale has been adopted. “Strongly agree” denotes 5 points, “agree” indicate 4 points, “Neutral” indicates 3 points, “disagree” denotes 2 points and “strongly disagree” indicates 1 point. The analysis have been scaled on the basis of mean score value. The collected data were classified and tabulated with the help of computer programming. The collected data was edited, coded and classified. The views of the farmers on marketing problems of coconut were then analyzed by applying relevant statistical techniques.

1.18 SAMPLING METHOD

The stratified sampling method was employed for the purpose of this survey. First the population was divided into homogeneous sub-parts (strata), which were mainly the coconut farmers. The Thanjavur district was further sub-divided into divisions and locations. This method assisted in identifying the exact locations/ sub-location where the actual survey was to be conducted. In the selected areas, all the farmers were then interviewed.

1.19 DATA COLLECTION TOOL

The main tool used for the survey was questionnaire. Primary data was collected from farmers using two-structured questionnaire. One questionnaire was designed specifically for farmers only. The study was conducted in local language Tamil. The farmers were probed through simple questions found in the questionnaires. Information sought under these instruments related to annual production of various coconut-based products as well as earnings from these products, prices and quantities, cultivating practices, problems involved in coconut marketing of coconut.
1.20 PILOT STUDY

A pilot study was conducted with 80 sample farmers. On the basis of their views, certain scales and variables were modified. Item analysis was also applied. The significance of difference between item mean of the high score group was found by calculating “t” value, thereby retaining items which have the greatest “t” value. After the pre-testing the data from the Thanjavur delta region was analyzed with the major focus on problems encountered in getting information from the respondents and the ability to achieve the set goals. Finally all the questions that proved difficult to administer were revised according in lion with the findings of the pre-testing exercise while important information that was not captured in the pre-tested survey questionnaire(s) was included in the revised version.

1.21 DATA COLLECTION

The data collection exercise was carried out by me. The research instrument was a questionnaire pertaining to the subject matter of coconut marketing problems.

1.22 DATA PROCESSING

Data entry, processing and analysis were done using SPSS for windows (version 19.0) spreadsheet program and Microsoft Excel 2007. Descriptive statistics (frequencies, scores, mean, maximum, minimum) were determined. The actual processing and analysis started with data cleaning to remove the gaps and ensure consistency. In order to test the association between independent variables and dependent variables, chi-square test was applied ANOVA was applied to find the variation within samples and between samples.
1.23 PERIOD OF STUDY

Secondary data were collected for a period of TEN years from 2000-2001 to find out the production and marketing of coconut. Further, the primary data were also collected for the year of 2010-2011.

1.24 RESEARCH TOOLS USED

1.24.1 Factor analysis

Factor analysis is the statistical methods used to measure variability in a set of unknowns determined to be factors. It is measuring how factors contribute to the results of the unknown variable. Factor analysis begins with a large number of variables and then try to reduce the interrelationships amongst the variables to a few numbers of clusters or factors.

Factor analysis finds relationships or natural connections where variables are maximally correlated with one another and minimally correlated with other variables and then groups the variables accordingly. After this process has been done many times a pattern appears of relationships or factors that capture the essence of all of the data emerges.

1.24.2 Chi-squire

Chi-squire is a statistical test commonly used to compare observed data with data would expect to obtain according to a specific hypothesis. The shi-square (I)test is used to determine whether there is a significant difference between expected frequencies and the observed frequencies in one or more categories.
1.24.3 Regression analysis

Regression is the determination of statistical relationship between two or more variable. In simple regression two variables are used. One variable (independent) is the cause of the behavior of another one (dependent). When there are more than two independent variables the analysis concerning relationship is known as multiple correlations and equation describing such relationship is called as the multiple regression equation.

Regression analysis is concerned with the derivation of an appropriate mathematical expression is derived for finding value of a dependent variable on the basis of independent variable. It is thus designed to examine the relationship of a variable $Y$ to a set of other variables $X_1, X_2, X_3, \ldots, X_n$. The most commonly used linear equation in $Y=b_1 X_1+b_2 X_2+ \ldots + b_n X_n+b_0$.

Here $Y$ is the dependent variable, which is to be found $X_1, X_2 \ldots \ldots$ and $X_n$ are the known variables with which predictions are to be made and $b_1, b_2 \ldots b_n$ are coefficient of the variables.

1.24.4 The multiple correlation analysis

The multiple correlations is a linear relationship among more than two variable. It is measured by the coefficient of multiple determinations, denoted as $R^2$, which is a measure of the fit of a linear regression. A regression’s $R^2$ falls somewhere between zero and one (assuming a constant term has been included in the regression); a higher value indicates a stronger relationship among the variable, with a value of one indicating that all data points fall exactly on a line in multidimensional space and a value of zero indicating no relationship at all between the independent variables collectively and the dependent variable.
1.24.5 Discriminate analysis

Discriminate analysis is used to distinguish between margins and costs of various intermediaries’ for coconut marketing. Margins and costs of various intermediaries for coconut marketing are measured using 15 statements. Based on this opinion of the farmers, discriminate analysis is carried out to distinguish between margins and costs of various intermediaries for coconut marketing.

The tests of equality of group means measure each independent variable’s potential before the model is created. Wilks’ lambda, the F statistic and its significance level are presented.

1.25 RESEARCH HYPOTHESES

Hypothesis-1
There is association between gender and high fluctuations in market prices of coconut.

Hypothesis-2
There is significant difference between overall assessments of performance of variety of coconut and the age of the farmers.

Hypothesis-3
There is significant difference between mean ranks towards variety of soil conditions by the farmers in the Thanjavur delta region.

Hypothesis-4
There is significant difference between male and female with respect to overall coconut marketing problems.
Hypothesis-5
There is association between price received by the farmer and the years of experience of farmer.

Hypothesis-6
There is significant difference between mean ranks towards problems involved in the coconut marketing faced by the farmers in the Thanjavur delta region.

Hypothesis-7
There is significant difference between income groups of farmers with respect to overall coconut marketing problems.

1.25.1 Null Hypothesis:
There is no significant difference between income groups of farmers with respect to overall coconut marketing problems.

1.25.2 Alternative Hypothesis:
There is significant difference between income groups of farmers with respect to overall coconut marketing problems.

1.26 LIMITATIONS OF THE STUDY

• The present study is based on the reliability of the primary data the sample units were selected from the population having multidimensional features of a large group. The farmers cultivating the coconut in some villages of Thanjavur district for a period less than 5 years were not selected for the study.

• Since the farmers involved in the production and cultivation of coconut, agriculture farming, coconut fibre, are assumed to be
surviving and facing marketing problems. The samples are selected at random out of these selected areas of Thanjavur district. Therefore the findings are applicable to the areas from which the samples were drawn, not applicable for other areas.

• The farmers in the chosen area felt that there was an exploitation of coconut farmers by the marketing middlemen because of the credit marketing tie up of their commodity. Traders entice farmers short of cash to borrow money from them without interest. This means that the farmers were unknowingly paying for the interest. This system also creates an interdependence of prices which concentrates profit among buyers. Market knowledge and information, again to the disadvantage of the farmers, are taken from the traders themselves. These limitations are specific to the Thanjavur delta region where the study was carried out, not applicable for other areas.

1.27 CHAPTER SCHEME:

Chapter 1 This chapter deals with a general introduction and background of the study tracing the evolution of coconut marketing. Besides the above, this chapter gives a brief account of the marketing problems of coconut in India, Tamilnadu and Thanjavur. It also presents the significance of the study, statement of problem of the study, limitations of the present study, and finally outlines of the structure of the study.

Chapter II Gives a review of literature on coconut marketing in India and Tamilnadu. It also presents various important factors affecting the performance of the sector contained in works of
several researchers, identifies the gap in past research, outlines the objectives of the study, the previous empirical findings and models developed to analyze the efficiency and performance parameters and thoroughly examined.

Chapter III This chapter presents the socio economic characteristics of farmers living and production of coconut in and around Thanjavur delta region.

Chapter IV Is the marketing practices of coconuts in the study area.

Chapter V Examines an overview of coconut industry.

Chapter VI Deals the cost and return of the coconut marketing.

Chapter VII Is the problems and prospectus of marketing of coconut (an analysis and interpretation)

Chapter VIII Offers the findings, suggestion and conclusion of the study.