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Economic Utilisation of Areca Leaf Sheaths for Rural Livelihood

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ABSTRACT

The enormous supply of areca leaf sheaths coupled with raising consciousness among society towards usage of eco-friendly products have paved a way for emergence of rural based areca leaf product manufacturing units. Areca growers reaped net profit of Rs.7120 per acre by selling leaf sheaths to manufacturing units. The industry has generated employment ranging from 2 labourers in very small units to 242 labourers in very large units per unit per annum depending upon the size of the industry. The manufacturers reaped net returns ranging from 0.65 lakh in very small units to 121.9 lakhs in very large units. The capital budgeting analysis indicated wealth generation of Rs. 0.72 lakhs in very small units and Rs. 59.09 crores in very large units with the annual rate of return of 17 and 88 per cent, respectively, indicating economic worthwhileness of areca leaf products manufacturing units. It is noteworthy that very large units repaid the initial investment in 0.13 years while others took more than one year. The data envelopment analysis indicated that very small, small and very large units were found to be cost inefficient with efficiency scoring of 0.5, 0.79 and 0.72, respectively. It was evident from the conjoint analysis that the consumer preference was influenced by quality parameters like desired dimensions, portability, ecofriendly nature and price of leaf products. There exists vast scope for development of this vital industry with potential supply of raw materials at 144 crore leaf sheaths produced in the state per annum. Hence, it is suggested that Government should encourage such agro based rural industries for development of rural economy.

Keywords: Areca leaf sheaths, Economic utilisation, Eco-friendly, Employment, Rural livelihood.

JEL: P25, Q18, Q21, Q52.

I

INTRODUCTION

Arecanut is cultivated extensively in the state of Karnataka on an area of 2.61 lakh hectares with annual production of 3.82 lakh tonnes. About three million farmers are dependent on arecanut for their livelihood as it generates enormous employment and income. Arecanut produces main product (Betelnut) and by-products (leaf sheath and arecanut husk). The main product is marketable while by-product goes waste if not properly utilised. Earlier, leaf sheaths were used as mulching material or source of organic matter. Of-late due to technological innovations in agro-based industries, it is possible to manufacture leaf products of different dimensions. As plastic goods are banned in many states, arecanut based products are gaining importance and penetrating deeper into the consumer market. It is observed that units manufacturing arecanut leaf plates and bowls on small scale as well as large scale have mushroomed

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in arecanut growing belts. Due to easy availability of raw materials in sufficient quantity and ever escalating demand in local and international market, entrepreneurs have been showing keen interest in establishing such units. The units are capital and labour intensive, generates substantial employment for the people living around. Keeping in view the economic significance, social and environmental importance and export potentiality of this vital rural based industry, the present study envisages detailed investigation into economic aspects of arecanut leaf product manufacturing to throw light on by-product utilisation for economic development of the region.

The study is divided into four sections. Section II provides details of methodology followed, i.e., selection of sample respondents, source of data, statistical tools employed to estimate economics, efficiency, customer preference, projection of raw material supply and contribution to state's gross domestic product (GDP). The results and discussion are presented in the third section, while the policy issues are discussed in the last section.

II

METHODOLOGY

2.1 *Data Source*

Primary data pertaining to capital investment made on the manufacturing unit, recurring expenses on labour, raw materials, packing materials, electricity/fuel were elicited from owners of manufacturing unit using pretested schedule.

2.2 *Selection and Categorisation of Areca Leaf Products Manufacturing Units*

The sample industries are not registered companies hence, the post stratification of industries has been made on the basis of number of leaf sheaths processed per day and magnitude of capital investment into very small, small, medium, large and very large units to capture the influence of scale economies (Table 1). Five units each representing above size groups aggregating to 25 units were selected from Shivamogga district of Karnataka state. Since the study is confined to Shivamogga district only, it was felt the sample of 25 units was representative and adequate. An attempt has been made to identify the crucial factors influencing consumer preference for areca leaf products. A sample of 30 respondent consumers were selected from Shivamogga city to represent the population using random sampling. Generally the consumers were found to use both areca products and plastic based products. Hence, the above sample representing the population was adequate and representative. Similarly, a sample consisting of 60 areca growers of Shivamogga district were selected randomly to elicit information on disposal of areca leaf sheaths, cost incurred towards disposal and returns accrued.

TABLE 1. CHARACTERISTICS OF ARECA LEAF PLATES AND BOWLS MANUFACTURING UNITS

Particulars (1)	Very small (2)	Small (3)	Medium (4)	Large (5)	Very large (6)
Number of leaf sheaths processed per day per unit	550	2000	4850	10000	20000
Capital investment per unit (Rs.)	107050	792000	1992000	3587000	15895000
Type of pressing machine used	Hand operated	Hand operated	Pedal operated hydraulics	Pedal and DC operated hydraulics	Hydraulics and hydropneumatics
Customers and destination of the product	Local	Local	Within state	National	National and International markets
Source of energy	Wastes generated out of leaf sheaths	Gas cylinder	Electricity	Electricity	Electricity

2.3 *Analytical and Statistical Tools*

Enterprise budgeting, data envelopment analysis, conjoint analysis, economic feasibility analysis, simple ratios and percentages were employed in processing raw data to draw meaningful inferences. Valuation of variable resources was made on per square inch basis.[1] Fixed costs were arrived at based on capacity utilisation.[2]

(a) *Returns*

Gross returns was arrived at by multiplying the quantity of finished products produced with selling price. Net returns was computed by taking the difference of total cost and gross returns.

(b) *Value Addition*

Value addition is the difference between the cost of raw material and price of finished product (Gangwar *et al*., 2010). The percentage value addition was estimated considering percentage change in the value of commodities at different stages, i.e., raw and finished forms [(price of finished good - price of raw material)/ (price of raw material)]*100.

(c) *Economic Viability of Investment*

Economic feasibility of investment on areca leaf plate and bowl manufacturing units was assessed employing net present worth, modified internal rate of return[3] and benefit cost ratio. Pay-back period an undiscounted measure was also worked out (Kiran *et al*., 2019).

(d) *Conjoint Analysis*

Conjoint analysis was performed considering various factors such as nature of product (areca or plastic products), price, shelf life (long/short), eco-friendliness

(yes/no), dimensions (flexible/rigid), portability (yes/no), quality (infection free or not), market accessibility (niche, limited, unorganised or unlimited and organised), social preference (yes/no), religious and cultural preference (yes/no). Thirty customers using both areca leaf products and plastics were given the preferences schedule to rank cards/combinations as per their opinion. Using orthogonal design in SPSS 16 version, 38 card combinations were selected, of which 6 cards were considered as hold out cases. The ranks given for various combinations by all the customers were used to identify crucial factors determining consumer preference products.

(e) *Data Envelopment Analysis (DEA)*

Cost efficient input oriented constant returns to scale model was employed to assess efficiency of areca leaf product manufacturing units. The analysis was performed using Coelli software (Chinnappa *et al*., 2018). For each Decision Making Unit (DMU), areca leaf products i.e., plates and bowls produced per year, labour employed (man-days), raw materials (sq. inch) and corresponding unit prices of inputs were considered in the calculation of cost- DEA efficiency score (Ernest and Retha, 2002). The rationale behind considering only labour and raw materials in the assessment of efficiency score was their percentage (>70 per cent) contribution towards total cost. The best DMU operates at 100 per cent technical efficiency (efficiency score =1) and the DMU with lower technical efficiency (score <1) works at a percentage less than 100. Allocative efficiency or otherwise called as pricing efficiency relies on cost of inputs. It is related to cost of inputs in relation to output, and equilibrium condition is attained when marginal cost equates average revenue. DMU's allocative efficiency is with regard to the allocation of inputs vis-a vis its price for a given level of output, so as to minimise the cost of production. The cost efficiency refers to the product of technical and allocative efficiencies expressed in percentage.

III

RESULTS AND DISCUSSION

3.1 *Economics of Production of Areca Leaf Plates and Bowls*

(a) *Capital Investment*

The very small units have been set up by small investors in the areca belt to earn their livelihood as household industries. The capital investment required for its establishment was Rs.1,07,050 per unit. The major investment was on hand pressing machines constituting over 98.1 per cent of the total investment (Table 2). The waste leaf sheaths are used as fuel hence, electrification was not necessary.

TABLE 2. CAPITAL INVESTMENT ON ARECA LEAF PLATES AND BOWLS MANUFACTURING UNITS

Particulars (1)	Very small (2)	Small (3)	Medium (4)	Large (5)	Very large (6)
Building		400000 (50.5)	500000 (25.1)	1157000 (32.3)	
Machine	105000 (98.1)	280000 (35.4)	1230000 (61.7)	1477000 (41.2)	14303500 (90)
Electrification charges			150000 (7.5)	150000 (4.2)	405000 (2.5)
Washing platform		10000 (1.3)	12000 (0.6)	25000 (0.7)	48500 (0.3)
Bore well with pumpset		70000 (8.8)	70000 (3.5)	98000 (2.7)	100000 (0.6)
CC camera				40000 (1.1)	40000 (0.3)
Sintex, washing gun, 1/2 hp motor to operate washing gun		32000 (4.0)	30000 (1.5)	40000 (1.1)	30000 (0.2)
Vehicle to procure raw material				300000 (8.4)	968000 (6.1)
Miscellaneous	2050 (1.9)			300000 (8.4)	
Total	107050	792000	1992000	3587000	15895000

The investment of Rs.7,92,000 per unit was required for small units of which, cost of buildings came to 50.50 per cent and machinery accounted for 35.4 per cent. Building of dimension 40'×14' is essential to house hand pressing machines, perform grading and packing operations. The godown of dimension 45'×21' is indispensable for storage of raw materials. About 14 hand pressing plate and bowl making machines operated by using gas cylinder as energy source were installed in the unit (Table 2).

The medium units required an investment of Rs.19,92,000 per unit for establishment (Table 2). Pedal operated hydraulic machines were employed to press leaf sheaths into plates and bowls. The investment on machines came to Rs.12,30,000 (61.75 per cent). Machines are operated with electricity. An investment of Rs.1,50,000 was made towards electrification charges for availing power supply of 15hp.

The capital investment made on large units came to Rs.35,87,000 per unit. Cost of building was highest at Rs.11,57,000 (32.3 per cent) followed by machines Rs.14,77,000 (41.2 per cent). Direct current (DC) operated hydraulic machines were employed in production of plates and bowls. DC operated machines reduce drudgery of human labour. CC camera in the premises enabled effective supervision of the unit. A total advance amount of Rs.3,00,000 @ Rs.15,000 was lent to each labourer as an advance amount to confirm their availability round the working period (Table 2).

The capital investment of Rs.1,58,95,000 per unit was required to establish very large units with hydro-pneumatics and hydraulic machines of which, pressing, cutting, grinding machines, drier, UV chamber and packing machine accounted for

Rs.1,43,03,500. Pressed leaf plates are subjected to drying with driers to maintain optimum moisture level. Care is taken to dry finished products to the desired moisture level and reduce possible microbial infestations at the time of storage and transit. The plates and bowls are subjected to grinding machine to give soft edge and smooth surface. UV treatment prevents mycelial and microbial infection. The products in these units are of high quality primarily meant for export. Power supply to the unit was obtained from KPTCL with an investment of Rs.4,05,000 (Table 2).

(b) *Income Accrued to Arecanut Growers*

Each acre of areca plantation with 640 palms produces 6,400 leaf sheaths per annum. Of-late farmers have realised the importance of this by-product after the inception of areca leaf plate manufacturing units in the surrounding regions and started supplying leaf sheaths to them at nominal rates to earn revenue. Arecanut growers realised gross returns of Rs.7,680 per acre and net returns of Rs.7,120 per acre after making provision for expenditure towards collection and bundling. The net income per leaf sheath worked out to Rs.1.11 (Table 3).

TABLE 3. INCOME GENERATED TO ARECANUT GROWERS

Particulars (1)	Value (2)
Palms per acre (No.)	640
Leaf sheaths per acre (No.)	6400
Expenditure towards collection of leaf sheaths per acre (Rs.)	560
Price per leaf sheath (Rs.)	1.2
Gross returns per acre (Rs.)	7680
Net returns per acre (Rs.)	7120
Net returns per leaf sheath (Rs.)	1.11

(c) *Profitability of Areca Leaf Plates and Bowls Manufacturing*

In very small units, the total cost of manufacturing plates came to Rs.2,11,034 per manufacturing unit. Of this, labour shared maximum at Rs.1,02,238 (48.45 per cent) followed by raw materials at Rs.71,505 (33.88 per cent) and fuel at Rs.18,465 (8.75 per cent). An expenditure of Rs.4,877 (2.31 per cent) was made on packing and packaging using polythene covers and bags of 42″ size. The interest on fixed capital indicated inventory position of very small units, was barely 1.74 per cent of the total cost. The depreciation on plant and machineries accounted for 2.87 per cent of the total cost. The total cost incurred on production of bowls of 4.5″ and 6″ dimension came to Rs.44,754 per manufacturing unit while the operational expenditure constituted 82.21 per cent of the total cost. As usual, labour and raw material formed the major chunk at Rs.17,762 (39.69 per cent) and Rs.12,422 (27.76 per cent), respectively. The unit cost of manufacturing plates (12″ and 10″) and bowls (6″ and 4.5″) worked out to Rs.2.46, Rs.1.75, Rs.0.72 and Rs.0.46, respectively (Table 4).

TABLE 4. ECONOMICS OF ARECA LEAF PLATES AND BOWLS IN VERY SMALL AND SMALL UNITS

	Very small units Value [Rs.]						Small units Value [Rs.]							
Particulars	Plates			Bowls			Plates					Bowls		
Variable cost [VC]	12″	10″	Total	6″	4.5″	Total	10″	8″	8×4″	11″	Total	4″ Round	4″ Square	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Raw material	42200	29305	71505	7950	4472	12422	549115	87858	43929	442953	1123855	95180	21965	117144
	(0.84)	(0.58)	{33.88}	(0.21)	(0.12)	{27.76}	(1.25)	(0.80)	(0.40)	(1.52)	{52.35}	(0.20)	(0.20)	{41.15}
Labour	60337	41901	102238	11367	6394	17762	290708	46513	23257	234504	594982	50389	11628	62018
	(1.20)	(0.84)	{48.45}	(0.30)	(0.17)	{39.69}	(0.66)	(0.42)	(0.21)	(0.80)	{27.71}	(0.11)	(0.11)	{21.78}
Packing materials	2787	2090	4877	1600	1033	2633	31390	7847	7847	22679	69764	8036	2676	10712
	(0.06)	(0.04)	{2.31}	(0.04)	(0.03)	{5.88}	(0.07)	(0.07)	(0.07)	(0.08)	{3.25}	(0.02)	(0.02)	{5.08}
Annual repairs	285	285	570	215	215	430	5300	848	424	4275	10847	919	212	1131
	(0.01)	(0.01)	{0.27}	(0.01)	(0.01)	{0.96}	(0.01)	(0.01)	(0.0004)	(0.01)	{0.51}	(0.002)	(0.002)	{0.40}
Fuel	10897	7568	18465	2053	1155	3208	71113	11378	5689	57365	145545	12326	2845	15171
	(0.22)	(0.15)	{8.75}	(0.05)	(0.03)	{7.17}	(0.16)	(0.10)	(0.05)	(0.20)	{6.78}	(0.03)	(0.03)	{5.33}
Interest on working	1942	1352	3294	386	221	608	47381	7722	4057	38089	97250	8494	2001	10496
capital	(0.04)	(0.03)	{1.56}	(0.01)	(0.01)	{1.36}	(0.11)	(0.07)	(0.04)	(0.13)	{4.53}	(0.02)	(0.02)	{3.69}
Sub total	118448	82501	200949	23572	13490	37062	995007	162167	85204	799865	2042243	178380	42027	220407
	(2.36)	(1.65)	{95.22}	(0.62)	(0.36)	{82.21}	(2.27)	(1.48)	(0.78)	(2.74)	{95.13}	(0.38)	(0.39)	{77.42}
Fixed cost [FC]														
Depreciation	3023	3023	6047	2278	2278	4557	13614	3402	3402	9077	29495	14748	3402	18150
	(0.06)	(0.06)	{2.87}	(0.06)	(0.06)	{10.18}	(0.03)	(0.03)	(0.03)	(0.03)	{1.37}	(0.03)	(0.03)	{6.38}
Interest on fixed capital	1831	1831	3663	1380	1380	2760	34284	8568	8568	22860	74280	37140	8568	45708
	(0.04)	(0.04)	{1.74}	(0.04)	(0.04)	{6.17}	(0.08)	(0.08)	(0.08)	(0.08)	{3.46}	(0.08)	(0.08)	{16.06}
Rental value of land	188	188	375	188	188	375	208	208	208	208	832	208	208	416
	(0.004)	(0.004)	{0.18}	(0.005)	(0.005)	{0.84}	(0.0005)	(0.002)	(0.002)	(0.0007)	{0.04}	(0.0004)	(0.002)	{0.15}
Sub total	5042	5042	10084	3846	3846	7692	48106	12178	12178	32145	104607	52096	12178	64274
	(0.1)	(0.1)	{4.78}	(0.1)	(0.1)	{17.19}	(0.11)	(0.11)	(0.11)	(0.11)	{4.87}	(0.11)	(0.11)	{22.58}
Grand total [VC+FC]	123490	87544	211034	27418	17336	44754	1043113	174345	97382	832010	2146850	230476	54205	284681
	(2.46)	(1.75)		(0.72)	(0.46)		(2.38)	(1.59)	(0.89)	(2.85)		(0.49)	(0.50)	
Quantity	50160	50160		37800	37800		438000	109500	109500	292000		474500	109500	
Gross returns	148975	107844		37800	26460		1274580	240900	208050	989880		284700	87600	
	(2.97)	(2.15)		(1.0)	(0.70)		(2.91)	(2.20)	(1.90)	(3.39)		(0.60)	(0.80)	
Net returns	25485	20300		10382	9124		231467	66554	110668	157870		54224	33395	
	(0.51)	(0.40)		(0.27)	(0.24)		(0.53)	(0.61)	(1.01)	(0.54)		(0.11)	(0.30)	
Value addition [VA] (Rs.)	2.13	1.57		0.79	0.58		1.66	1.4	1.5	1.87		0.4	0.6	
Per cent Value addition	253.57	270.69		376.19	483.33		133	175	375	123		200	300	
Break even output	8266	10084		10121	11312		75165	16914	10873	49454		236800	29702	

Notes : Figures in parentheses indicate unit costs and returns. Figures in flower bracket indicate percentage to the total.

The manufacturer realised net returns of Rs.0.51 and Rs.0.4 per plate of 12″ and 10″ and Rs.0.27 and Rs.0.24 per bowl of 6″ and 4.5″ respectively. The net return earned per plate was higher than bowls. The average variable cost indicated increasing trend with increase in the size of plates.

In small units, the total operational cost on areca plates of various dimensions came to Rs.21,46,850 per manufacturing unit. Of this, variable cost constituted for 95.13 per cent and rest was fixed cost (4.87 per cent). The expenditure on raw material alone was Rs.11,23,855 (52.35 per cent) followed by labour at Rs.5,94,982 (27.71 per cent) and fuel at Rs.1,45,545 (6.78 per cent). Gas cylinder was used as fuel to operate hand pressing machines. An expenditure of Rs. 69,764 (3.25 per cent) was incurred towards packing materials. Among fixed costs, interest on fixed capital formed 3.46 per cent followed by depreciation at 1.37 per cent. The total cost incurred for manufacturing of 4″ round and square bowls came to Rs.2,30,476 and Rs.54,205, respectively per manufacturing unit. The variable cost formed 77.42 per cent and remaining 22.58 per cent was formed by fixed cost. Of the total cost, raw material formed major item at Rs.1,17,144 (41.15 per cent) followed by labour at Rs.62,018 (21.78 per cent), Interest on fixed capital was Rs.45,708 (16.06 per cent) and depreciation on machineries and accessories was Rs.18,150 (6.38 per cent). The per unit cost of production ranged from Rs.2.85 to Rs.0.89 for 11″ and 8×4″ plates. The 10″ plates were sold at Rs.2.91, 11″ at Rs.3.39, 8″ at Rs.2.2 and 8×4″ at Rs.1.9. In case of bowls of 4″ round and 4″ square, an average expenditure of Rs.0.49 and Rs.0.50 was incurred on per unit basis fetching net returns of Rs. 0.11 and Rs.0.30, respectively (Table 4).

Medium units manufactured plates of 12″, 10″ and 8″ dimension and incurred cost of Rs.35,29,701 per manufacturing unit. The variable cost formed major chunk at Rs.33,10,951 (93.80 per cent) and rest 6.20 per cent by fixed costs. Of the total cost, raw material constituted 63.58 per cent at Rs.22,44,068. The other major items of expenditure were labour (17.78 per cent), packing materials (6.43 per cent) and interest on fixed capital (4.23 per cent). An expenditure of Rs.1,15,674 (3.28 per cent) was made on electricity per annum. The total expenditure made on production of 6″ and 4″ bowls came to Rs.11,32,750 per manufacturing unit. The variable cost formed 80.73 per cent of the total cost and rest being shared by fixed cost 19.27 per cent. The major item of expenditure was on raw material at Rs.5,88,332 (51.94 per cent) followed by labour at Rs.1,64,510 (14.52 per cent), packing materials at Rs.71,837 (6.34 per cent), depreciation of machines and accessories at Rs.67,850 (5.99 per cent) and interest on fixed capital at Rs.1,49,400 (13.19 per cent). The unit costs and returns of medium units as given in the Table 5 indicate that the net returns was higher in case of 8″ plates followed by 12″ and 10″ plates. The average cost of production was Rs.2.55, Rs.1.82 and Rs.1.23, respectively for 12″, 10″ and 8″ plates. Bowls of 6″ and 4″ were manufactured by medium units for which cost of Rs.0.76 and Rs.0.42 was incurred. The net return obtained per bowl was in order of Rs.0.24 and Rs.0.18.

TABLE 5. ECONOMICS OF ARECA LEAF PLATES AND BOWLS IN MEDIUM AND LARGE UNITS

	Medium units Value [Rs.]							Large units Value [Rs.]								
Particulars	Plates				Bowls			Plates						Bowls		
Variable cost [VC]	12″	10″	8″	Total	6″	4″	Total	10″ square	8″ round	10″ round	7″ round	6″ round	Total	4″ round	4″ square	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Raw material	1210284	630356	403428	2244068	453856	134476	588332	1928984	925912	1446738	708902	520826	5531362	154319	154319	308637
	(1.66)	(1.15)	(0.74)	{63.58}	(0.41)	(0.18)	{51.94}	(1.32)	(0.85)	(1.32)	(0.65)	(0.48)	{62.06}	(0.21)	(0.21)	{48.11}
Labour	338421	176261	112807	627490	126908	37602	164510	523204	251138	392403	192277	141265	1500287	41856	41856	83713
	(0.46)	(0.32)	(0.21)	{17.78}	(0.12)	(0.05)	{14.52}	(0.36)	(0.23)	(0.36)	(0.18)	(0.13)	{16.83}	(0.06)	(0.06)	{13.05}
Packing materials	110312	67526	49276	227112	51100	20683	71837	117600	70200	88200	54000	50400	380400	20400	20400	40800
	(0.15)	(0.12)	(0.09)	{6.43}	(0.05)	(0.03)	{6.34}	(0.08)	(0.06)	(0.08)	(0.05)	(0.05)	{4.27}	(0.03)	(0.03)	{6.36}
Annual repairs	6400	4800	4800	16000	9600	6400	16000	15593	11695	11695	11965	11965	62911	7796	7796	15593
	(0.01)	(0.01)	(0.01)	{0.45}	(0.01)	(0.01)	{1.41}	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	{0.71}	(0.01)	(0.01)	{2.43}
Electricity	62386	32493	20795	115674	23395	6932	30326	148637	71346	111478	54624	40132	426218	11891	11891	23782
	(0.09)	(0.06)	(0.04)	{3.28}	(0.02)	(0.01)	{2.68}	(0.1)	(0.07)	(0.10)	(0.05)	(0.04)	{4.78}	(0.02)	(0.02)	{3.71}
Interest on working	84362	44431	28871	157664	33243	10305	43548	132675	64582	99506	49595	37129	383488	11491	11491	22982
capital	(0.12)	(0.08)	(0.05)	{4.47}	(0.03)	(0.01)	{3.84}	(0.09)	(0.06)	(0.09)	(0.05)	(0.03)	{4.30}	(0.02)	(0.02)	{3.58}
Sub total	1771609	933053	606289	3310951	698102	216398	914500	2866694	1394873	2150020	1071363	801716	8284667	247754	247754	495507
	(2.43)	(1.70)	(1.11)	{93.80}	(0.64)	(0.30)	{80.73}	(1.96)	(1.27)	(1.96)	(0.98)	(0.73)	{92.94}	(0.34)	(0.34)	{77.23}
Fixed cost [FC]																
Depreciation	27140	20355	20355	67850	40710	27140	67850	49300	41250	29550	39450	28200	187750	17180	17000	34180
	(0.04)	(0.04)	(0.04)	{1.92}	(0.04)	(0.04)	{5.99}	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	{2.11}	(0.02)	(0.02)	{5.33}
Interest on fixed	59760	44820	44820	149400	89640	59760	149400	107610	80708	80708	80708	80708	430440	53805	53805	107610
capital	(0.08)	(0.08)	(0.08)	{4.23}	(0.08)	(0.08)	{13.19}	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	{4.83}	(0.07)	(0.07)	{16.77}
Rental value of land	500	500	500	1500	500	500	1000	2143	2143	2143	2143	2143	10714	2143	2143	4286
	(0.001)	(0.001)	(0.001)	{0.04}	(0.0005)	(0.001)	{0.09}	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	{0.12}	(0.003)	(0.003)	{0.67}
Sub total	87400	65675	65675	218750	130850	87400	218250	159053	124100	112400	122300	111050	628904	73128	72948	146076
	(0.12)	(0.12)	(0.12)	{6.20}	(0.12)	(0.12)	{19.27}	(0.11)	(0.11)	(0.11)	(0.11)	(0.10)	{7.06}	(0.10)	(0.10)	{22.77}
Grand Total [VC+FC]	1859009	998728	671964	3529701	828952	303798	1132750	3025747	1518974	2262421	1193664	912767	8913571	320881	320701	641583
	(2.55)	(1.82)	(1.23)		(0.76)	(0.42)		(2.07)	(1.39)	(2.07)	(1.09)	(0.83)		(0.44)	(0.44)	
Quantity	730000	547500	547500		1095000	730000		1460000	1095000	1095000	1095000	1095000		730000	730000	
Gross returns	2175400	1127850	930750		1095000	438000		4117200	2409000	3066000	1992900	1105950		518300	438000	
	(2.98)	(2.06)	(1.70)		(1.00)	(0.60)		(2.82)	(2.20)	(2.80)	(1.82)	(1.01)		(0.71)	(0.60)	
Net returns	316391	129122	258786		266048	134202		1091453	890027	803579	799236	193183		197419	117299	
	(0.43)	(0.24)	(0.47)		(0.24)	(0.18)		(0.75)	(0.81)	(0.73)	(0.73)	(0.18)		(0.27)	(0.16)	
Value addition (Rs.)	1.32	0.91	0.96		0.59	0.42		1.5	1.35	1.48	1.17	0.53		0.5	0.39	
Per cent Value addition	80	79	130		144	233		114	159	112	180	110		238	186	
Break even output	158007	184588	110821		361001	287913		184945	133441	133810	145596	396609		197643	280569	

Notes: Figures in the parentheses indicate unit costs and returns. Figures in the flower bracket indicate percentage to the total.

Large units manufactured 10″ square, 8″ and 10″ round, 7″ and 6″ plates incurring an expenditure of Rs.89,13,571 per manufacturing unit. Of the total cost, variable cost accounted for 92.94 per cent (Rs.82,84,667) and remaining 7.06 per cent was fixed cost. Raw material accounted highest at Rs.55,31,362 (62.06 per cent) followed by labour Rs.15,00,287 (16.83 per cent), packing material at Rs.3,80,400 (4.27 per cent), electricity Rs.4,26,218 (4.78 per cent), interest on working capital Rs.3,83,488 (4.30 per cent) and interest on fixed capital Rs.4,30,440 (4.83 per cent). All the units irrespective of their size borrow mainly from banks for establishment and running of the units incurring interest payments. The large units had made substantial investment and incurred higher interest on fixed capital. The manufacturing of 4″ round and 4″ square shaped bowls required an expenditure of Rs.3,20,881 and Rs.3,20,701, respectively per manufacturing unit. The variable cost incurred on bowls was Rs.4,95,507 (77.23 per cent) and fixed cost shared 22.77 per cent at Rs. 1,46,076. As usual, the expenditure made on raw material was maximum at Rs.3,08,637 (48.11 per cent). Labour formed 13.05 per cent of the total cost and remained as the second largest cost component. Interest on fixed capital at Rs.1,07,610 (16.77 per cent) was the other major cost item. The large manufacturing units of areca plates and bowls spent Rs.2.07, Rs.1.09 and Rs.0.83 for each piece of 10″, 7″ and 6″ round plates and Rs.0.44 for 4″ round and 4″ square bowls. The net returns realised were Rs.0.73 in case of 10″ and 7″ round plates. The 6″ round plates fetched meager returns (Rs.0.18). Brought net returns of bowls was Rs.0.27 (4″ round) and Rs.0.16 (4″ square) (Table 5).

Very large units are involved in manufacturing plates of dimensions 9″, 8″, 7×8.5″ and 6″ incurring an expenditure of Rs.4,22,02,973 per manufacturing unit. Of the total cost, the share of variable cost was maximum at Rs.3,58,09,830 (84.85 per cent) and the rest was shared by fixed cost (15.15 per cent). The expenditure made on labour was highest at Rs. 1,84,46,396 (43.71 per cent) followed by raw materials at Rs.98,56,477 (23.35 per cent), Interest on working capital Rs.31,35,338 (7.43 per cent), rental value of land Rs.26,00,000 (6.16 per cent) and electricity Rs.24,30,364 (5.76 per cent) are the other major costs in plate manufacturing. Bowls of 4″ and 3.5″ dimensions are manufactured at very large units by incurring total cost of Rs.76,66,365 per manufacturing unit. The share of variable cost was 60.72 per cent at Rs.46,54,658 and fixed cost at Rs.30,11,707 (39.28 per cent). The share of fixed cost reflects the magnitude of capital investment made on the unit. As usual, labour formed the major chunk at Rs.20,46,528 (26.69 per cent) followed by raw material Rs.10,93,523 (14.26 per cent), packing materials Rs.5,96,167 (7.78 per cent), rental value of land Rs. 13,00,000 (16.96 per cent), depreciation Rs. 7,88,433 (10.28 per cent) and interest on fixed capital Rs.9,23,274 (12.04 per cent). As could be seen in the Table 6, the average cost of production of plates ranged from Rs.2.56 (9″) to Rs.1.38 (6″). All plates fetched higher returns due to their better selling prices.

TABLE 6. ECONOMICS OF ARECA LEAF PLATES AND BOWLS IN VERY LARGE UNITS

Particulars	Value [Rs.]							
	Plates					Bowls		
Variable cost [VC]	9″	8″	7×8.5″	6″	Total	4″	3.5″	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Raw material	4460713	2680099	1228761	1486904	9856477	917842	175681	1093523
	(0.64)	(0.50)	(0.47)	(0.28)	{23.35}	(0.13)	(0.10)	{14.26}
Labour	8348224	5015805	2299626	2782741	18446396	1717741	328786	2046528
	(1.19)	(0.94)	(0.88)	(0.53)	{43.71}	(0.24)	(0.18)	{26.69}
Electricity	1099902	660846	302982	366634	2430364	226317	43319	269636
	(0.16)	(0.12)	(0.12)	(0.07)	{5.76}	(0.03)	(0.02)	{3.52}
Repairs	214925	163433	80597	161194	620149	223881	55970	279851
	(0.03)	(0.03)	(0.03)	(0.03)	{1.47}	(0.03)	(0.03)	{3.65}
Packing materials	457856	348161	171696	343392	1321105	476933	119233	596167
	(0.07)	(0.07)	(0.07)	(0.07)	{3.13}	(0.07)	(0.07)	{7.78}
Interest on working capital	1412376	852018	391197	479747	3135338	308578	60376	368954
	(0.20)	(0.16)	(0.15)	(0.09)	{7.43}	(0.04)	(0.03)	{4.81}
Sub total	15993996	9720362	4474860	5620612	35809830	3871293	783365	4654658
	(2.28)	(1.82)	(1.70)	(1.07)	{84.85}	(0.53)	(0.43)	{60.72}
	Fixed cost [FC]							
Rent	650000	650000	650000	650000	2600000	650000	650000	1300000
	(0.09)	(0.12)	(0.25)	(0.12)	{6.16}	(0.09)	(0.36)	{16.96}
Depreciation	605516	460445	227069	454137	1747167	630746	157687	788433
	(0.09)	(0.09)	(0.09)	(0.09)	{4.14}	(0.09)	(0.09)	{10.28}
Interest on fixed capital	709075	539192	265903	531806	2045976	738619	184655	923274
	(0.10)	(0.10)	(0.10)	(0.10)	{4.85}	(0.10)	(0.10)	{12.04}
Sub total	1964591	1649637	1142972	1635943	6393143	2019366	992342	3011707
	(0.28)	(0.31)	(0.43)	(0.31)	{15.15}	(0.28)	(0.54)	{39.28}
Grand Total	17958587	11369999	5617831	7256555	42202973	5890658	1775707	7666365
[VC+FC]	(2.56)	(2.13)	(2.14)	(1.38)		(0.81)	(0.97)	
Quantity	7008000	5329000	2628000	5256000		7300000	1825000	
Gross returns	56414400	39168150	21155400	24966000		25550000	4562500	
	(8.05)	(7.35)	(8.05)	(4.75)		(3.50)	(2.50)	
Net returns	38455813	27798150	15537569	17709444		19659341	2786794	
	(5.49)	(5.22)	(5.91)	(3.37)		(2.69)	(1.53)	
Value addition (Rs.)	7.41	6.85	7.58	4.47		3.37	2.4	
Per cent value addition	1158	1370	1613	1596		2592	2400	
Break even output	340484	298307	179996	444550		679921	479392	

Notes: Figures in the parentheses indicate unit costs and returns. Figures in the flower bracket indicate percentage to the total.

(d) *Value Addition*

Value addition reflects the income and employment potential subsumed in the process of conversion of raw material into finished product. The value addition in very small units was estimated to be 253 and 270 per cent in case of 12″ and 10″ plates while 376 and 483 per cent in the case of 6″ and 4.5″ bowls, respectively. Manufacturers procure raw materials at Rs.0.84 and turn it to 12″ plate by spending Rs.2.46 and sell at Rs.2.97 retaining Rs.0.51 as margin. Thus, Rs.0.84 worth raw material was transformed into Rs.2.97 worth finished good (Table 4). In small units, the value addition was found to be highest in 8×4″ rectangular plates at 375 per cent. It was in the order of 200 and 300 per cent, respectively in case of 4″ round and 4″

square bowls (Table 4). The value addition was found to be highest in case of 4″ bowl at 233 per cent due to lower cost of raw material (Rs.0.18) and manufacturing (Rs.0.42) in case of medium units. In plates, it ranged between 80 to 130 per cent (Table 5). The value addition in large sized units ranged between 112 to 180 per cent in plates and 186 to 238 per cent in bowls. It was highest in bowls due to lesser cost of raw materials (Table 5). The extent of value addition was over 1000 per cent in 9″ and 8″ plates and 1500 per cent in 7×8.5 and 6″ plates in very large units due to scale economies (Table 6). The economic benefits of value addition mainly depend on the operation of scale economies in the manufacturing, operational and pricing efficiency.

(e) *Break Even Output*

The results of break-even analysis indicated that production of plates and bowls of various dimensions across different sizes of manufacturing units was observed to be higher than break even output signaling the presence of profit (Table 4 to 6).

3.2 *Summary of Economics of Areca Leaf Products*

(a) *Income Accrued to Manufacturers*

The summary of economics of areca leaf products in different sized units on per manufacturing unit basis is presented in Table 7. The very small unit realised gross returns of Rs.3,21,079 and net returns of Rs.65,291 from sale of 1,75,920 plates and bowls of 12″, 10″, 6″ and 4.5″ dimension. Small units produced a total of 15,33,000 plates and bowls of 10″, 11″, 10″ round, 8″, 8×4″ and 4″ round and square dimensions and obtained gross returns of Rs.30,85,710 and net returns of Rs.6,54,179. The medium unit stood third in order with net returns of Rs.11.04 lakhs from sale of 36,50,000 units' incurring an expenditure of Rs. 46.62 lakhs. Large unit manufactured 73 lakhs of plates and bowls of different dimensions and shapes earning gross returns of Rs.1,36,47,350. The net returns accrued to the large unit was Rs.40,92,196. The total quantity of 9″, 8″, 7×8.5″, 6″ plates and 4″and 3.5″ bowls manufactured by the very large unit came to 2,93,46,000 units generating gross returns and net returns of Rs.17,18,16,450 and Rs.12,19,47,110, respectively.

(b) *Employment*

Employment generation in man-days was estimated on per unit and per annum basis and discussed below. Areca leaf products manufacturing is regarded as labour intensive enterprise. The enterprise has created employment of 600 man-days in very small units, 3285 man-days in small, 3960 man-days in medium, 7920 man-days in large and 88210 in very large units (Table 7). In other words, very small units

provided employment for 2 labourers, small for 9 labourers, medium for 11 labourers, large for 22 labourers and very large for 242 labourers per unit per annum. A perusal of table clearly reflects the reliance of industry on women labour force. Women labour force contributed 55 to 78 per cent of the total work force in the industry. It could be regarded as one of the possible ways of women empowerment. Men labour was predominantly used for pressing of leaf sheath into various sizes and shapes of plates and bowls using machinery. Women labour was engaged in cleaning, drying, washing, grading, packing and labelling of finished goods for marketing.

TABLE 7. SUMMARY OF ECONOMICS OF ARECALEAF PRODUCTS

Particulars/Unit size	Very small	Small	Medium	Large	Very large
(1)	(2)	(3)	(4)	(5)	(6)
Physical output					
Plates (No.)	100320	949000	1825000	5840000	20221000
Bowls (No.)	75600	584000	1825000	1460000	9125000
Income accrued to manufacturers					
Total variable cost (Rs.)	238012	2262650	4225450	8532420	40464489
Total fixed cost (Rs.)	17776	168880	437000	702032	9404850
Total cost (Rs.)	255788	2431531	4662451	9555154	49869340
Total returns (Rs.)	321079	3085710	5767000	13647350	171816450
Net returns (Rs.)	65291	654179	1104549	4092196	121947110
Employment					
Women	360 (60)	2555 (78)	2520 (64)	4320 (55)	59704 (68)
Men	240 (40)	730 (22)	1440 (36)	3600 (45)	28506 (32)
Total	600	3285	3960	7920	88210
Income accrued to labour force (Rs.)	120000	657000	792000	1584000	20492924
Operational efficiency measures					
Gross ratio	0.8	0.79	0.81	0.7	0.29
Operating ratio	0.74	0.73	0.73	0.63	0.24
Fixed ratio	0.06	0.05	0.08	0.05	0.05
Capital turnover ratio	3	3.9	2.9	3.8	10.81
Economic viability					
NPW (Rs.)	72092	1518852	5901036	17273053	590858458
MIRR (per cent)	17	25	48	57	88
BCR	1.03	1.07	1.16	1.2	2.05
Pay back period (years)	1.64	1.21	1.8	0.88	0.13
Economic efficiency					
Technical efficiency	0.65	0.86	1	1	1
Allocative efficiency	0.76	0.92	0.92	1	0.72
Cost efficiency	0.5	0.79	0.92	1	0.72
Existing level of resource use					
Raw material (sq. inch)	14365290	98988000	2.46E+08	4.42E+08	1.393E+09
Labour in man-days	600	3285	3960	7920	88210
Optimum level of resource use					
Raw material (sq. inch)	10651956	92823150	2.46E+08	4.42E+08	1.393E+09
Labour (man-days)	190.861	1663.2	3960	7920	31838.4
Per cent deviation from optimum					
Raw material (sq. inch)	34.86	6.64			
Labour (man-days)	214	97.5			177

(c) *Income Generation to Labour Force*

It may be observed that income generation to labour force per unit per annum varied from Rs. 1.2 lakhs to Rs. 20.50 lakhs across the size groups. Very small units generated income of Rs. 1.2 lakh, small units Rs. 6.57 lakh, medium units Rs. 7.92 lakh, large units Rs. 15.84 lakh and very large sized units Rs.20.5 lakh to rural labour folk (Table 7). The income potential directly varied with size.

(i) Operational Efficiency of Areca Leaf Plates and Bowls Manufacturing Units

Operational efficiency expressed in terms of gross ratio, operating ratio and fixed ratio indicated that very large units are more efficient with gross ratio of meagre 0.29 indicating that total cost incurred towards production of products formed hardly 29 per cent of the gross returns. Next in the order was a large sized unit with gross ratio of 0.7. In rest of the cases, gross ratio hovered around 0.8. The capital turnover ratio was highest at 10.81 in very large units and in rest of the cases it hovered around 3 indicating every rupee of capital earned gross returns of Rs. 3 to the unit (Table 7).

(d) *Economic Viability of Investment*

The costs and returns streams were discounted at the rate of interest charged by commercial banks (12 per cent) to work out NPW, BCR and MIRR. NPW ranged from Rs. 72,092 in very small units to Rs. 59.1 crore in very large units indicating economic viability and amount of wealth generated by the unit over its life period after duly accounting for inflation (Table 7). BCR ranged from 1.03 in very small units to 2.05 in very large units justifying investment worth-whileness. MIRR ranged 17-88 per cent across all the sizes of manufacturing units. As the MIRR was quite high, entrepreneurs can borrow credit from commercial banks or co-operatives at the rate of 12 per cent and invest on areca leaf plate unit to reap returns at the rate of MIRR. Based on MIRR, the investment made on manufacturing units is considered to be safe and economically worthwhile. Pay-back period signaled that within a very short time period of <1 year, the investment made on the unit could be recovered in case of large and very large sized units. In rest of the cases, it took close to 2 years for recovery.

(e) *Economic Efficiency*

The perusal of Table 7 clearly indicates that medium, large and very large units were found to be technically efficient with efficiency score of 1. Technical efficiency score was lowest in case of very small unit at 0.65 reflecting the existence of inefficiency to the tune of 35 per cent. The situation was little better in case of small units at 0.86. The possible reason for inefficiency was the size and scale of business.

Size reflects the magnitude of capital investment and scale reflects the operational capacity to utilise the capital. Both of these were found to be low in case of very small and small restraining them to produce more per unit of input. Large, medium and small units were found to be allocatively efficient in order of magnitude with efficiency score of 1 and 0.92, respectively. Very large units had allocative inefficiency of 28 per cent. In order to produce quality output, very large units heavily depend on manual labour for performing special operations like drying, scrubbing, buffing, quality packing, labeling more precisely. Very small, small and very large units were found to be cost inefficient. Cost inefficiency in case of very small and small units is due to technical and pricing inefficiency. In order to improve efficiency, the very small units should reduce raw materials by 34.86 per cent and labour by 214 per cent and small unit by 6.64 and 97.5 per cent. In case of very large sized units cost inefficiency was solely due to allocative/pricing inefficiency. It could be resolved by reducing dependence on manual labour by 177 per cent through mechanisation of operations (Table 7).

3.3 *Consumer Preference for Areca Leaf Products*

Conjoint analysis was carried out to assess consumer preference for areca leaf products (Table 8). Higher utility score for factors indicate greater preference. Most of the factors considered for assessment of customer preference for areca leaf products are of discrete type. Discrete represents presence of yes or no levels. Price is the only factor which is treated as scale variable. The conjoint analysis assumes linear model for price factor implicating its linear relation with utility. The direction of relation between price and utility is indicated as 'less' indicating that lower levels of price factor are preferred. It explicitly indicates that utility possesses linear and negative relation with the price. Higher the price, lesser the utility and vice versa. The sign of utility estimates exhibit the relation between factor and utility. As expected, price has got negative sign signaling the presence of inverse relation with utility. As price increases, utility gained by consumer decreases. The utility estimate was -1.93 for price of more than three rupees while it was less (-0.48) for price level less than one rupee. Quality and shelf life of the product had negative sign reflecting the existence of negative relation with utility. Areca leaf products are more prone to mycelial infection compared to plastics consequently affecting shelf life. Plastic based products are free from mycelial growth and possess better shelf life. Dimensions and portability are the major factors having greater bearing on utility. The utility estimate of dimension and portability was 3.61 and 1.52, respectively. Customers prefer areca leaf products over plastics or paper based products because of the availability of products in desired dimensions and shapes. Areca products are flexible in terms of dimensions while plastics or paper based products are more rigid restricting the preference of customers. Portability is the other factor influencing customer preference for areca leaf products over plastics. Portability enables easy

handling due to its heat resistance when hot food is served. Nature of the product is the other major factor influencing consumer preference with utility estimates of 1.20. This reflects the presence of ecological and environmental concern and consciousness among customers. The factors which have got least influence on customer preference for areca leaf products are social and religious factors. Social and religious factors will remain neutral between areca based and plastic based products in terms of customers' preference.

TABLE 8. FACTORS INFLUENCING CONSUMER PREFERENCE FOR ARECA LEAF PRODUCTS

Factors (1)	Levels (2)	Utility estimate (3)	Std. error (4)	Importance score (5)
Dimension	Flexible	3.61	1.29	26.5
	Rigid	- 3.61	1.29	
Portability	Portable	1.52	1.29	11.94
	Non portable	- 1.52	1.29	
Quality	More prone to fungal infection	- 1.3	1.29	11.07
	Less prone to fungal infection	1.3	1.29	
Price	< Rs.1	-0.48	1.15	10.26
	>Rs.1 to Rs. <2	-0.97	2.3	
	>Rs.2 to < Rs.3	-1.45	3.45	
	>Rs.3	-1.93	4.6	
Nature of product	Areca leaf products	1.2	1.29	9.13
	Plastic products	- 1.2	1.29	
Shelf life	Long shelf life	- 0.38	1.29	8.22
	Short shelf life	0.38	1.29	
Eco-friendliness	Eco-friendly	0.6	1.29	7.53
	Non-ecofriendly	- 0.6	1.29	
Market accessibility	Niche, limited and unorganised market	0.81	1.29	6.37
	Unlimited and organised market	- 0.81	1.29	
Social acceptance	More	0.55	1.29	5.33
	Less	- 0.55	1.29	
Religious and cultural acceptance	More	- 0.08	1.29	3.64
	Less	0.08	1.29	
Constant		17.71	3.15	

The relative importance of each factor known as an importance score are computed by taking the utility range for each factor separately and dividing by the sum of the utility ranges for all factors. The values thus represent percentages and sum up to 100. The calculations are done separately for each consumer and the results are then averaged over all customers. Dimension (26.50), Portability (11.94), Quality (11.07), Price (10.26), Nature of the product (9.13) are the important factors influencing consumer preference for areca leaf products. Social and religious factors have got very low importance score reflecting their meager influence on consumer preference.

3.4 *Supply of Raw Material (Areca Leaf Sheaths)*

Areca leaf sheath is the crucial raw material in areca leaf plates and bowls manufacturing industries. Its supply was estimated for Karnataka state as a whole and

for major arecanut growing regions in the state. Shivamogga, Chickmagalur, Uttara Kannada, Dakshina Kannada and Udupi are the traditional arecanut growing districts of the state. Tumkur, Davangere and Chitradurga are the non-traditional districts of arecanut (Kiran *et al*., 2014). To estimate supply of raw material, i.e., areca leaf sheaths, estimates of area under arecanut in major districts and state as a whole is essential. The estimate of area under arecanut for the study year 2016-17 was arrived at through extrapolation. The data on area under arecanut from 2005 to 2014 was obtained from Directorate of Economics and Statistics, Bangalore for state and major districts. Exponential model was employed for estimating the rate of growth in area. Excepting Chickmagalur, in all other districts positive growth rate was observed indicating the potential of area expansion. The rate of growth was highest in Tumkur (6.63 per cent) followed by Udupi (5.81 per cent), Shivamogga (5.54 per cent), Davangere (5.20 per cent), Chitradurga (2.97 per cent) and Uttara Kannada (2.62 per cent). The rate of growth in area was 3.62 per cent for the state. The estimate of area for the year 2016-17 was arrived at by extrapolating area during 2014-15 at the corresponding exponential growth rate. Extrapolated estimates of area under arecanut are presented in Table 9. Consultation with officials of Department of Horticulture revealed the actual area under bearing arecanut gardens. The rationale is, only the bearing arecanut palm sheds leaf sheaths. Area under bearing arecanut palm was arrived at by considering the percentage of area under arecanut at bearing stage. Drip irrigated arecanut garden produce better quality raw material as compared to arecanut gardens irrigated by flood and sprinkler methods as they are prone to fungal infections and are of poor quality. Thus, the potential supply was estimated considering the area under drip irrigation in consultation with the State Horticulture Department. Information on number of palms per hectare and number of leaf sheaths shed per palm was gathered. On an average, there are 1500 palms on one hectare and each palm sheds six leaf sheaths per annum. At this rate, potential supply of raw material was estimated for major districts and state as a whole. As per the estimates, the potential supply of raw material in Karnataka state stood at 143.89 crore leaf sheaths per annum. In the order of magnitude, Chickmagalur at 25.94 crore emerged as the major source of raw material supply followed by Shivamogga (24.11 crore), Davangere (21.66crore), Dakshina Kannada (19.09 crore) & Tumkur [17.71 crore] (Table 9).

3.5 *Projection of Supply of Areca Leaf Sheaths during Next Five Years*

Efforts have been made to forecast raw material supply for next 5 years. This estimate will serve as an indicator for prospective entrepreneurs to have their start up in eco-friendly sustainable enterprise. Raw material supply varies with area under arecanut at the same pace of growth. Hence, rate of growth in area under arecanut was used to forecast raw material supply. Accordingly, the raw material supply at 2021-22 stood at 173.68 crore (Table 10).

TABLE 9. SUPPLY ESTIMATES OF ARECA LEAF SHEATHS IN KARNATAKA STATE (2016-17)

District	Area in ha. (2016-17)	Per cent area under bearing garden	Area under bearing garden (ha.)	Area under arecanut connected to drip (ha.)	Total number of palms	Total number of leaf sheaths shed per year
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Chitradurga	23922	0.8	19137.6	17223.84	25835760	155014560
Davangere	41145	0.65	26744.25	24069.83	36104738	216628425
Tumkur	36434	0.6	21860.4	19674.36	29511540	177069240
Shivamogga	55820	0.6	33492	26793.6	40190400	241142400
Dakshina Kannada	37875	0.7	26512.5	21210	31815000	190890000
Uttara Kannada	19353	0.8	15482.4	12385.92	18578880	111473280
Chickamagalur	37930	0.95	36033.5	28826.8	43240200	259441200
Udupi	8954	0.6	5372.4	4297.92	6446880	38681280
Karnataka	280488	0.7125	199847.7	159878.2	239817240	1438903440

TABLE 10. EXTRAPOLATED SUPPLY ESTIMATES OF ARECA LEAF SHEATHS IN KARNATAKA STATE

Major districts/Year	2017-18	2018-19	2019-20	2020-21	2021-22
(1)	(2)	(3)	(4)	(5)	(6)
Chitradurga	164359161.7	169240628.8	174267075.4	179442807.6	184772259
Davangere	239743544.5	246863927.7	254195786.4	261745401.2	269519239.7
Tumkur	201326962.7	207306373.5	213463372.8	219803235	226331391
Shimoga	268601082.5	276578534.7	284792917.2	293251266.8	301960829.4
Dakshina Kannada	202672524.9	208691898.9	214890048.3	221272282.7	227844069.5
Uttara Kannada	117390999.6	120877512.3	124467574.4	128164261.4	131970739.9
Chickmagalur	225840710.7	232548179.9	239454860.8	246566670.2	253889700.3
Udupi	43306617.65	44592824.2	45917231.07	47280972.84	48685217.73
Karnataka	1544965646	1590851125	1638099404	1686750956	1736847459

3.6 *Contribution to State's Gross Domestic Product (SGDP)*

Value addition method of estimation of national income was employed to ascertain the contribution of areca leaf plates and bowls manufacturing units to state gross domestic product. Most demanded dimension of areca leaf products such as plates (12″, 10″ and 8″) and bowls (6″ and 4.5″) were considered for the estimation procedure. The estimation requires information on potential supply of raw materials in the state, average number of plates/bowls manufactured, gross returns accrued to farmers, manufacturers, wholesalers and retailers. Weighted averages for these estimates were computed considering sample units of varied size of the present study. Weighted averages were considered for further computation to avoid statistical bias. The potential raw material supply in the state for the year 2016-17 was estimated to be 143.89 crore. Using this enormous amount of raw materials, 287.78 crore areca leaf products (plates/bowls) could be manufactured. The weighted proportion of raw materials utilised for manufacturing plates and bowls of different dimensions were in the order of 20 per cent, 15 per cent, 15 per cent, 30 per cent and 20 per cent for 12″, 10″,8″, 6″ and 4.5″, respectively. The number of plates/bowls manufactured in the same order stood at 57.56, 43.17, 43.17, 86.33 and 57.56 crores. Value addition to areca leaf sheaths at different stages viz., cultivation, manufacturing, wholesaling and

retailing across products of different dimensions came to Rs. 808.23 crores (Table 11). The stakeholders such as farmers, manufacturers, wholesalers and retailers, respectively shared 27.6 per cent, 34.5 per cent, 10.2 per cent and 27.8 per cent of the contribution to GDP from the areca leaf sheath sector.

TABLE 11. CONTRIBUTION OF ARECA LEAF PLATES AND BOWLS MANUFACTURING UNITS TOWARDS STATE'S GROSS DOMESTIC PRODUCT (SGDP)

Stages / Dimensions	12″	10″	8″	6″	4.5″	Total value addition	Share
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
No. of plates/bowls	575561376	431671032	431671032	863342064	575561376		
Returns accrued to farmers per plate /bowl	1.66	1.15	0.74	0.41	0.18		
Total returns accrued to farmers	955431884.2	496421686.8	319436563.7	353970246.2	103601047.7	2228861429	27.58
Returns accrued to manufacturers per plate/bowl	1.31	1.38	1.46	0.59	0.52		
Total returns accrued to Manufacturers	753985402.6	595706024.2	630239706.7	509371817.8	299291915.5	2788594867	34.50
Returns accrued to wholesalers per plate/bowl	0.4	0.5	0.2	0.2	0.2		
Total returns accrued to Wholesalers	230224550.4	215835516	86334206.4	172668412.8	115112275.2	820174961	10.15
Returns accrued to retailers per plate/bowl	1.25	0.9	0.9	0.6	0.4		
Total returns accrued to Retailers	719451720	388503928.8	388503928.8	518005238.4	230224550.4	2244689366	27.77
Total value addition	2659093560	1696467159	1424514408	1554015717	748229789.9	8082320633	

Note: Total leaf sheaths supply – 1438903440 and No. of plates/bowls manufactured with available raw material-2877806880.

IV

CONCLUSION AND IMPLICATIONS

The foregoing discussion concludes with major findings, i.e., arecanut growers realised net returns of Rs.7,120 per acre from sale of leaf sheaths. The profit accrued to manufacturers varied from Rs.65,291 (very small units) to Rs.12,19,47,110(very large units). Areca manufacturing unit proved itself as labour intensive providing employment in the range of 2 to 242 labourers round the year across very small to very large sized units. It is considered as prime source of economic empowerment of women in the rural areas as majority (55 to 78 per cent) of the labour force engaged

was constituted by women. Value addition was found to be highest in case of very large sized units at 1165 to 1622 per cent in plates and 2497 to 2684 per cent in bowls due to the operation of scale economies. Investment on the manufacturing unit was proved to be economically viable. Conjoint analysis identified dimension, portability, quality and price as the major factors influencing customer preference to areca leaf products against the substitutes available in the market. In terms of economic or cost efficiency, very small, small and very large units were found to be inefficient. The estimated raw material supply during the next five years would be 173.68 crore in Karnataka state. Areca by-product industry contributes Rs.808.23 crores or Rs.8 billion to state's GDP.

The farmers have to be educated in the scientific management of shed leaf sheaths collection, bundling, stocking and transportation. This helps the manufacturers to procure quality raw materials required for their industries. Efforts in this direction may be done by Department of Horticulture/District industry centres. Since it is an upcoming agro-based industry, government must take steps to protect and promote them in a big way providing subsidies/ grants/ free electricity etc. Organised and efficient marketing system is lacking in this line of industry. Hence, government may think of providing orderly marketing system through market regulation. Consumers/customers interested to buy areca based products for their needs should also be educated on source, quality, usage and disposal through mass media. As large work force is engaged in manufacturing of areca products, the service conditions as found in case of other industries can also be extended to them, *viz*., provident fund, gratuity, minimum wages, leave facility, overtime bonus etc.

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NOTES

1) Valuation of raw materials: Manufacturers procure raw material from arecanut growers of surrounding regions at farm gate price. Wastage of five per cent of leaf sheath was noticed and accounted as cost in themanufacturing process. Valuation of plates and bowls was done on sq. inch basis by multiplying leaf sheath area in sq. inches with per sq. inch cost. The total procurement cost of raw material inclusive of wastage was divided by available leaf sheath area for manufacturing of plates and bowls in sq. inches to arrive at cost of raw material.

Valuation of labour:Labour used in the industry was valued using wage rates provided locally on per manday basis and apportioned on the sq. inch basis.

Valuation of electricity/fuel: Electricity/fuel charge per sq. inch area of leaf sheath was estimated by dividing total electricity charges by total leaf sheath area used for plates and bowls manufacturing.

Valuation of packing and packaging materials: Quantity of packing materials (polythene covers in kg) and packaging materials (large sized bags of 45"or 46" / boxes in number) required to pack finished products was taken into consideration. The obtained quantity was later multiplied with market price of materials. Quantity of twines required in kg to stitch packaging materials was considered and multiplied with market price to cost account twines.

Annual repairs: Repairs of machines, motors and accessories used in the manufacturing unit was apportioned across finished products based on their capacity utilisation.

Interest on working capital: Interest rate charged by commercial banks for recurring expenses on agro-based industries was considered. Interest component was worked out on total working capital. Interest rate varied across size of manufacturing unit and type of loan availed by the entrepreneur.

2) Capacity utilisation refers to share of production of individual commodities in the total production.

3) Modified internal rate of return (MIRR) sums the discounted negative cash flows to the starting time and sums the positive cash flows to the final period adjusting for the reinvestment rate. By dividing and taking the nth root, it determines the rate of return for the positive and negative cash flows. *MIRR* = (Future value of discounted positive cash flows / present value of negative cash flows at the financing cost of the company)^(1/n)-1.

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