

FINANCIAL ANALYSIS OF COCONUT OIL EXTRACTION USING LOCALLY MANUFACTURED BABY EXPELLERS

M T N Fernando, J M N Marikkar, K V N N Jayalath and S D J N Subasinghe

Coconut Research Institute, Lunuwila, Sri Lanka

ABSTRACT

This paper analyses the financial feasibility of coconut oil extraction using locally manufactured Baby Expellers, and identifies constraints faced by users of Baby Expellers. Data were collected by a field survey (February, 1999) of a purposive sample of fifteen Baby Expeller users located in Puttalam, Gampaha and Kurunegala districts, using a structured questionnaire, supplemented with informal discussions. Gross margin (GM), pay-back period and break-even prices of inputs and outputs were the different economic indicators employed. The results revealed that oil extraction using Baby Expellers is economically less attractive at the market prices of coconut oil and copra that prevailed in February 1999. However, there is a marked improvement of the oil producers' GM when either copra prices are reduced or oil prices are increased, even by small amounts. The study also revealed that the profitability of oil extraction is more sensitive to changes of copra prices than oil prices. As the initial capital requirement to install the Baby Expeller is substantial, an increased access to loans was recommended to popularize this technology especially among small and medium entrepreneurs. The desirability of granting a grace period of over six months for borrowers was emphasized as the payback period of the initial investment was also over six months. Low tariffs for palm oil importation and shortage of copra availability especially during lean periods of coconut production appear to be notable constraints faced by Baby Expeller users. Areas requiring R and D to improve performance of the existing Baby Expeller machines are also suggested.

INTRODUCTION

Extraction of coconut oil using locally manufactured Baby Expellers¹ seems to be gaining popularity as a cottage industry in many parts of the coconut-growing areas in the country. The choice of alternative oil-processing technologies, specially by small and medium size entrepreneurs, is greatly influenced by the scale of production and the initial capital requirement of these technologies in addition to the existing resource base of low and

¹ These expellers have an average capacity of about 300 kg of coconut oil per 8 hours. Often these expellers were driven by electric motors.

medium-income groups (Anon. 1983, and Etherington and Mahendrarajah, 1997). These attributes of the technology under review seem more appropriate than the large-scale oil processing technologies, to the existing resource base of medium-income groups. Recently, the Coconut Research Institute (CRI) received several inquiries from potential millers who wish to install Baby Expellers, about the economic feasibility of these machines as well as the likely problems and constraints when using it. However, this information was not readily available at the CRI, and this motivated the present study to assess the economic feasibility of oil extraction using Baby Expellers.

OBJECTIVES

This study aims to:

- (i) determine the economic feasibility of oil extraction using locally manufactured Baby Expellers
- (ii) identify the constraints faced by current Baby Expeller users, and
- (iii) examine the R and D required to improve the performance of the locally manufactured Baby Expellers.

METHODS

Data

Data were collected by a field survey, in February 1999, by interviewing a purposive sample of 15 Baby Expeller users² located in Puttalam, Kurunegala and Gampaha districts, through a single visit, using a structured schedule supplemented with informal discussions.

Analysis

Different economic indicators, namely Gross Margin (GM) per 8 hour working shift, the Pay-back Period, and the Break-even Price of inputs and outputs were employed.

²At least, a sample of 30 respondents is required to satisfy the statistical requirements. However, the population of current holders of locally manufactured Baby Expellers would not exceed fifty. So, we argue that 15 respondents are a fair representation of the above population. In terms of mode of operation, size etc., the entire population of baby expellers seems to be homogeneous. So a purposive sampling was adopted.

The GM was computed by deducting total variable cost from gross income. Pay-back is the length of time required to pay off the initial investment. Break-even price of inputs means the price of inputs, at which the Baby Expeller user neither loses nor gains. Similar interpretation applies for break-even price of output.

The GM for oil extraction using Baby Expellers at prevailing input and output prices, and the time taken to pay-back the fixed cost involved in establishing the machines were calculated in the base scenario. The sensitivity of the GM in the base scenario for variations in oil and copra prices, each by 10, 20 and 30 per cent was assessed in the sensitivity analysis. In addition, this section includes the computation of break-even prices of selected inputs and outputs.

The constraints faced by present Baby Expeller users and their suggestions on R & D needs of the current Baby Expeller were qualitatively assessed without employing any statistical procedures because data were collected from a limited sample of only 15 respondents.

RESULTS AND DISCUSSION

(I) Base scenario

(i) Gross Margin (GM)

Cost of production (COP) of 1 kg of coconut oil at prevailing prices of inputs (copra, electricity, fuel wood etc.) was found to be Rs 91³. However, the current price (as at 26 February, 1999) of 1 kg of coconut oil is Rs 85, which implies that there is a loss of Rs 6 per kg of oil extracted. Other by-products such as poonac and pressed oil compensate for this loss. When the incomes of these by-products are accounted for, the Baby Expeller generates a GM of some Rs 950 per 8-hour working day (see Table 1).

Table 1: Cost and returns of coconut oil extraction using baby expellers

Item	Unit Price	INCOME (Rs/8 hrs)
OUT PUT (per 8 hrs)		
• 300 kg of oil per 8 hrs	@ Rs 85 per kg	25 500
• 181 kg of poonac per 8 hrs	@ Rs 9 per kg	1 629
• 53.5 kg of pressed oil per 8 hrs	@ Rs 4 000 per barrel of (200 kg) pressed oil	1 070
Gross Return		28 199
		COST (Rs/8 hrs)

³ 1 US \$ = Rs 69.45 as at 26 February 1999.

INPUTS

(A) Variable Costs

• Labor 2 MD (one man for cutting & drying while the other man is for working in the expeller)	@ Rs 200 per MD	400
• Materials		
- Copra (535 kg of "kada" copra is required to extract 300 kg of oil)	@ Rs 12 400 per candy (or 254 kg) of "kada" copra	26 118
- Fuel wood for dryer (1 cubic yard of "wal dara" is required to obtain 230 kg of oil. So, to obtain 300 kg of oil, 1.3 cubic yard of "wal dara" is required.	@ Rs 275 per one cubic yard of "wal dara"	358
- Electricity	@ Rs 4.40 per unit of electricity under industrial category	275
- Grease	@ Rs 160 per kg of grease (daily the machine has to be greased - about 100g/day)	16
Total variable cost (Rs/8 hrs)		27 167

(B) Maintenance Costs (Rs/8 hrs)

	Unit Price	Cost (Rs) to extract oil from 535 kg of copra (or cost per 8 hrs working day)
• Monthly tax to the Ceylon Electricity Board	@ Rs 250 per month (24 working days a month)	10.40
• Capital depreciation If the machine were operated 8 hrs a day, "CONE" has to be welding filled monthly	@ Rs 750 per filling (24 working days a month)	31.25
• If the machine is operated 8 hrs a day, "WORM" has to be filled and carved out once in three months	@ Rs 2 000 per filling and carving out (24 working days a month, and hence 72 working days per 3 months)	28.00
• Filter cloths	A length (2.5 ft x 2.5 ft) of filter cloth (@ Rs 3 000) can be used for 1 year (280 working days/ year)	11.00
Total maintenance cost (Rs/8 hrs)		80.65
Total variable costs & maintenance costs (Rs/8 hrs)		27 248
Gross Margin (Rs/ 8 hrs)		951

Notes : MD - Man-days. 1 US \$ = Rs 69.45 as at 26 February, 1999.

Source : Survey of Baby Expellers, 1999.

(ii) Pay-back Period

The fixed costs involved in establishing a Baby Expeller units were computed (Table 2).

Table 2: Fixed costs involved in installing a Baby Expeller and accessories

Item	Unit price	Rs
i) Baby Expeller machine	@ Rs 75 000 ^a	75 000
• 10 HP motor (RPM 1 440)	@ Rs 14 500 to 18 000	16 250
• 2 nos. of V-belts	@ Rs 325/= per belt (Dengil brand)	650
• Starter	(MEM English starter) (An Indian starter costs Rs 2 000/=)	3 000
ii) Cutter	@ Rs 3 000 per cutter	3 000
• 5 HP motor	@ Rs 12 000 per motor	12 000
• 2 nos. of V-belts	@ Rs 275 per belt	550
iii) Dryer^b	@ Rs 4 000 per dryer	4 000
• 2 HP motor	@ Rs 8 000 per motor	8 000
• Starter	(MEM English starter) (An Indian starter costs Rs 2 000/=)	3 000
• A V-belt	@ Rs 275 per belt	275
iv) Filter	@ Rs 50 000 per filter	50 000
• 2 HP motor		8 000
• A V-belt ^c		275
v) Container (to collect poonac)		250
vi) Container (to collect oil)		250
vii) Tray (to keep the oil collecting container)		250
ix) Construction of a concrete base (to fix the Baby Expeller)		1 750
Total		186 550

Notes :

- a - The price of the Baby Expeller manufactured by the Halmillakele Engineering works of Wennappuwa was quoted for this example.
- b - Use of dryers is not essential if copra is properly dried (< 6% moisture). Alternatively, cut pieces of copra could be sun dried (2 - 3 hours) before feeding into the expeller.
- c - Filter cloths were accounted for under maintenance cost.

As shown in Table 2, the total fixed cost involved in installing a Baby Expeller is about Rs 187 000. At the prevailing copra and oil prices, 197 eight hour working days, i.e. over half a year, are required to pay-back the initial investment cost, which is a substantial blocking of capital for small and

medium scale entrepreneurs. While the economic life is about 40-50 years, parts like cones, worms etc. have to be completely replaced every 3 -4 years.

(II) Sensitivity analysis

The sensitivity of the GM in the base scenario for changes in oil and copra prices by plus and minus 10, 20, and 30 per cent was assessed (see Tables 3 and 4 respectively for oil and copra price changes).

Table 3: GM (Rs/8 hours) of coconut oil extraction at various oil prices

Oil price						
- 30%	- 20%	-10%	at present price	+ 10%	+ 20%	+ 30%
- 6699 (- 805%)	- 4149 (- 537%)	- 1599 (- 269%)	950	3501 (269%)	6051 (537%)	8601 (805%)

Note : Figures in parentheses are the percentage change of GM from the base scenario.

Source: Table 1.

As shown in Table 2, if the oil price is increased by 10 per cent, i.e. if the present oil price of Rs 85 per kg is increased to Rs 93.50 per kg, Baby Expeller users' GM is increased from Rs 950 per 8 hours to Rs 3 501 per 8 hours, representing a 269 per cent increase. The opposite is true for a reduction of oil price by 10 per cent. The consequences in response to the other variations in oil price in Table 3 can be interpreted in the same way. What all these imply is that the change in oil price by a small amount results in a great impact on oil producers' GM.

Percentage increase in GM in response to a decrease in copra price by 10 per cent is 275 per cent (Table 4), and how the GM changes in response to other variations in copra prices (as shown in Table 4) can be explained in the similar manner. These findings suggest a conclusion as for the case of oil price changes, i.e. a small change in copra price results in a marked impact on GM of oil producers.

Table 4: GM (Rs/8 hours) of coconut oil extraction at various copra prices

Copra price						
- 30%	- 20%	- 10%	at present price	+ 10%	+ 20%	+ 30%
8788 (825%)	6175 (550%)	3561 (275%)	950	- 1662 (- 275%)	- 4273 (- 550%)	- 6887 (- 825%)

Note : Figures in parentheses are the percentage change of GM from the base scenario.

Source : Table 1.

GM increases by some 275 per cent in response to the copra price reduction by 10 per cent, and the corresponding increase in GM in response to the oil price increase by 10 per cent is 269 per cent (compare Tables 3 and 4). This implies that the profitability of oil extraction is marginally more sensitive to changes in copra prices than that of the oil prices.

- **Break-even prices of oil and copra**

(a) Break-even price of oil

The break-even price of oil, meaning the price of oil at which the Baby Expeller holder neither loses nor gains, was found to be Rs 81.80 per kg of oil⁴. The current price of oil is Rs 85 per kg, and the break-even price of oil is just a reduction of some 3.75 per cent less than the current oil price, implying a fine balance between projects and losses implying that the current oil price is at a very sensitive position given the higher prices of raw materials, copra in particular.

(b) Break-even price of copra

Given the current prices of oil, poonac and pressed oil, Rs 85 per kg, Rs 9 per kg and Rs 20 per kg respectively, the maximum price of copra to break-even was computed to be Rs 12 850 per candy (254 kg). This price represents merely a 2.8 per cent increase from the current copra price of Rs 12 500 per candy, suggesting that the present price of copra is almost at its maximum given the prevailing oil price.

⁴ Incomes from poonac and pressed oil were also accounted for in calculating the break-even price of oil.

(III) Constraints Faced by Baby Expeller Users

Baby Expeller users pointed out some constraints hindering their business, and they are:

- Importation of palm oil at concessionary tariffs

The tariff for importation of palm oil has been varying over the time. Originally, the tariff was about 40 per cent, which was then reduced to zero, and increased up to 8-9 per cent, which is in effect at present (26 February, 1999). With this low tariff rate, palm oil price in the domestic market is as low as Rs 75 per kg. Coconut oil cannot be supplied at such a low price as the COP of coconut oil is higher (Rs 91 per kg). Therefore, Baby Expeller users were of the view that the local coconut oil industry has to be protected by imposing higher tariffs for palm oil imports.

- Shortage of copra in lean crop periods

When higher prices are offered for coconuts by desiccated coconut (D.C.) millers, particularly in lean crop periods, the copra manufacturing industry is seriously affected because coconut growers prefer to sell their coconuts to D.C. manufacturers at higher prices without selling to copra manufactures at low prices. This results in a shortage of copra for the oil industry. A practical example follows.

Some Rs 80 was paid to growers by D.C. millers for nuts equivalent to a kg of D.C. as at 26 February, 1999.

Approximately 120 kg of D.C. is produced from 1000 nuts⁵. On this D.C. outturn, the price paid by D.C. millers per nut was Rs 9.60. This was a competitive price and copra manufactures could not pay such a high price to growers given the prevailing price of coconut oil.

(IV) Research and Development Needs

Baby Expeller users* suggested some areas requiring research and development for improving locally manufactured expeller machines⁶.

⁵ D.C. out turn is a function of soil type, pick number, coconut variety, rainfall etc. For the purpose of this calculation, the average D.C. out turn reported by the sample of respondents (120 kg per 1000 nuts), was used.

⁶ These suggestions are however limited to the Baby Expellers manufactured by the Halmillakele Industries, Wennappuwa.

- Expeller users have found that mixing a little D.C. with copra (some 10-15 kg per candy of copra) imparts an attractive color to coconut oil, and hence some millers feed copra into expellers mixed with some D.C. However, the size of the expeller of the present machine is not big enough to efficiently crush D.C. This was identified by millers as defining requiring the locally manufactured Baby Expeller which needs to be corrected. The need for such an improvement of the machine is further emphasized by the following. Often, villagers bring sliced pieces of sun-dried coconuts mixed with sun-dried coconut residue to the mills to have the oil extraction on payments. The efficiency of oil extraction from coconut residue by the present Baby Expeller is poor, and hence improvement is required for this reason as well.
- Some millers were of the view that the design of the machine is sound and the finish is also satisfactory, but the workmanship requires improvement. To quote one example they pointed out, “bearings are of poor quality and some clamps do not fix tightly”.
- As the bars of the bar set are widely spaced, separation of oil from coconut residues in the expeller is not efficient. Extracted oil is always mixed with coconut residues. Millers suggested that this defect of the machine should be overcome.

SUMMARY AND CONCLUSIONS

An attempt was made to assess the economic feasibility of coconut oil extraction using Baby Expellers as a cottage industry. A purposive sample of fifteen entrepreneurs in Puttalam, Kurunegala and Gampaha districts, who have installed Baby Expeller machines were interviewed in February, 1999 in a single visit, using a structured questionnaire supplemented with informal discussions. Such economic indicators as Gross Margin (GM), Pay-back Period and Break-even Prices of inputs and outputs were employed to analyze the data. Results revealed that the GM of coconut oil extraction using Baby Expellers is not attractive under the input and output prices that prevailed during the period of the survey (February, 1999). However, a small, positive change in price of copra and oil resulted in a marked improvement in terms of returns of the enterprise. The study also revealed that the profitability of oil extraction is more sensitive to variations in copra prices than that of the variations in oil prices, although the differences of changes in GMs in response to either oil or copra price changes is small. Total fixed cost required to establish a Baby Expeller is substantial, of the order of Rs 187 000, and hence easier access to industrial loans might be an useful means to encourage especially the small and medium entrepreneurs to invest in these machines. The pay-back period of the initial capital investment was found to

be over a half a year, so granting a grace period of over 6 months for borrowers might be desirable to allow them adequate time to generate surplus returns for repaying loans. The local coconut oil industry appears to be seriously affected by the reduced tariffs for palm oil importation. However, increased tariff may also lead to efficiency losses and protectionist policies may not be sustainable in the emerging globalization scenario. So, in depth studies are required on tariffs. As D.C. millers pay competitive prices for coconuts, particularly in lean crop periods, nut supply to copra manufacturers is reduced, and this appears to be a serious threat for the sustenance of the local oil industry. Some useful information on areas requiring R & D of the present Baby Expeller machine are also highlighted.

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