Chapter 2
International Scenario of Coconut Sector

P. Rethinam

Abstract Coconut, known as the 'tree of life', *Kalpavriksha*, 'tree of abundance' and 'nature's supermarket', cultivated in more than 94 countries worldwide, provides livelihood security to millions of people in the Asia and Pacific regions. The coconut industry, which traditionally relied upon copra and coconut oil and to some extent coir, is experiencing tremendous transformation towards product diversification, high-value product development, by-product utilization and more importantly as a health drink. This chapter provides an account of global market dynamics of organic coconut water, virgin coconut oil, functional foods and health drinks from coconut including neera, coconut sugar, cosmeceuticals, oleochemicals and biofuel/bio-lubricants in the consumers' market. India's domestic consumption and global export and import of coconut products such as coconut oil, copra meal/copra cake, fresh coconut, desiccated coconut, coconut milk, cream, milk powder, coconut shell charcoal, activated carbon, coir and coir products are also elaborated. Causes for low productivity in coconut across the producing countries and various strategic solutions for increasing production as well as approaches needed to face future global challenges to transform coconut industry into a successful venture are outlined. A brief description of global organizations promoting coconut industry such as APCC, COGENT and BUROTROP is also provided in this chapter.

2.1 Introduction

Coconut (*Cocos nucifera* L.), the 'tree of life', *Kalpavriksha*, 'tree of abundance' and 'nature's supermarket', has geographically spread around the world to even very distant islands from Asia to America aided by waves as well as through mariners migrating and trading between various countries. Coconut palms can be seen

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along the coast and in interior regions of almost all the tropical countries between the tropics of Cancer and Capricorn. Its wide distribution has been favoured by its usefulness, adaptability to different ecological conditions and ability to float in sea water and germinate on the coastal soils when washed ashore. Coconut has been used by human and their immediate ancestor species for at least half a million years as tender nut, dry fruit, source of food, drink, oil and wood as well as for shelter and aesthetic purposes (Foale 2003).

Health-promoting qualities of coconut milk and oil have been recognized in Ayurveda system of medicine for over 4000 years. There is a detailed mention of the functional properties of coconut in all classical Ayurveda texts called Samhitas. There are lot of ancient and present evidences to show that coconut is good for the health. But, unfortunately, the soya bean lobby defamed the coconut industry with false propaganda to promote soya oil. Now that the true facts have been realized, the demand for various products in the nonproducing countries has enormously increased which made the sunset coconut industry to a sunrise coconut industry.

Coconut water and neera are emerging as world health drinks, and the coconut water industry is growing as a multimillion dollar industry. Demand for coconut products as functional foods, functional drinks, nutraceutical, pharmaceutical and cosmeceutical products, etc. is growing at a fast rate. Coconut value-added products such as coir, coir pith, coir pith briquettes, grow bags, husk chips, geotextiles, shell charcoal, activated carbon, etc. are gaining importance and are now in huge demand because of their eco-friendly nature.

2.2 Global Coconut Scenario

As per the statistics of 2015, coconut is cultivated in more than 94 countries in the world in 11.988 million ha producing 67.04 billion nuts with a productivity of 5592 nuts ha^{-1}. Coconut is one of the major crops which provides livelihood security to millions in the Asia and Pacific regions, which together occupy more than 89.60% of global coconut area and 85.91% of copra production earning more than 1.08 billion US$ as export income.

Coconuts have, for a very long time, been an important crop in these regions and play an important part in the local economy and culture of not only for large producers such as the Philippines, India and Indonesia but also the Pacific Islands, where coconut palms are integral part to the livelihoods of many smallholders.

The area under coconut and its production have increased almost two times from 1969 to 2015. The overall global productivity remained mostly less than 1 mt copra ha^{-1} $year^{-1}$ which has to be substantially increased to provide sustainability. Over a period of about five decades, there was considerable increase in area and production from the initial period with no improvement in the productivity. Though the world area under coconut cultivation increased from 5.23 million ha in 1969 to 11.988 million ha in 2015, there is a gradual decline in total area from 2012 onwards. More or less the same trend was also observed in APCC countries which have a share of

Table 2.1 Area, production and productivity of coconut during various years

Country	2011	2012	2013	2014	2015
Area(million ha)					
World	12.035	12.241	12.225	12.195	11.988
APCC countries	10.793	10.988	10.975	10.928	10.733
Production of whole nuts					
World	65,381,223	71,851,535	69,909,092	68,505,812	67,041,674
APCC countries	56,307,021	63,835,154	61,736,420	60,180,632	58,783,273
Productivity (nuts ha^{-1})					
World	5433	5870	5707	5618	5592
APCC countries	5216	5810	5625	5507	5477
Productivity (Copra mt ha^{-1})					
World	0.910	1.001	0.995	0.952	0.958
APCC countries	0.846	0.970	0.960	0.910	0.916

89.5% of area and 87.7% of production (APCC 2015). The trend in area, production and productivity during various years is given in Table 2.1.

The trend in production of coconut as whole nut as well as copra equivalent is presented in Tables 2.2 and 2.3. Production of coconut in copra equivalent for top three countries (India, Indonesia and the Philippines) of the world is depicted in Fig. 2.1.

World area under coconut (Table 2.4) clearly indicates that no significant area expansion has taken place during 2010 to 2015 period. Therefore, any future efforts should focus on vertical expansion, by consolidation of coconut plantations, filling up of gaps, replanting and productivity increase. The trend in area under coconut cultivation in the world and APCC countries during 2011 to 2015 is given in Fig. 2.2.

Although coconut is widely dispersed in most of the tropical regions and grown in 93 countries in the world, out of 11.988 million ha of global area under this crop, close to ten million ha is contributed by only 4 countries, viz. Indonesia, the Philippines, India and Sri Lanka. These countries together contribute nearly 80% of the total area under coconut and its production in the world (Fig. 2.3).

As per the data available from APCC Coconut Statistical Yearbook 2015, Indonesia is the largest coconut-producing country with an area of 3.57 million ha and production of 2.96 million t of copra equivalent, followed by the Philippines with an area of 3.52 million ha and production of 2.26 million mt of copra equivalent. India, with 1.98 million ha and production of 2.73 million mt copra equivalent, occupies third place in area and second place in production (Fig. 2.4.).

The productivity of copra equivalent is more than 1 mt ha^{-1} in India, Malaysia, Papua New Guinea, Sri Lanka, Thailand and Vietnam. Vietnam recorded fast improvement in productivity. Countries like China, Myanmar, Brazil and Venezuela have shown an average productivity level of around 2.27 mt ha^{-1} of copra. Under normal ecological conditions, the global productivity ranges from 900 to 1500 kg copra equivalent ha^{-1} only. The productivity of coconuts has not made much progress over a period of five decades because the bulk of the existing coconut palms is

Table 2.2 Production of coconuts as whole nuts during various years

Country	2011	2012	2013	2014	2015
A. APCC countries	56,307,021	63,835,154	61,736,420	60,180,632	58,783,273
F.S. Micronesia	40,000	40,000 r	45,000	59,000 r	59,000
Fiji	160,000	179,500	148,000	200,000	165,000
India	16,943,000	23,351,000	22,680,000	21,665,000	20,440,000
Indonesia	16,189,000	16,060,000	15,563,000	15,330,000	14,804,000
Jamaica	95,500	95,700	95,700	98,500	99,200
Kenya	181,041	185,024	246,416	258,737	265,206
Kiribati	57,500	58,000	56,200	54,600	43,900
Malaysia	563,000	624,000	501,000 r	528,000 r	538,000
Marshall Islands	29,500	33,000	35,000	35,000	35,000
Papua New Guinea	1,495,000	1,495,000	1,482,592	1,483,000	1,483,000
Philippines	15,245,000	15,864,000 r	15,354,000	14,696,000	14,735,000
Samoa	180,000	262,000	267,000	267,000	267,000
Solomon Islands	100,000	100,000	100,000	100,000	100,000
Sri Lanka	2,707,000	2,927,000	2,513,320	2,870,000	3,056,000
Thailand	845,000	806,000	838,000	800,000 r	809,000
Tonga	86,100	81,600	81,762	75,100	71,698
Vanuatu	450,000	447,000	493,980	415,110	378,269
Vietnam	940,380	1,226,330	1,235,450	1,245,585	1,434,000
B. Other countries	9,074,202	8,016,381	8,169,672	8,325,180	8,258,401
Continents					
Asia	956,779	919,021	951,183	984,935	955,709
Pacific	278,950	251,255	248,132	245,274	236,342
Africa	1960,735	1,973,332	2,017,843	2,029,370	2,034,715
America	5,877,738	4,872,773	4,952,514	5,065,601	5,031,635
World total	65,381,223	71,851,535	69,906,092	68,505,812	67,041,674

Source = APCC Coconut Statistical Yearbook (2015)

old and almost one third are senile. Very often, coconut plantations are grown under suboptimal management conditions. The plantations are also affected by serious diseases and pests. The varieties and hybrids developed in various research institutes have made only very little impact in terms of area expansion except probably in India especially in areas where coconut is cultivated under irrigation. Since bulk of the coconuts is grown under rainfed conditions, farmers prefer local talls than hybrids. Coconut-producing countries should aim to reach a much higher yield level which is possible with adoption of adequate management practices, because many farmers are able to get more than 100 to 150 nuts palm^{-1} year^{-1}. Indian average productivity of coconut is 10,614 nuts ha^{-1} as in 2015–2016. In some of the countries, proper harvesting is not being done, and even the fallen nuts are not collected fully, leading to incorrect low production figures.

Table 2.3 Production of coconuts in copra equivalent during various years (mt)

Country	2011	2012	2013	2014	2015
A. APCC countries	91,32,898	10,652,936	10,535,164	9,942,086	9,832,948
F.S. Micronesia	6500	7275	7373	7373	7373
Fiji	26,667	29,833	24,568	38,161	27,500
India	2,259,000	3,113,000	3,024000	2,889,000	2,725,000
Indonesia	3,174,378	3,189,895	3,051,585	3,005,916	2,960,851
Jamaica	15,917	15,950	15,950 r	16,417	16,500
Kenya	13,926	14,233	18,956	19,904	20,402
Kiribati	9594	9708	9418	9134	7349
Malaysia	112,511	124,830	120,240	126,720	129,120
Marshall Islands	5405	6046	7000	5000	5000
Papua New Guinea	299,000	299,000	299,000	299,000	299,000
Philippines	2,077000	2,633,000	2,715,000	2,216,000	2,258,000
Samoa	65,000	52,000	52,920	53,000	53,000
Solomon Islands	20,000	20,000	20,126	20,126	20,126
Sri Lanka	517,000	559,656	480,497	548,757	584,321
Thailand	218,000	219,000	202,000 r	219,000	202,000
Tonga	17,000	16,325	17,100	15,699	14,988
Vanuatu	61,000	89,400	98,796	79,204	72,175
Vietnam	235,000	253,785	370,635	373,675	430,243
B. Other countries	1,815,050	1,603,275	1,633,936	1,665,036	1,651,080
Continents					
Asia	191,356	183,805	190,236	196,987	191,142
Pacific	55,790	50,251	49,627	49,055	47,268
Africa	392,147	394,666	403,569	405,874	406,943
America	1,175,757	974,553	990,504	1,013,120	1,006,327
World total	10,947,948	12,256,211	12,169,100	11,607,122	11,484,628

Source: APCC Coconut Statistical Yearbook (2015)

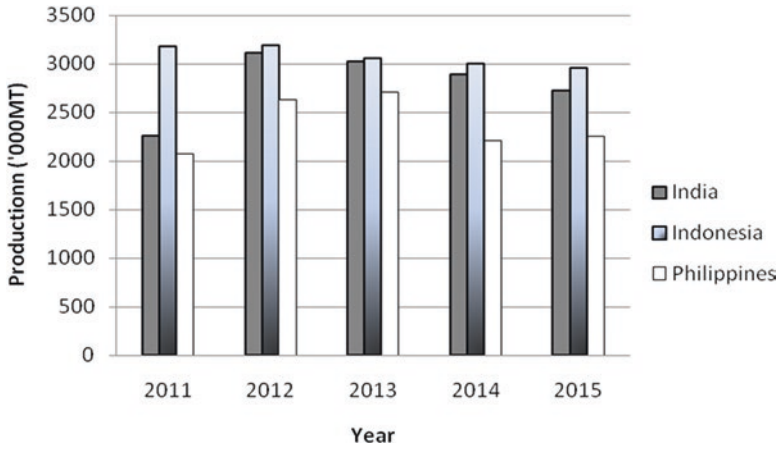

Fig. 2.1 Production of coconut in copra equivalent for top three countries

Table 2.4 Area under coconut cultivation during various years (in 1000 ha)

Country	2010	2011	2012	2013	2014	2015
A. APCC countries	10,778	10,793.0	10,988	10,975	10,927	10,733
F.S. Micronesia	17.0	17.0	18	18	18	18
Fiji	60.0	60.0	65	60	60	64
India	1895.0	1896.0	2071	2137	2141	1975
Indonesia	3739.0	3768.0	3782	3654	3610	3571
Jamaica	15.4	15.6	15.8	15.8	15.9	15.9
Kenya	78.0	82.0	86	177	177	177
Kiribati	19.0	19.0	19	20	20	20
Malaysia	106.0	106.0	101	88	88	82
Marshall Islands	8.0	8.0	8	8	8	8
Papua New Guinea	221.0	221.0	221	221	221	221
Philippines	3576.0	3562.0	3574	3551	3502	3517
Samoa	102.0	104.0	97	99	99	99
Solomon Islands	38.0	38.0	38	38	38	38
Sri Lanka	395.0	395.0	395	395	440	440
Thailand	232.0	216.0	214	209	208	202
Tonga	34.0	34.0	33.8	33.8	31	31
Vanuatu	96.0	96.0	92	92	92	92
Vietnam	147.0	155.0	157	158	158	162
B. Other countries	1243	1242.0	1253	1250	1268	1255
Continents						
Africa	389.0	388.0	397	394	455	451
America	620.0	620.0	622	622	581	580
Asia	130.0	130.0	130	130	186	184
Pacific	104.0	104.0	104	104	46	40
World total	12,021.0	12,035.0	12,241	12,225	12,195	11,988

Source = APCC Coconut Statistical Yearbook (2015)

2.3 Coconut Industry: Supply–Value Chain

Coconut industry, traditionally, relies upon copra and coconut oil and to some extent coir. Copra is the dried meat or dried kernel of coconut from which coconut oil is extracted. The earliest evidence of the extraction and usage of coconut oil is found in early Tamil literature (India) of the first century AD. As coconut oil is extracted from copra, it has become an important agricultural commodity in many coconut-producing countries. It also yields coconut cake which is mainly used for livestock feed. There has been a transformation from traditional coconut-copra-coconut oil production to product diversification, high-value product development and by-product utilization. The coconut supply–value chain is depicted in Fig. 2.5.

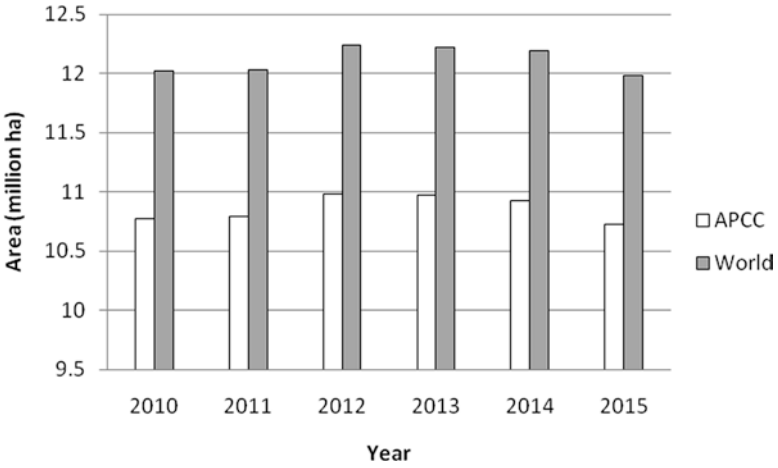

Fig. 2.2 Trend in area under coconut during 2011 to 2015

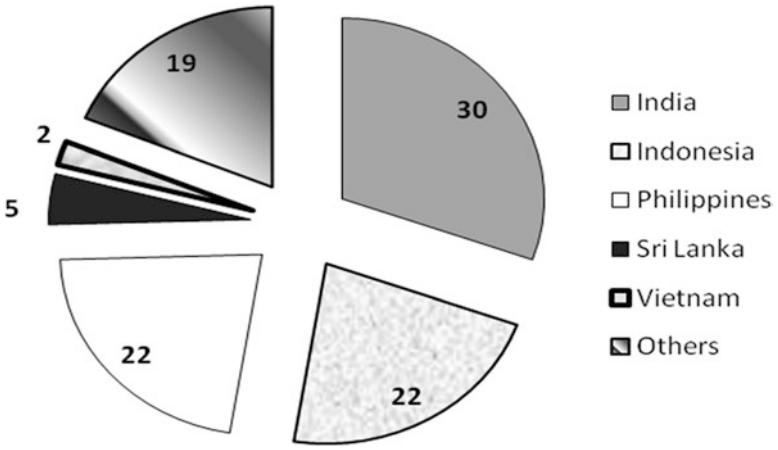

Fig. 2.3 Percentage share in world coconut area during 2015

2.4 Opportunities for Product Diversification, Value Addition and By-Product Utilization

Coconut being a versatile crop, it is possible to use each and every part of coconut palm for making value-added products as given below.

1. Inflorescence: Sugar (jaggery), *neera*, toddy (fermented sap – coconut wine), vinegar, beverage, confectionery, jelly.
2. Coconut meat: Tender coconut in syrup, coconut jam, puddings/ice cream.

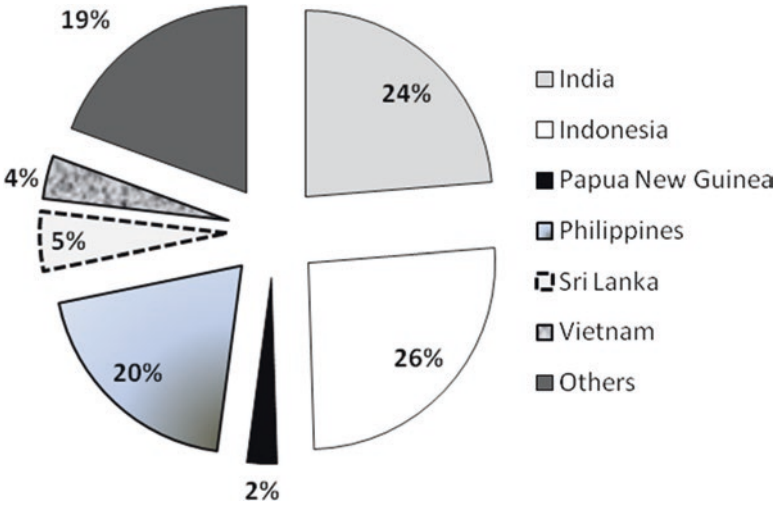

Fig. 2.4 Percentage share in world coconut production in copra equivalent

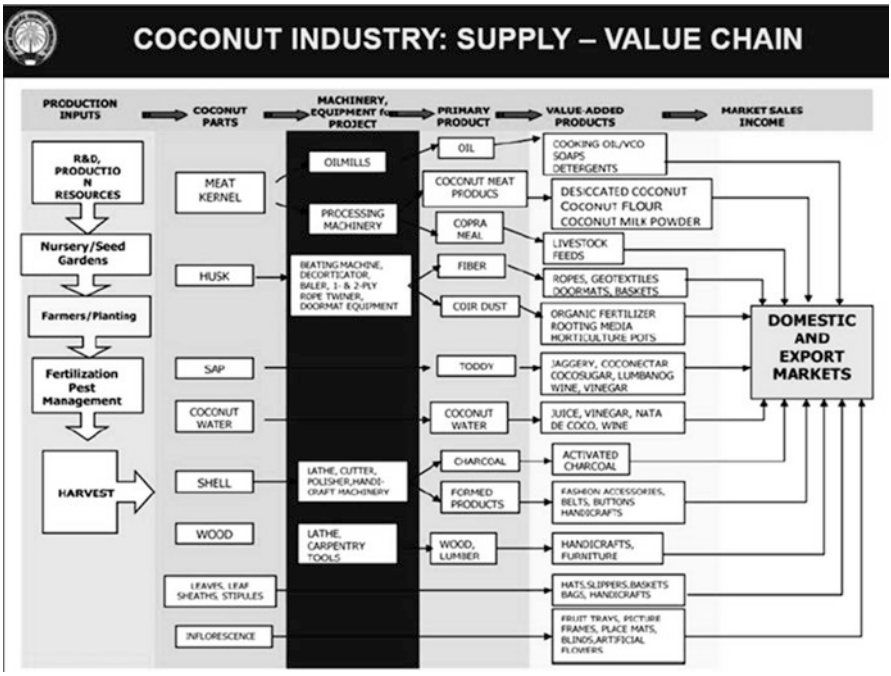

Fig. 2.5 The coconut industry: supply–value chain. (Source: Arancon 2013)

3. Mature coconut: Desiccated coconut, partially defatted coconut powder, roasted coconut paste, coconut chips, ball copra, cup copra, dehydrated edible coconut meat, fresh coconut gratings, coconut milk, milk powder, coconut oil, coconut flour, coconut meal.
4. Coconut milk: Coconut milk powder (dehydrated milk), coconut milk syrup, coconut spread/cheese, coconut honey/candy, coconut skim milk beverage, coconut protein, coconut curd, ice cream, low-fat/high-fat jam, virgin coconut oil, coconut flour, coconut cake.
5. Coconut water: Tender nut water and meat shake, pouched/tinned coconut water, coconut water spray dried powder, water concentrate/syrup, vinegar, *nata de coco*, carbonated coconut water, toddy.
6. Husk: Coir, fibre, rubberized coir fibre, coir yarn, coir mats, high-value coir wall panelling, rope, mattresses, coir rugs, geotextiles, coir dust, coir dust briquettes, grow bags, husk chips, coir dust compost, coir dust-based flowering pots, fibre-based ornaments, etc.
7. Coconut shell: Shell powder, charcoal, activated charcoal, ice cream cups, shell ornaments, spoons, and many eco gift products.
8. Coconut leaves: Leaf midribs for broomstick, roofing, flower vase and drawing mats, coconut leaf-based vermicompost.
9. Coconut stem: Furniture, doors, window and door frames, wall panels, floor tiles, packing cases, stem chips, etc.

For more details, please see Chap. 13.

2.5 Demand for Coconut

Demand for coconut has grown upwards up to 500% in the last decade, so much so the producers are not able to keep pace with. European markets have, therefore, taken a number of steps to curb their demand. Specifically, the European Union has proposed levies on vegetable oil imports to the EU, and they have promoted the use of alternate vegetable oils such as palm, canola and soya and put stricter aflatoxin regulations into place within the copra production market. Indeed, numerous foreign firms are looking to invest in the supply side of coconut production, especially in places such as Sri Lanka's ultra-productive 'Coconut Triangle' region. Today, the top coconut suppliers are struggling to meet the increasing demands of the global economy. Coconut has been a cash crop for decades and even with stiff competition from other vegetable oils, it promises to continue to be a profitable venture in the future. Nonetheless, the major coconut producers must be aware of the current situation and take steps to ensure that their farms are sustainable enough to stand the test of time.

2.6 Domestic Consumption of Major Coconut Products

The domestic consumption of major coconut products is given in Table 2.5.

Among the various products, the consumption of desiccated coconut has increased considerably (the highest being 549,574 mt during 2013), while no spectacular variations are observed in terms of domestic consumption of copra, coconut oil and copra meal.

2.7 Global Export of Coconut Products

Global export of coconut products exceeds US$ 1.2 billion annually. Though more than 50 products of coconut are being exported, only 14 products, viz. copra, coconut oil, desiccated coconut, coconut milk, milk powder, cream, coconut water, neera, coco sugar, coco chemicals, virgin coconut oil, shell charcoal, activated charcoal and coir-based products, are being exported on a larger scale. The export market of coconut and coconut products is highly concentrated with less than half a dozen exporting countries accounting for over 80% of the total quantity traded in most cases.

The Philippines is the largest exporter of coconut products earning US$ 841 million year^{-1}, followed by Indonesia, Sri Lanka, Malaysia, India and Thailand. India exports mainly coir and coir products including geotextiles and coir pith. World export of coconut products is presented in Table 2.6.

Among the products exported, coconut oil remains as the major one. But in terms of growth rate, it shows a fluctuating trend. The copra export reduced considerably because the copra-producing countries themselves have started processing coconut oil and other value-added products which is a recent development. Global export of desiccated coconut also showed fluctuation over the years, and it was 3.04 lakh mt during 2015. India imports desiccated coconut from Sri Lanka. In the past 5-year period, export of activated carbon increased from 152,490 t to 189,938 mt. The export of coir and coir products also showed fluctuations, and it decreased from 331,221 mt during 2014 to 286,671 mt during 2015. India and Sri Lanka are the major coconut fibre-producing countries.

Table 2.5 Domestic consumption of major coconut products during various years

Products	2011	2012	2013	2014	2015
Copra (million t)	5.482	5.845	5.442	5.430	5.341
Coconut oil (million t)	3.493	3.712	3.418	3.359	3.297
Copra meal (million t)	1.779	1.906	1.752	1.690	1.662
Desiccated coconut (mt)	269,275	254,190	549,574	397,426	394,064

Source: APCC Coconut Statistical Yearbook (2015)

Table 2.6 World export of various coconut products during 2011 to 2015

Products	2011	2012	2013	2014	2015
Fresh coconut(mt)	445,837	373,179	491,835	791,551	682,018
Copra (mt)	161,584	167,866	106,794	186,926	154,130
Copra meal (mt)	611,643	1,060,417	1,184,585	851,428	696,469
Coconut oil (mt)	1,862,669	2,142,817	2,228,404	2,100,013	2,096,558
Desiccated coconut (mt)	386,286	360,916	379,881	440,500	304,280
Coconut milk/cream and coconut milk powder (mt)	25,618	42,556	42,724	50,208	63,395
Charcoal (mt)	275,905	261,749	308,964	360,525	414,269
Activated carbon(mt)	152,490	256,720	209,311	239,594	189,938
Coconut shell (mt)	275,905	261,749	308,964	355,288	414,269
Coir yarn (mt)	6339	6588	6362	6392	6630
Coir and coir products (mt) [a]					
APCC countries	304,305	295,421	290,458	331,025	286,475
Other countries	200	196	196	196	196
Total	304,505	295,617	290,654	331,221	286,671

Source: APCC Statistical Yearbook (2015)

[a]Mostly coir yarn, coir mattings, coir mats, rugs, carpets, rubberized coir and coir rope (from India) and mattress fibre, bristle fibre, coir yarn, twisted fibre and coir twine (from Sri Lanka). Other countries include Indonesia, Malaysia, the Philippines and Thailand

Table 2.7 Global coconut oil production (1000 mt)

Country	2010	2011	2012	2113	2014
Philippines	1746	1137	1353	1511	1360
Indonesia	857	840	830	868	980
India	413	407	401	376	563
Malaysia	45	51	44	53	43
Vietnam	33	34	34	34	2
Papua New Guinea	52	55	55	36	22
Mexico	132	130	131	129	127
Other countries	310	311	311	322	315
Total	3616	2991	3288	3358	3412

Source: Uron Salum (2017)

2.7.1 Coconut Oil

Coconut oil production has increased from 1.95 million mt in 1960 to 3.41 million mt in 2014 (Table 2.7). It can be seen that the coconut oil production has been ranging between 2.99 (during 2011) and 3.61 million mt (during 2010).

The world coconut oil export from 1999 to 2015 ranged from 1.86 million mt in 2011 to a maximum of 3.24 million mt in 2005 (Fig. 2.6). Coconut oil continues to remain the major product of export. Coconut oil was the largest source of lauric oil

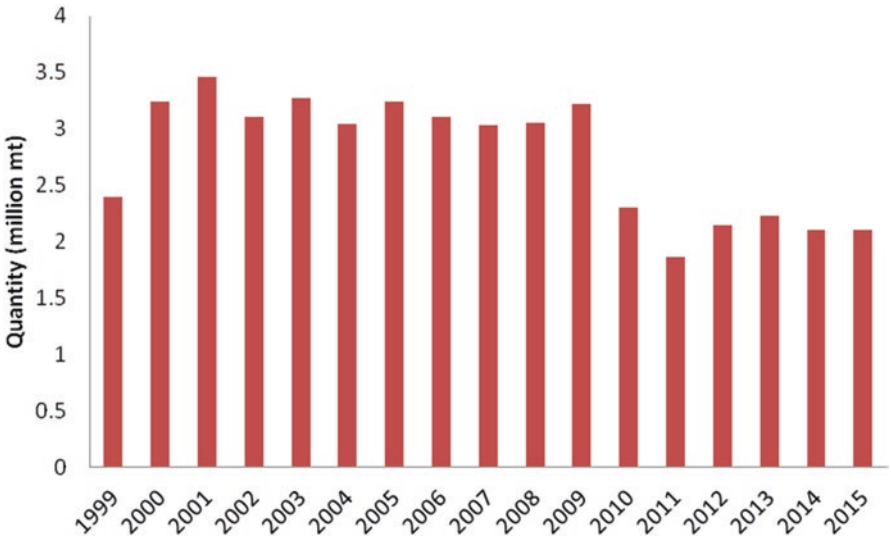

Fig. 2.6 World coconut oil export: 1999–2015

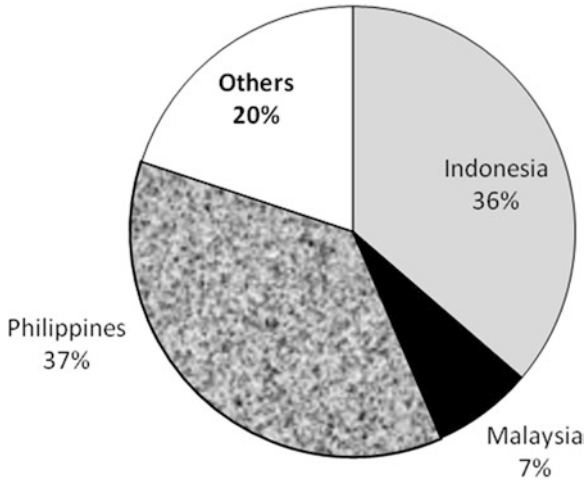

Fig. 2.7 Percentage share of coconut oil exports in the world

in the world. In the recent years, palm kernel oil production has exceeded that of coconut oil, and this has contributed to a slight reduction in export of coconut oil. Therefore, the price has to be competitive with other oils in the global market.

The Philippines, Indonesia and Malaysia are the leading coconut oil exporters, together contributing about 80% of the total world export (Fig. 2.7). Malaysia may be exporting coconut oil after importing from other countries. A comparison of export of coconut oil in the world vis-a-vis APCC countries and among the top three

Table 2.8 World export of coconut oil during various years (mt)

Country	2011	2012	2013	2014	2015
A. APCC countries	1,546,241	1,845,859	1,880,730	1,821,156	1735,108
Fiji	1328	3794	1494	1630	1794
India	4251	6552	6829	7067	7725
Indonesia	540,050	799,973	630,568	771,419	760,072
Kenya	600	553	38	612	161
Malaysia	143,611	136,783	131,068	187,665	152,091
Marshall Islands	–	3956	3330	124	–
Papua New Guinea	54,349	19,847	13,466	11,068	18,467
Philippines	781,411	852,236	1,080,836	815,018 r	765,558
Samoa	2509	3935	1428	1450	1020
Solomon Islands	470	172	196	238	1163
Sri Lanka	1931	2499	3821	11,254	8679
Thailand	1200	366	651	1960	15
Tonga	2531	3961	1428	1452	1020
Vanuatu	12,000	10,011	5535	9208	6570
Vietnam	–	1221	42	991	10,773
B. Other countries	316,428	296,958	347,674	278,857	361,450
Continents					
Asia	7700	8636	7204	6553	8110
Pacific	–	7333	6423	5287	7527
Africa	10,928	13,571	11,210	7930	8312
America	36,900	14,057	17,268	27,368	60,877
Europe	260,900	253,361	305,569	231,719	276,624
World total	1,862,669	2,142,817	2,228,404	2,100,013	2,096,558

Source: APCC Coconut Statistical Year book (2015)

APCC countries is presented in Table 2.8. APCC countries contributed around 83% of the total world export of coconut oil during 2015.

India and Sri Lanka are not able to compete since the domestic price is always higher than the world export price. The share of India is quite insignificant (0.3%). Virgin coconut oil (VCO) has received much attention globally in the recent times. The popularity of VCO is growing among consumers in all the continents due to its myriad properties including potential health benefits. The fast-developing and high-value niche global market for virgin coconut oil offers a good prospect for improvement of the income of coconut farmers. The USA is the largest importer of VCO in the world. The European market for VCO has also grown significantly over the past few years, driven by the increasing attention that European consumers are paying to healthier diets. Globally, the Philippines is the largest exporter of VCO. Besides the Philippines, other leading VCO exporters are Indonesia, India, Malaysia and Papua New Guinea. India exported 818 mt VCO in the year 2015–2016, and this is 3.8% higher than the quantity exported during the previous year. The USA is India's major export destination.

2.7.2 Copra Meal/Copra Cake

Copra meal is an important commercial by-product of copra while extracting coconut oil and has significant use in the large-scale production of commercial cattle feed. The bulk of coconut meal is exported from APCC countries. The world export market of copra meal almost falls into the category of oligopoly, wherein Indonesia and the Philippines together contribute more than 95% of the total exports (Table 2.9). India never developed an efficient export chain of copra meal, chiefly due to the huge absorption of this by-product into the domestic market as cattle feed.

2.7.3 Fresh Coconut

Fresh coconut is mainly used for domestic consumption and coconut-based industries (Table 2.10). Future potential exists for export of fresh nut for various purposes, which can be exploited.

Table 2.9 Export of copra meal during various years (mt)

Country	2011	2012	2013	2014	2015
A. APCC countries	599,628	1,035,224	1,166,255	835,226	689,670
Fiji	54	209	0.14	75	30
India	3	14	418	37	–
Indonesia	182,833	356,237	256,392	281,336	281,482
Kiribati	578	314	74	216	–
Malaysia	1495	1779	2064	2206	2088
Marshall Islands	2000	487	940	482	–
Papua New Guinea	22,630	10,195	5084	5250	8471
Philippines	373,135	646,044	892,281	536,186	381,873
Samoa	3061	3908	1121	2094	6531
Sri Lanka	6522	9685	187	2556	4184
Thailand	–	4	2	2	–
Vanuatu	6917	6082	7692	4786	5011
Vietnam	400	266	–	–	–
B. Other countries	12,015	25,193	18,330	16,202	6799
Continents					
Asia	100	103	1098	588	177
Pacific	–	365	431	503	867
Africa	3815	18,084	10,151	13,588	5505
America	–	247	308	1003	169
Europe	8100	6394	6342	521	81
World total	611,643	1,060,417	1,184,585	851,428	696,469

Source: APCC Coconut Statistical Yearbook (2015)

Table 2.10 World export of fresh coconut during 2011–2015 (mt)

Country	2011	2012	2013	2014	2015
A. APCC countries	424,372	322,829	414,149	687,470	599,345
Fiji	–	267	236	74	64
India	21,717	38,088	51,466	52,720	14,896
Indonesia	304,911	159,503	154,231	417,042	420,561
Jamaica	75	25	88	77	29
Kenya	–	436	–	–	–
Malaysia	55,588	18,498	53,127	48,247	44,906
Philippines	7318	2316	40,020	1753	3670
Samoa	555	453	673	1311	609
Sri Lanka	7910	19,510	21,246	33,073	13,204
Thailand	25,077	37,017	32,620	49,239	68,255
Vietnam	1221	65,214	60,442	83,934	33,151
B. Other countries	21,465	50,511	77,709	104,081	82,673
Continents					
Asia	955	1997	3491	8201	3172
Pacific	50	26	41	49	23
Africa	3486	4322	32,090	11,969	13,098
America	16,974	18,144	18,577	39,215	40,522
Europe[a]	–	25,861	23,487	44,647	25,858
World total	445,837	373,179	491,835	791,551	682,018

[a]re-export Source: APCC Coconut Statistical Yearbook (2015)
Conversion factor: 1 mt of husked nuts = 1250 whole nuts

2.7.4 Desiccated Coconut

Desiccated coconut (DC) is prepared from coconut kernel. It is rich in healthy saturated fats and is an excellent source of dietary fibre. The export of desiccated coconut (Table 2.11) is also increasing every year, and there is a lot of potential for this product since it is being used in confectioneries, chocolate industries, etc. With 30% of the world's imports, the European Union (EU) remains as the largest importer of DC coconut in the world.

The Philippines and Indonesia are the major global exporters of DC, accounting for more than 50% of the exports (Fig. 2.8.). Though India is the largest producer of raw coconut in the world, DC export is only to the tune of about 1% of the global exports. Nevertheless, during the year 2015–2016, India exported 4261 mt of DC worth Rs 52.60 crores. Since the demand is likely to increase by 10% annually, coconut-growing countries can exploit the situation.

Table 2.11 World export of desiccated coconut during various years (mt)

Country	2011	2012	2013	2014	2015
A. APCC countries	260,553	238,809	2617,387	305,749	232,883
India	4190	5173	3004	5166	2606
Indonesia	51,665	61,511	75,930	86,797	85,902
Malaysia	8194	7762	7137	9800	11,246
Philippines	111,868	94,877	130,669	109,099	69,548
Sri Lanka	45,135	40,224	28,202	51,132	36,131
Samoa	560	2747	38	12.4	–
Thailand	3941	3063	1839 r	3441 r	2311
Vietnam	35,000	23,452	14,568 r	40,302	25,139
B. Other countries	125,733	122,107	118,494	134,895	71,397
Continents					
Asia	24,409	20,364	21,800	24,761	21,874
Pacific	391	155	80	144	174
Africa	22,778	27,966	18,500	31,808	287
America	41,811	35,790	35,017	37,372	6564
Europe[a]	36,344	37,832	43,097	40,636	42,498
World total	386,286	360,916	379,881	440,500	304,280

[a]re-export Source: APCC Coconut Statistical Yearbook (2015)

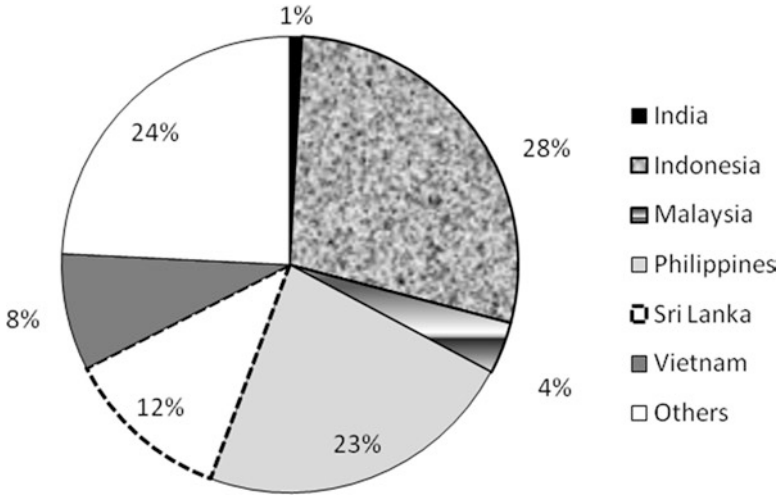

Fig. 2.8 Percentage share of DC exporting countries in the world

2.7.5 Coconut Milk/Cream and Milk Powder

Coconut milk/cream and milk powder are high-value healthy, commercial products for the higher-end consumer market across the world. They are in great demand as could be seen from Table 2.12. These are being used in various functional and

Table 2.12 World export of coconut milk/cream and milk powder during various years (mt)

Country	2011	2012	2013	2014	2015
Coconut milk/cream	12,808	32,823	34,033	39,497	49,139
Indonesia	1394	18,297	19,212	19,440	20,229
Philippines	2918	3103	306	2544	4001
Samoa	400	348	354	100	77
Sri Lanka	8096	11,075	14,161	17,413	24,832
Coconut milk powder	12,810	9733	8691	10,711	14,256
Malaysia	3925	3493	3600	3575	6358
Philippines	2467	1599	389	1301	2256
Sri Lanka	4446	4641	4702	5835	5642

Source: APCC Coconut Statistical Yearbook (2015)

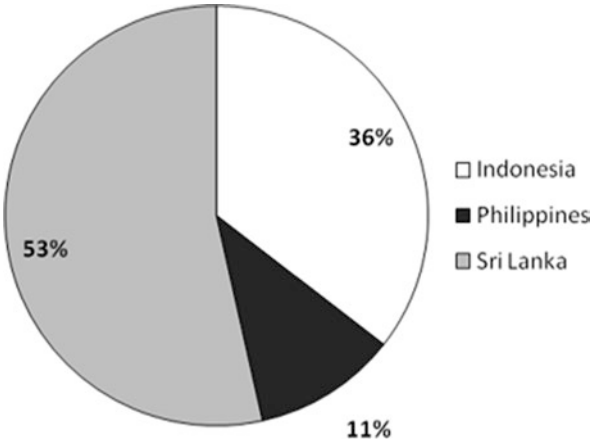

Fig. 2.9 Percentage share of export of coconut milk/cream by various countries

nutritional food preparations. The demand shows a steady increase due to the increased awareness of the health benefits of these products. Coconut milk is an excellent substitute for the dairy milk, and of late the health-conscious consumer segment is much aware of the comparative benefits of this product. Sri Lanka and Indonesia together contribute more than 90% of total export share of coconut milk/cream (Fig. 2.9.). India's share in this segment is insignificant.

2.7.6 Coconut Shell Charcoal and Activated Carbon

Coconut shell charcoal and activated carbon are the by-products of coconut. The coconut shell which was being wasted for a long time is now being utilized for making valuable products, which are highly useful in many purification processes. The demand will be increasing in the years to come, and the coconut-producing countries should take advantage of the situation. Their export details are given in Table 2.13. Indonesia has almost monopolized the shell charcoal export market in

Table 2.13 Export of coconut shell charcoal and activated carbon from selected countries during various years (mt)

Country	2011	2012	2013	2014	2015
Shell charcoal	275,905	261,749	308,964	360,525	414,269
Philippines	24,634	47,926	92,505	77,334	60,373
Sri Lanka	4957	6916	6359	8736	8853
Indonesia	230,452	180,671	178,500	249,682	330,012
India	15,862	26,236	31,600	24,773	15,031
Activated carbon	152,490	256,720	209,311	239,594	189,938
Philippines	41,449	128,246	62,362	60,060	54,561
Sri Lanka	31,359	30,271	36,629	37,230	31,747
Indonesia[a]	13,548	25,225	20,208	21,724	25,713
Malaysia	20,557	16,066	16,222	15,197	15,311
Thailand	9096	5475	6170	8822	8261
India	36,481	51,437	67,720	96,561	54,345
Total[b]	428,395	518,469	518,275	600,119	604,207

Source: APCC Coconut Statistical Yearbook (2015).
[a]*Includes wood–/coal-based activated carbon*
[b]*Aggregate of coconut shell charcoal and activated carbon on shell charcoal basis*

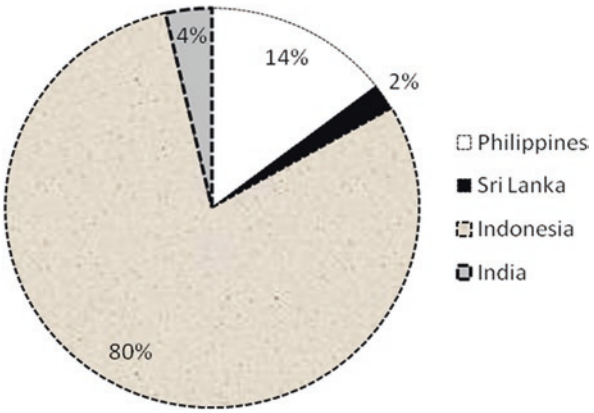

Fig. 2.10 Percentage share of export of shell charcoal by various countries

the world with around 80% contribution of the total exports, while the Philippines follows with 14.6% share in the world exports (Fig. 2.10). India too shows positive signals in the export segment of shell charcoal with a share of about 4% in the total exports, while the remaining share is that of Sri Lanka (2.1%).

2.7.7 Coir and Coir Products

India and Sri Lanka are the pioneers in exporting coir products throughout the world (Fig. 2.11), and till recently, they were the only coir-producing and coir-exporting countries. In the recent past, coir industry was established in other countries such as the Philippines, Indonesia and Thailand. Quantity of coir and coir products exported in the year 2015 was 0.29 million tonnes (Table 2.14). Around 80% of the export is in the form of coir fibre. China is the major buyer of coir fibre (90%), and its requirement is expected to increase 10–20% every year. At present, there is a deficit of nearly 20% in supply of coir fibre in the world. Since there is a preference for eco-friendly products globally, natural fibre-based products will have a great demand in the future.

2.8 Price of Coconut Products

Global coconut oil price has been highly fluctuating. The international price of coconut oil was US$ 1110 in 2015 which is 11.7% less compared to the 2014 price (Uron Salum 2017). In major coconut-producing countries like India, the domestic price is much higher (Table 2.15). There is a growing competition for fresh coconut since it is being increasingly used for other coconut products.

Coconut water, which is being mostly wasted, fetches US$ 800/t, the price for coconut milk is US$ 800 /t and those of milk powder is US$ 2800 /t, fatty alcohol US$ 1125 /t, coir bristle fibre US$ 460/t and activated carbon US$ 945/t (Table 2.16) (Rethinam 2004).

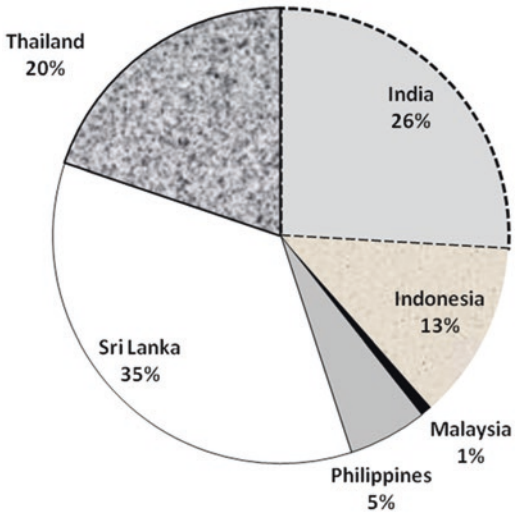

Fig. 2.11 Percentage share of export of coir and coir products by various countries

Table 2.14 Export of coir and coir products during various years (mt)

Country	2011	2012	2013	2014	2015
APCC countries	304,305	295,421	290,458	331,025	286,475
India	75,733	71,592	75,652	81,738	74,225
a. Coir yarn	5572	4479 r	4360	4187	4013
b. Coir mattings	1434	1461	2834	2270	1550
c. Coir mats	63,510	61,139	63,384	69,132	62,471
d. Coir rope	754	405	468	632	525
e. Rugs and carpets	418	78	68	114	363
f. Rubberized coir	393	390	283	993	955
g. Others	3652	3640	4255	4410	4348
Indonesia	46,173	43,089	24,109	31,972	36,171
Malaysia	12,570	13,963	14,027	11,877	2399
Philippines	7635	8201	29,407	27,834	16,085
Sri Lanka	120,616	119,376	112,529	137,900	100,863
a. Mattress fibre	78,174	57,924	53,142	36,320	18,090
b. Bristle fibre	9450	8160	10,251	16,409	11,62
c. Coir yarn	767	1025	2002	2205	2617
d. Twisted fibre	26,808	45,119	41,406	74,744	62,584
e. Coir twine	5417	7148	5728	8222	5960
Thailand	41,578	39,200	34,734	39,704	56,732
Other countries	200	196	196	196	196
Total	304,505	295,617	290,654	331,221	286,671

Source: APCC Coconut Statistical Yearbook (2015)

Table 2.15 Coconut oil price in major coconut-growing countries (US$/mt)

Countries	1997	1999	2001	2010	2014	2015
India	1448	1265	649	1263	2316	NA
Indonesia	570	628	267	944	1267	1069
Philippines	636	775	282	1271	1396	1043
Sri Lanka	946	945	680	1923	2043	1951

2.9 Import of Coconut Products

Import of coconut products is either for domestic consumption or for re-export.

2.9.1 Copra

Since coconut-producing countries are utilizing copra to produce coconut oil, its availability in the international market has considerably reduced (Table 2.17).

Table 2.16 Annual average price for selected coconut products during various years (US$/mt)

Product	1997	2000	2010	2014
Copra	434	305	732	834
Coconut oil	657	450	1116	1257
Coconut meal	NA	NA	108	253
Desiccated coconut	1149	791	1637	2650
Fatty alcohol	1225	1082	1500	NA
Fatty acid	923	833	335	654
Coconut milk – liquid	1502	1361	1771	1996
Coconut milk powder	3010	3097	2715	4301
Coconut water	807	870	1019	1270
Nata de coco	1301	1114	1104	720
Coconut vinegar	813	779	431	1555
Mattress fibre	183	199	312	212
Bristle fibre	619	524	517	396
Coir rope	689	599	615	1009
Rubberised fibre	2134	1526	2626	2657
Coir dust	194	195	280	316
Coir rope	NA	NA	1326	1009
Shell charcoal	282	253	402	438
Activated carbon	1109	994	1376	1554

Value addition and utilization of by-products give more income than coconut oil as could be seen from Table 2.14

Table 2.17 Import of copra during various years (mt)

Country	2011	2012	2013	2014	2015
European countries	441	395	619	426	1611
African countries	17	1790	50	73	1979
American countries	–	157	108	–	6
Asian countries	169,024	143,297	76,604	38,290	121,159
Bangladesh	28,765	13,500	13,500	–	–
China	4	52	–	–	40
India	1600	1600	1600	84	–
Indonesia	15	66	190	448	–
Malaysia	33,090	18,601	7140 r	19,499	24,018
Pakistan	10,869	18,519	17,804	18,100	20,135
Philippines	91,465	64,712	33,274	–	75,351
Singapore	3165	3150	3000	–	–
Sri Lanka	–	23,097	–	–	–
Others	51	–	96	159	1435
Pacific countries	–	2560	–	44	2023
World total	169,482	147,647	76,654	38,833	126,778

Source: APCC Coconut Statistical year book (2015)

2.9.2 Coconut Oil

Coconut oil import by European and American countries is continuing to remain high (Table 2.18). Out of the 21 million mt of import of coconut oil during 2015, around 45% was to European countries, followed by 28% by American countries.

2.9.3 Copra Meal

Asian countries are the major producers, importers and consumers of copra meal (Table 2.19), and among such countries, South Korea leads with around 60%. Coconut meal as cattle feed has always a good demand in China, Vietnam and India.

2.9.4 Desiccated Coconut

Import of desiccated coconut continues to increase every year, and European countries are importing large quantities of this product (36.2% during 2015) followed by American (22.8%), African (19.3%), Asian (18.1%) and Pacific (3.6%) countries (Table 2.20). This trend is likely to continue since desiccated coconut is largely being used in confectionery and chocolate industries.

Table 2.18 Import of coconut oil (mt)

Country	2011	2012	2013	2014	2015
European countries	1,024,500	1043,336	1,089,250	931,464	948,779
American countries	517,600	539,525	588,250	585,124	586,326
African countries	25,200	18,915	288,153	18,359	31,876
Asian countries	526,362	401,715	476,319	514,629	530,667
Pacific countries	15,400	14,950	20,209	15,868	18,449
World total	2,109,062	2,018,441	2,462,181	2,065,444	2,116,097

Source: APCC Coconut Statistical Yearbook (2015)

Table 2.19 World import of copra meal during various years (mt)

Country	2011	2012	2013	2014	2015
European countries	18,000	18,330	18,330	8226	7364
American countries				3488	4976
African countries	3400	3210	3210	8366	1538
Asian countries	563,955	623,705	623,255	259,032	638,863
Pacific countries	10,900	13,300	13,300	10,342	11,484
Others	18,300	16,900	16,900	2154	17,464
World total	614,555	675,445	674,995	291,608	681,689

Source: APCC Coconut Statistical Year Book (2015)

Table 2.20 World import of desiccated coconut during various years (mt)

Country	2011	2012	2013	2014	2015
European countries	127,573	136,549	133,255	240,804	139,441
American countries	71,069	70,519	69,639	101,398	87,858
African countries	21,284	18,730	279,599	61,428	74,252
Asian countries	66,080	64,877	54,778	85,980	69,610
Pacific countries	11,479	11,179	11,026	12,538	13,842
Others	11,290	11,254	–	–	–
World total	308,775	313,108	478,658	502,148	385,003

Source: APCC Coconut Statistical Yearbook (2015)

Table 2.21 World import of coir fibre during various years (1000 mt)

Country	2011 [r]	2012 [r]	2013	2014	2015
European countries	244.265	250.947	244.556	313.61	295.920
American countries	98.204	94.025	58.191	126.89	159.85
Others	529.396	588.629	602.791	1697.33	1832.88
World total	871.865	933.601	905.538	2138.13	2288.65

Source: APCC Coconut Statistical Year Book (2015) r – revised

2.9.5 Coir Fibre

Import of coir fibre is also increasing since there is good demand for natural fibres in the West. European countries import large quantities of coir fibre (Table 2.21), and among the other countries, India and China are the leaders. China makes value-added products like rubberised mattress, while European countries make high-value coir products like wall panel.

2.9.6 Coir Yarn

European countries import coir yarn (Table 2.22), for blending with other fibres to produce high-value coir products. Among the countries in the Asian continent, China imports sizeable quantity of coir yarn, and it touched 612.09 mt during 2015.

2.10 Production of Major Oilseeds

The production of major oilseeds is given in Table 2.23. The increase in production of coconut oil is only 1.78%, while the same for palm oil, soya bean and rapeseed mustard oils were 35.0%, 26.65% and 16.07%, respectively. In the case of palm kernel oil, another source of lauric oil, growth is 3.78% which is much more than that of coconut oil. There is vast scope to increase production of virgin coconut oil

Table 2.22 World import of coir yarn (1000 mt)

Country	2011	2012	2013	2014	2015
European countries	3.99	2.724	8973	342.05	167.98
American countries	0.44	0.606	1114	132.84	166.07
Others	1.40	0.676	3495	1735.10	2016.95
World total	5.83	4.006	13,582	2209.99	2351.00

Source: APCC Coconut Statistical Year Book (2015)

Table 2.23 Production of nine major vegetable oils (million mt)

Vegetable oils	1997	2001	2005	2009	2013	2014	2015	% share 2015
Palm	17.62	23.96	33.59	45.27	53.83	59.74	62.51	35.96
Soybean	20.82	27.84	33.55	36.11	43.18	45.25	48.81	28.08
Rape seed	11.83	13.74	16.06	21.72	23.80	27.00	26.27	15.11
Sunflower	9.32	8.16	9.73	13.04	13.75	16.16	15.11	8.69
Cotton	3.95	4.04	5.01	4.70	5.28	4.91	4.71	2.71
Palm kernel	2.17	2.95	3.95	5.24	6.25	6.54	6.85	3.94
Groundnut	4.21	5.14	4.51	4.16	5.29	3.92	3.69	2.13
Coconut	3.43	3.25	3.50	3.26	3.52	3.02	2.95	1.70
Olive	2.68	2.77	2.92	3.02	2.87	3.39	2.92	1.68
World production	76.03	91.85	112.82	136.52	157.77	169.93	173.82	100

Source: Uron Salum (2017)

and other value-added products such as coconut milk, milk powder, desiccated coconut, etc., which fetch higher price. It is obvious that a fair price for coconut cannot be ensured if used solely as a vegetable oil source.

2.11 Emerging New Applications

It has been realized that coconut oil with health benefits and possessing good flavour and taste is a very versatile product. In the past 20 years, it has been projected as one of the forbidden ingredients, by vested lobbies, that people wanted to avoid because of the fat content. But with the evidences from clinical studies and with awareness, coconut oil is getting accepted rapidly. Indeed, looking at the many coconut products available in the market, coconut, formerly maligned as being too fatty, has become some kind of a wonder product.

2.11.1 Organic Foods

The global organic food market is growing due to increased consumer awareness about overall health benefits of organic foods. But, the demand for organic foods is concentrated in countries where consumers have high purchasing power. The largest

organic markets in terms of global revenue distribution are European Union (53% market share) and North America (40%). In the USA, the growth rate for the sale of organic products is 17%. Consumption of organic oil is 95,000 mt which is only 0.1% of the total oil consumption. Compared to other oils, organic coconut oil and organic virgin coconut oil can easily be produced since the bulk of coconut plantings are managed without the use of inorganic fertilizers and pesticides (Rethinam 2008). Coconut organic foods as niche products, coming from certified organic farms, processed by authorized firms and certified by registered certification bodies, can have a cutting edge in the market.

2.11.1.1 Organic Coconut Water: Global Market Dynamics

The global market for organic coconut water is expected to be steered by its taste and many health benefits it offers. Moreover, the presence of antioxidants and micronutrient content could prompt consumers to prefer it over other conventional soft drinks. The drink is also regarded as having curative properties for disorders such as vomiting and diarrhoea and in restricting cholesterol levels. For details, please refer to Chap. 15.

Emerging evidence about the skin and hair benefits of coconut water and its consumption in yoga institutes and health clubs are all expected to serve as an opportunity for companies in the organic coconut water market. Coconut water is by far the leading plant-based water available for sale worldwide. In 2016, coconut water accounted for 96% of the volume share in the global sale of all plant-based water with over 700 million litres sold and with a market value of about 2.2 billion US dollars. In the USA, the industry for coconut water has experienced a continued growth in market size with a projected 1.98 billion US dollars, with the forecasted generated revenue for 2019 being 612.5 million.

In order to meet the challenges associated with the relatively short shelf life of coconut water, several producers are now offering frozen organic coconut water. This enhances its shelf life, allowing it to be transported to regions where coconut water is not readily available. Packaging is proving to be an especially important product differentiator for companies competing in the global organic coconut water market. It is now available in small, easy-to-carry tetra packs, cans and plastic bottles. Organic coconut water is now available in powder form also.

Latin America, North America, Asia-Pacific, Europe, Japan, the Middle East and Africa are major global markets for organic coconut water. South Africa has been identified as the fastest-growing regional market for packed coconut water. In the United Kingdom, consumption of organic coconut water approximates 25–26 million litres. The consumption of coconut water is also remarkably high in tropical countries, such as Sri Lanka, India, Thailand and Brazil, where coconuts grow in abundance.

2.11.1.2 Virgin Coconut Oil

Virgin coconut oil (VCO) processed from coconut kernel and coconut milk with very low free fatty acid (FFA) is gaining popularity as healthy nutritive oil. The oil is found to be good for the immune system as it contains lauric acid, which the body converts to a monoglyceride that has antiviral, antibacterial and antifungal properties. Please see Chap. 15 for details. Marketing opportunities of natural VCO and organic all-natural VCO may be exploited in niche health markets to obtain premium prices. A large number of small-scale units of VCO have been set up in many countries which use different processing methods. It is all the more necessary to strictly follow quality standards in order to sustain credibility and demand. The market for VCO seems to be a fast-growing one with its growing demand as functional food and pharmaceutical, nutraceutical and cosmeceutical agent (Rethinam 2006a, b; Rethinam and Amrizal 2006).

The Philippines is the major producer of VCO followed by most of the Asian coconut cultivating countries such as Thailand, Indonesia and Sri Lanka with Indian production also increasing considerably over the years. Export of VCO from the Philippines has increased from a meagre 103 mt during 2003 to 1693 mt during 2008 and then to 4914 mt during 2011 and to 36,332 mt during 2015. It is being exported to countries such as the USA, Korea, Japan, Netherlands, Singapore, Malaysia, South Africa and Australia. Countries in the Pacific region like Fiji and Samoa are also exporting VCO to Australia. Indonesia is producing VCO involving more than 200 small and medium manufacturers in the country, most of the production being consumed domestically. Virgin coconut oil export market itself is of recent origin and expanding at a faster rate. Organic VCO fetches a very high price compared to normal coconut oil.

2.11.2 Functional Foods

The market is attracting health-conscious groups with functional foods. While the conventional food sector has an expected growth rate of 1–3%, functional foods are catching up with a growth rate of 7–8%. Since coconut milk, milk powder and desiccated coconut provide lauric acid which can help to build up resistance/immunity against viral, fungal and bacterial diseases, these can find a market as components of functional foods.

2.11.2.1 Functional Drinks from Coconut

The global functional food drinks market, defined as ‘soft drink with added health benefits’, shows a continuously growing trend especially as a sports drink, energy drink, wellness drink and welcome drink. Beverages showed strong growth between 1998 and 2003, expanding by a compound annual growth rate of almost 11%. One reason behind the success of functional beverages is convenience and portability.

Tender nut water (young coconut water) and mature coconut water in pure form and also with mineral and vitamin fortification can have a wider market – both domestic and international – if supported by a well-directed marketing network. Apart from the drink's credibility as a lower calorie alternative to other juices, there are other factors which make it so popular. Coconut water contains many vitamins and minerals, including niacin, pantothenic acid, riboflavin, thiamine, potassium, magnesium, manganese, phosphorus, selenium, zinc, calcium and vitamins C, A, E and K. It is being marketed as an alternative to sports drinks. From athletes to an increasingly health-conscious middle class, it is credited as an answer to the growing demand for natural, healthy products.

The most important attributes of this drink are that it is slightly sour tasting, cholesterol free, fat free, and packed with electrolytes and potassium. There are over 100 brands manufacturing coconut water, and over 250 companies have beverages with some form of coconut water in them. There is an increasing demand for the coconut drink in the European Union countries and America. Coconut water currently represents an annual turnover of US$ 2 billion which is expected to reach US$ 4 billion in the next 5 years. Brazil is marketing most of the coconut water in cartons. Ten per cent of coconuts available are used for industrialized coconut water. Proper packaging and labelling with good shelf life will definitely increase its demand in the world market.

2.11.2.2 Neera

Coconut nectar juice, from the inflorescence, in the fresh form, is known as *neera* which becomes toddy on fermentation. *Neera* is used as a health and nutritive drink which is popularized by some of the government agencies such as in India.

2.11.2.3 Coconut Sugar

The coconut palm syrup can be crystallized to produce fine granules of sugar, which is well accepted by the global market. Nature created this product such that it cannot be processed in factories. Coconut sugar is produced in palm habitats by local people, which is a good livelihood option. In countries like Indonesia, around 50,000 mt of coconut sugar is produced per month, which has a good local market in the country. The greatest advantage of the coconut sugar industry is that it can be produced in villages by small- or medium-scale enterprises and cooperatives involving women groups.

Organic-certified supply chain now encompasses over 7000 smallholder farmers specific to coconut sugar (Benjamin-Ripple 2012). The global market for coconut sap sugar has been increasing and dominated by Indonesia, Thailand and the Philippines. There is an ever-increasing demand for coconut sugar both in the local and international markets due to its health benefits. It can be a most suited alternative sweetener, especially when agave sugar is being rejected owing to the high

fructose content. Coconut sugar has tremendous market potential owing to its low glycemic index (35 per serving compared to 65–100 of cane-based sugar) and high nutrient content. Thus, coconut sap sugar is safe even for diabetic patients. It was in 2007 that the Philippines first exported coconut sap sugar to the USA. Afterwards, the Philippines supplied it to the Middle East, South Korea, Hong Kong, Norway, Canada, Switzerland, Australia, France and New Zealand. This alternative sugar industry is estimated to be a US$ 1.3 billion industry, and hence the market prospects are enormous.

2.11.3 Coconut Shell Charcoal and Activated Carbon

Global Coconut Shell Activated Carbon Industry 2014 Market Research Report indicates that the major markets are the regions including North America, Europe and Asia and countries such as the USA, Germany, Japan and China.

2.11.4 Cosmeceuticals

Production of cosmetics and personal products in Asia and Pacific countries is just developing with emerging popularity as skin whitening products. Coconut oil, which is rich in C12 and C14 fatty acids (lauric and myristic), is good for skin care when applied pure or as cleaning products. With a growth of 10% for cosmetics and personal care products and 5 to 19% for soap in Asia and Pacific, the requirement is enormous. Many of the Pacific countries are importing all these products now.

2.11.5 Oleochemicals

Industrially useful natural fatty acids known as ‘lauric oils’ (capric acid, lauric acid, myristic acid, palmitic acid) and ‘fatty alcohol’ (lauryl alcohol and myristyl alcohol) which are key ingredients for common oleochemical products such as detergents, soaps and cosmetics are currently derived from coconut oil, palm kernel oil and also babassu seed. The long-term market trend for oleochemicals is favourable with world capacity expected to rise to 12 million mt and production to 10.8 million mt. The global market for natural fatty acids (primarily derived from coconut, palm and palm kernel oil) is expected to reach $ 13 billion by 2018. The market for lauric acid alone was estimated at about $ 1.4 billion in 2008. The market for myristic acid is estimated at about $ 600 million. Consumer trend is increasing towards application of oleochemicals in detergent, soap and personal care products, and hence there is good scope for coconut-based oleochemicals.

2.11.6 Biofuel/Bio-Lubricants

Energy security perspectives have become a driving force for the use of vegetable oil-based biodiesel fuels. Numerous countries are in the process of making biofuel. Three challenges the biofuel sector must overcome are price considerations, lack of awareness about the fuel and negative impact on the glycerin supply to existing markets. Bio-lubricants are functional fluids made from vegetable oils and downstream esters. Coconut oil as a bio-lubricant has been used in India for three-wheelers. Overall the global usage of renewable raw material in lubricants and related functional fluid applications is about 250,000 mt. The Philippines is moving forward in this aspect followed by Thailand, Vanuatu and Marshall Islands. Marshall Islands uses the double filtered coconut oil directly to run car, fish boat, truck, etc. The Philippines is using a mixture of diesel and methyl ester from CNO at 99:1 ratio and planning to increase it to 95:5. These developments of the coconut oil in biofuel industry indicate a bright future for the use of natural renewable resources to produce fuels.

It is an irony that the Clean Development Mechanism (CDM) of the Kyoto Protocol currently excludes tree crops like coconut from carbon sequestration credits. These perennial plantations are very similar to forest plantations in the carbon benefits they offer. In addition to timber, coconut yields nuts regularly, providing renewable energy. Moreover, coconut palms are mostly owned by smallholders, a fact which complies with the CDM goals like poverty alleviation and sustainability.

2.11.7 Biomass as Alternate Source for Fuel

Coconut biomass like coconut shell and coconut petioles can be used for producing alternate sources of energy. Coconut shell-based gasifiers are now becoming popular. The leaf petioles along with other biomasses are being used for generating energy.

2.11.8 Premium Grade Monolaurin and HIV/AIDS

Over a period of 22 years, 42 million people in the world would have been affected by HIV/AIDS. Coconut oil, with 48% lauric acid, is a potential source for producing monolaurin (lauricidin) which has been experimentally found to reduce the virus. Though Dr. Jon Kabara, a US scientist, has done preliminary work, pilot-scale testing with a large number of AIDS patients has to be carried out. The Philippines has done certain basic studies, and further elaborate research is planned. For details on nutrition and health, please refer to Chap. 15.

2.11.9 Coir and Coir Pith

Currently, the global annual production of coir fibre is 350,000 mt. Yet, this renewable resource is underutilized, with local coir mills processing only a fraction of the available husk, which accrue more or less year round as a waste during coconut processing. Historically, Sri Lanka has been the world's largest exporter of various fibre grades, whereas India exports largely value-added products – yarn, mats and rugs. Global trade volume for coir fibre, value-added products now stands at about $ 140 million year^{-1} with India and Sri Lanka, respectively, accounting for about 70 and 60 million dollars. Multifarious uses of coir fibre include coir wood for furniture, doors, wall panel, wardrobe, coir veneer board, medium density coir board, coco lawns, handmade paper, other eco-friendly products, low-cost wall panels, rubberized coir for car seats, biodegradable pots in horticulture sector, natural fibre pith, geotextile for soil conservation and natural fibres as reinforcements in industrial products. Moreover, coir milling and value addition, especially spinning and weaving, are important regional employers, particularly in rural Southern India and coastal Sri Lanka, providing work to more than half a million people, mostly women working part-time. Other coconut-growing countries, including the Philippines, Thailand and Vietnam, are now expanding their production with a view to exporting coir fibre.

2.12 Yield Gap in Coconut

A maximum yield of 480 nuts palm^{-1} year^{-1} was reported in a palm in Thazhava, Kerala, India, with an estimated yield of 13.84 mt copra year^{-1} (Iyer et al. 1979). A yield of 6 mt copra year^{-1} was recorded in the high-yielding hybrids and varieties in farmers' fields in certain areas. A yield of 3–4 mt ha^{-1} of copra for hybrid varieties under ideal management has been achieved at research institutes around the world. But the realized average yield is less than 1 mt ha^{-1} (Fig. 2.12) indicating the tremendous scope for increasing the productivity.

2.12.1 Causes for Low Productivity

The low productivity of coconut around the world in general is due to various reasons, viz. the presence of old and senile palms in more than two third of the area; overcrowding in some countries; sparse populations in some other countries; planting nondescriptive varieties without proper selection of either mother palms or seedlings; non-adoption of recommended management practices; natural disasters like hurricane, cyclone, etc.; pest infestation; disease problems; and improper harvesting. In addition, coconut predominantly being a smallholders' crop, the resource-poor

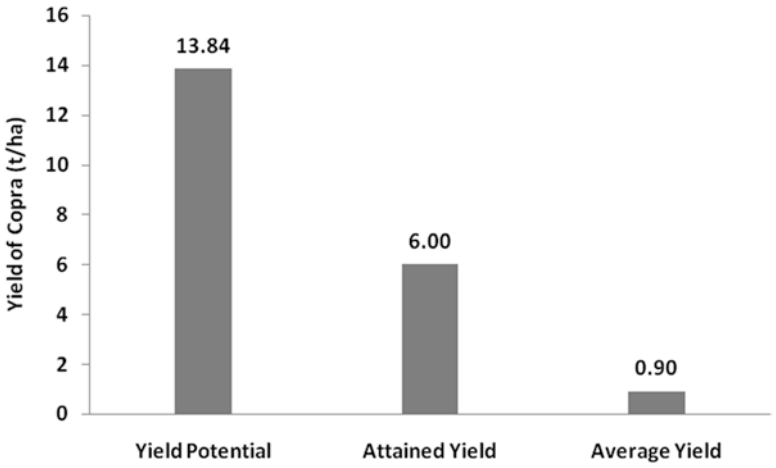

Fig. 2.12 Yield gaps in coconut

farmers are not able to take up replanting and provide proper management due to financial constraints. The political will was also either inadequate or totally absent. Many countries started feeling that coconut industry is dying, and some of the countries have reduced the area. Now they have realized the export potential of various coconut products stimulating attention to coconut (Rethinam 2008).

2.12.2 Strategic Solutions for Increasing Production

Sustainable productivity will be necessary to meet the growing demand of raw material for the processing industries at cost-effective prices. Production can be increased through area expansion and productivity increase. Since land has become a scarce commodity due to diversified uses, urbanization and industrialization, the only option left is productivity increase (Rethinam 2005).

2.12.3 Integrated Approach to Increase Productivity

Over a period of time, the research conducted in different parts of the coconut-growing countries has helped to develop technologies to increase farm income and coconut productivity as well as farm-level processing technologies to increase the income and employment (Rogonon 2004). Productivity of coconut plantations can be increased through rejuvenation of existing plantations by gap filling with high-yielding varieties and hybrids; optimum input management through organic recycling; nutrient and water management introducing micro-irrigation, fertigation, soil

and moisture conservation, replanting/under-planting to eliminate old senile and unproductive plantations; adopting integrated farming system approach (inter/mixed/multiple/multi-storied cropping and mixed farming); taking adequate care to maintain soil health; and taking up proper plant protection measures. For details, please see Chaps. 7, 10, and 12.

2.13 Approaches to Face Future Global Challenges

In the wake of mounting intense competition in global markets arising from the liberalized trade environment, the future prospects of the coconut industry lie solely on its overall competitive ability. The industry has to tap the full potential of coconut as a renewable resource, which could be used to generate a range of environment-friendly, natural products, with a wide variety of end uses and applications. Likewise, producing countries need to exploit to the fullest their individual comparative advantages in cultivation, processing and marketing of coconuts and various products. The moot factors in achieving a sustainable degree of overall competitiveness in the coconut industry are listed hereunder:

1. *Encouragement for farm-level processing*: Encourage community processing at farm level engaging farm youth and women to go for farm-level processing such as dehusking, shelling, collecting coconut water and making copra, virgin coconut oil or coconut products like chips, vinegar, charcoal from shell and handicrafts from shell, coir fibre and coir pith. Farm-level processing, on a farmer private entrepreneur participatory approach, will provide large quantity of raw materials at one place.
2. *Organic farming*: Converting the weakness of non-application of inorganic fertilizers into strength by adopting organic farming to produce niche organic products to derive better price and income. Organic farming associations can be encouraged to take up organic farming in larger areas.
3. *Linking farmers to the market*: If farmers are linked to the market, it will increase their profits encouraging them to produce more coconut as well as take up processing at farm level as indicated below:

    (i) Diversifying products/developing products for niche market: Large-scale product diversification and value addition from coconut and its by-products.
    (ii) Increasing processing efficiency and quality standards matching with international standards: Precision processing for making quality products, maintaining international quality standard, proper labelling and packaging with suitable branding.
    (iii) Intensive market promotional efforts, market study and market forecasting, conducting trade/investment mission and participation in international trade fairs and exhibitions.

(iv) Promotion of nontraditional coconut products like biofuel, bio-lubricants, etc. and coir-based products like geotextile, coir pith composites, grow bags, etc.
(v) Promoting coconut-based eco-tourism in island countries/establishment of coconut world.
(vi) Effective transfer of technology through training by setting up farmer's field school, farmer's participatory demonstration, etc.
(vii) Improving international/national transport facilities particularly water transport to reduce the freight charges.

2.14 Global Organizations Promoting Coconut Industry

The major organizations are Asian and Pacific Coconut Community (APCC), COGENT and BUROTROP.

2.14.1 Asian and Pacific Coconut Community (APCC)

The Asian and Pacific Coconut Community (APCC) is an intergovernmental organization of coconut-producing countries organized in 1969 under the aegis of the United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP). The APCC Secretariat is located in Jakarta, Indonesia, and is headed by an executive director.

The APCC has 18 coconut-producing member countries accounting for over 90% of world coconut production and export of coconut products. The APCC member countries include Federated States of Micronesia, Fiji, India, Indonesia, Kiribati, Malaysia, Marshall Islands, Papua New Guinea, the Philippines, Samoa, Solomon Islands, Sri Lanka, Thailand, Tonga, Vanuatu and Vietnam. Jamaica and Kenya are associate member countries of the APCC.

For executing its functions, the APCC Secretariat coordinates with member countries through a network of national liaison officers. Their responsibilities include the development of the coconut industry and national focal points that deal with coconut in their respective countries. The Asian and Pacific Coconut Community maintains close contacts with the United Nations Organization and its special agencies. The objectives of the Asian and Pacific Coconut Community (APCC) are to promote, coordinate and harmonize all activities of the coconut industry.

Its vision is to improve the socio-economic conditions of all stakeholders of the coconut industry in the member countries, particularly the small coconut farmers. APCC's mission is to assist the member countries to develop their coconut industries to increase productivity; reduce cost of production and adopt integrated coconut-based farming systems; encourage organic farming; promote farm-level

processing; promote product diversification, value addition and by-product utilization; improve quality standards; intensify market promotional activities and research; harmonize trade-related issues; and develop human resources for effective transfer of technology.

2.14.2 International Coconut Genetic Resources Network (COGENT)

COGENT's goal is to strengthen international collaboration in conservation and use of coconut genetic resources, to improve coconut production on a sustainable basis and to boost livelihoods and incomes of coconut stakeholders in developing countries, 39 producing countries with their own research centres and 2 regional organizations working on global conservation. COGENT is a scientific network built for mutual interest and not a formal organization. Decisions are taken during the steering committee meetings, expected to be held annually.

The achievements are as follows:

COGENT multisite International Coconut Gene banks have been established to conserve 200 important accessions in 5 regions: Brazil, Côte d'Ivoire, India, Indonesia and Papua New Guinea.

Development of the International Coconut Genetic Resources Database (CGRD).

Protocols for in vitro embryo culture, cryopreservation, morphometric and molecular marker-based methods, pest risk assessment and germplasm health management, collection, characterization and ex situ and in situ conservation.

Evaluation of 38 high-yielding hybrids in a multilocation trial involving four African and three Latin American/Caribbean countries.

Evaluation of farmers' varietal preferences in 15 countries.

From 1994, the network was involved in more than 288 projects, trainings, meetings and workshop activities. One thousand ninety coconut researchers shared information and technologies. Inadequacies of resources have unfortunately forced COGENT to slow down its activities.

2.14.3 Bureau for the Development of Research on Tropical Perennial Oil Crops (BUROTROP)

BUROTROP is a global network for the development of research on tropical perennial oil crops started in 1990. It is a French-based international organization. The general objective is to strengthen the capabilities of member countries in research and development of coconut and oil palm.

The target beneficiaries are the NARS (35 countries representing 90% of the production for coconut). Through these, the poor smallholders in developing

countries who live below poverty level, consumers in developing countries, processors and traders, commercial sector in Europe, development agencies, policy-makers and donors are benefitted.

BUROTROP had 94 active members, 63 individual members and 31 corporate members (11 private companies, 19 public organizations and 1 NGO). In addition to the active members, BUROTROP has many associated members. BUROTROP is not itself a research organization; however, it initiates and coordinates research team groups and networks. It is unfortunately non-functional now.

2.15 Future Strategy

Though the growth of coconut industry is slow, it holds promise in the future as it is such a versatile crop. Availability of quality planting material to meet the increasing demand and good management practices will help in increasing the productivity. Efforts made in product diversification, value addition and by-product utilization, in the recent past, with innumerable high-value products, will make it more competitive and will go a long way in providing food, nutritional, health and social security. Full advantage has to be taken on the positive effects of monolaurin derived from coconut on health effects. There will be growing demand for coconut since its shortage is already felt in many countries like Thailand, Malaysia and Indonesia. International cooperation in research, development and marketing has to be necessarily strengthened. Apart from providing environmental sustainability, coconut can provide livelihood security in the future, provided there is willingness from farmers and strong commitment and political will to develop this industry as a whole and make coconut industry as a sunrise industry.

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