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Full Length Research Paper

Costs and efficacy of operating coffee hand pulpers in Ethiopia: A cost- benefit analysis

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In Ethiopia coffee quality suffers as a result of less care being taken for the trees and during harvesting and processing. About 40% of the quality of coffee is determined by primary processing, while the other 20% and 40% is attributed to secondary processing and field practices respectively. Thus, primary processing is crucial in enhancing the quality and subsequent value of coffee. The methods of coffee processing are sun-dried and wet processing. Hand pulpers are being promoted to improve the quality of processed coffee. A cost-benefit analysis was conducted to assess the efficacy and measure the profitability of operating hand pulpers compared to sun-dried processing methods. The hand pulpers have a benefit cost ratio of 1.2, internal rate of return of 28.37% and a net present value of US$ 1,231. The coffee hand pulpers achieved good separation efficiency, which is consistent with the theoretical conversion ratio (5:1) of red cherries to parchment. The costs of producing 1 kg of pulped coffee are twice the costs of a similar quantity of sun-dried coffee. The corresponding prices of pulped coffee are more than double those of sun-dried coffee, which therefore makes pulped coffee more profitable to the farmers. The quality of coffee processed by hand pulpers was significantly different (p=0.04) and better than sun-dried coffee. This finding is in conformity with the views of 97% of the farmers that used hand pulpers. There was underutilization of capacity of the hand pulpers despite the existence of high potential of coffee production. This means that sustainability of the hand pulpers would require production of higher quantities of coffee, organised harvesting and good hand pulper operating skills.

Key words: Quality, costs, benefits, efficacy, processing.

INTRODUCTION

Coffee forms an integral part of the national economy of Ethiopia. Ethiopian coffee accounts for 4% of the world's production and 2% of the global export to all destinations. Currently, coffee contributes 38% of the foreign exchange earnings and about 10% of the gross domestic product. More than 25% of the population of Ethiopia, representing 15 million people, are dependent on coffee for their livelihoods, including 8 million people directly involved in coffee cultivation and 7 million in the pro-cessing, trading, transport, and financial sectors (Oxfam, 2002). Ethiopia is Africa's largest coffee producer and 8th in the world; producing close to 0.4 million tones annually. 95% of the coffee comes from close to one million small subsistence farmers, whose average land holding is about 0.5 ha (FDRE, 2003).

Coffee quality suffers as a result of less care being taken for the trees and during harvesting and processing. The methods of coffee processing are sun-dried (natural) and wet (washed) processing. Under sun-dried processing, the ripe cherry is dried whole, while for wet processing the cherry is pulped before drying. In Ethiopia, washed coffee accounts for 35% while sun dried accounts for 65% of all the coffee produced. It is generally estimated that coffee quality is determined by about 40% in the field, 40% at primary processing, and 20% at secondary/export processing. This underscores the importance of primary processing in enhancing the quality and subsequent value of coffee. Improved coffee processing enhances the intrinsic value of the coffee and also improves the potential for developing relationships with consumers at all levels including the importers and roasters. Hand pulpers (manual small scale coffee washing

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stations) are being promoted to improve the quality of processed coffee. The estimated capacity of each pulping machine is 50 kg of red cherry per hour or 250 kg of red cherry per day. Assuming the harvesting period in the project area to be around 2 months, a total quantity of cherries to be processed by one pulping machine during the season would be (50 kg *5 h *60 days) 15,000 kg of red cherries. Assessment of the performance of the hand pulpers is necessary to establish how they compare with the existing coffee processing methods.

A cost-benefit analysis of the hand pulpers was conducted to assess farmer perceptions, examine the efficacy, measure profitability and assess the sustainability of the hand pulpers. This study was part of the project titled, “Improving coffee quality in East and Central Africa through enhanced processing practices (Rwanda and Ethiopia)”.

MATERIALS AND METHODS

Cost-benefit analysis was conducted to estimate and total up the equivalent monetary values of the benefits and costs to the coffee growers to establish whether the hand pulpers are worthwhile (Watkins, 2006). This was undertaken by comparing the difference between what the situations in the study area is with and without the hand pulpers as well as assessing the cost effectiveness of operating the hand pulpers. Costs and benefits for existing processing methods as well as those for the hand pulpers were compared to establish the efficiency of operating the hand pulpers (Ostertag, 1995; Ferris et al., 2001). Ideally the analyses involved evaluating the hand pulpers against the existing coffee processing systems defined for purposes of this study as “without” hand pulpers, that is the farmers’ current sun-dried coffee processing.

A stratified multistage random sampling procedure was adopted for the selection of the growers at different levels. To get a representative sample of the whole of the coffee growing area of Ethiopia, two regional states (Oromia and Southern) were identified in the first stage. The two regional states constitute the main coffee growing areas. The second stage of sampling involved selection of two zones from each of the regional states. Jimma and Illubabor zones from Oromia Regional State were selected, while in the Southern Regional State Sheka and Bench Maji Zones were selected. In the third stage of sampling, one woreda (district) was selected from each of the zones. The selection of the woredas was based on prevalence of coffee processing problems. The selected woredas are Goma, Alle Didu, Yeki and Sheko (Table 1). 25 farmers were randomly selected from each of the woredas and supplied with hand pulpers. Each of the hand pulpers was used by a group of five farmers. The farmers in whose farms the hand pulpers were located were also considered as the managers of the hand pulpers. All the managers of the hand pulpers were interviewed using structured and pre-tested questionnaires.100 coffee growers cum hand pulper managers were interviewed from the 4 Woredas. The managers had aggregated data from all the group members. The data included direct operating costs such as labour costs, repairs, transport costs, farmer perceptions about the hand pulpers, numbers of growers using the hand pulpers, coffee prices and coffee sales. Data was collected for the agricultural year 2005/06.

In order to undertake comprehensive economic analysis projected values were used for subsequent years. The approach was to assume capacity utilization of two thirds in the second year and full capacity utilization in the third effective project year. This assumption was based on the fact that some farmers were already achieving more than 50% capacity utilisation in year 1. It was assumed that the operating costs would increase in proportion to the increase in capacity utilisation. The other assumption in the analysis was that the coffee market situation would remain at the current level or improve. This means that the prices would not be lower than the current prices. In order to take care of risks, a risk discount factor was used. This procedure consists in an addition to the rate of interest figure employed in the discounting calculation (Baumol, 1995). The risk discount factor used was low because coffee production is considered to be a low risk enterprise according to expert opinion. The investment in the equipment would also have a low risk because the ministry of agriculture employs processing experts that know how to deal with the hand pulpers and worked with suppliers during installation and distribution of hand pulpers. Market fluctuations were assumed to be minimal given the current upward trend in prices and improvements in coffee quality. Data collected were analysed using descriptive and inferential statistics.

Table 1. Different regions, zones and woredas selected.

Regional State	Zone	Woreda
Oromia	Jimma	Goma
	Illubabor	Ale Didu
Southern	Sheka	Yeki
	Bench Maji	Sheko

RESULTS AND DISCUSSION

Hand pulpers distributed

25 hand pulpers were supplied to each of the 4 Woredas that participated in the project. Each of the hand pulpers was used by a group of five farmers. Thus, a total of 500 farmers were involved in pulped coffee processing. The concerned Woredas were Alededidu, Gomma, Sheko and Yeki. The amount of pulped coffee produced by all the Woredas was 101,872 kg while the amount of sun-dried coffee produced under natural conditions by an equivalent number of growers was 332,123

Farmer perceptions of the hand pulpers

There was enthusiasm among the farmers regarding use of the hand pulpers. In most of the cases all the 5 farmers used the hand pulpers as per the initial agreement. Farmers preferred hand pulpers to other coffee processing methods.

The quality of coffee processed by the hand pulpers was better than that processed by other methods. 97% of the farmers who used the hand pulpers reported that the

Table 2. Liquoring and bean quality assessment results for pulped coffee produced using improved methods.

Item description	B/Maji Zone	Jimma Zone	Illubabor Zone	Total
	Sheko Woreda	Gomma Woreda	Ale didu Woreda	
No. of participating farmers	99	61	95	255
Grade 1-2 (%)	45	39	46	44
Grade 3 (%)	55	61	54	56
Grade 4 (%)	-	-	-	-
Local use (%)	-	-	-	-

Yeki Woreda did not participate because its coffee was purchased by Tepi Cooperative Union, out of Grades 1 and 2; Grade 2 had a larger proportion.

Table 3. Liquoring and bean quality assessment results for sun-dried coffee produced using conventional methods (%).

Zone	Grade 1	Grade 2	Grade 1-2	Grade 3	Grade 4	Local use
B/Maji	-	0.2	0.2	6.4	28.9	64.5
Sheka	0.04	1.3	1.7	9.06	26.6	63.02
Keffa	0.01	3.8	3.81	30.7	28.4	37.08
Jimma	0.09	3.6	3.69	57.9	27.0	11.5
Illubabor	0.03	9.2	9.23	73.6	13.6	3.5
Gambella	-	0.13	0.13	9.7	25.6	64.6

quality of coffee processed by the hand pulpers was better than that processed by the other methods. The farmers' views were due to a number of good attributes of the pulped coffee. Among these are good colour, good smell, good appearance and better taste. Sixty two per cent of the farmers reported that pulped coffee had higher demand compared to coffee processed by other methods. They attributed this to the fact that other buyers were enticing them to sell coffee to them though they had an agreement to sell to the designated exporters. The coffee liquoring tests confirmed the farmers' views. Sixteen samples of coffee from the four woredas were taken and assessment of the cup and green coffee quality was undertaken both by the coffee liquoring unit (CLU) and private exporters in Jan 2006, and the results of the cup tasting were found to be above average for coffee from all the four woredas (Table 2). Similarly, a total of 255 samples from pulped coffee were collected in April including Yeki with only 5 bulk samples of pulped coffee and cup-tasting done at the CLU with support from Illy café and the result of cup taste were found to be above average. Results for the assessment of the cup and green coffee quality from other methods are shown in Table 3. It is the case therefore, that with the use of hand pulpers coffee quality improved over the natural (sun-dried) coffee processing method. The improvement in the quality of pulped coffee in essence makes it a new class of coffee. This was indeed impressive especially given that the pulped coffee was produced at the farm level

From the laboratory inspection results (Tables 2 and 3), it can be concluded that pulped coffee had by far a better quality than the conventional sun-dried coffee. Substantial amount of coffees processed by the other methods falls within the range of Grades 3, 4 and local use. The liquoring results revealed that coffee from the project activities had good raw and cup value. The raw value indicated that it is clean from any off smells. The coffee also has good raw appearance, uniform bean size, very small defective beans on the lots and proper moisture content. According to the cup value the coffee was very clean, that is free from musty, earthy, chemical taste defects, which are the usual quality features of coffee from these areas. The coffee also had balanced and good acidity, body and flavour. A comparison of the coffee qualities from the other methods and pulped coffee for Grades 1 and 2 aggregated, and 3 from Tables 2 and 3 lends support to the fact that pulped processing produces higher quality coffee. These outcomes may be attributed to group training given to the farmers, good processing method and equipment, farmers starting to appreciate that good coffee quality generates better returns, technical support provided by the project staff and a reliable marketing system.

Efficiency of operating hand pulpers

The efficiency of operating the hand pulpers is determined by capacity utilization, quality of coffee processed, conversion ratio of red cherries to parchment and maintenance requirements. For purposes of this study efficiency is assessed based on capacity utilization and the conversion ratio. No maintenance costs were incurred

Table 4. Costs and benefits of hand pulpers in Ethiopia (US$).

Year	Cost	Benefit	Net benefit	Discounted net benefit
0	3127.56	0	-3127.56	-3127.56
1	732.70	1767.08	1034.38	940.35
2	1370.12	3120.00	1749.82	1446.13
3	2055.27	4680.00	2624.73	1971.99

Table 5. Cost of equipments and drying materials supplied for 1 pulper (US$).

Item description	Unit price	Cost	Remark
Hand pulper	650.00	650.00	1 hand pulper
Plastic hose/delivery	1.21/m	82.27	5 meter
Plastic hose/suction	0.92/m	4.60	48 meter
Chicken wire	39.00/bed	975.00	5 bed /head
Treadle pressure pump	91.41	91.41	1 pump
Water tanks	57.97/unit	173.91	3 pieces
Hand trays	24.65/unit	246.87	49.29/head
Shade net	3.20/m^2	208.00	41.6 US$ /head
Nails	2.4 US$ per head	12.00	2.4 US$/head
Sisal bags	0.90	58.50	11.7 US$/head
Hessian cloth	1.00/mt	325.00	65 US$/head
Polythene sheet	12/bed	300.00	5 bed/head
Total Cost		3127.56	-

incurred during this initial processing phase. According to model specification the estimated capacity of each pulping machine is 50 kg of red cherry per hour or 250 kg of red cherry per day. Assuming the harvesting period in the project area to be around 2 months, the total quantity of cherries to be processed by one pulping machine during the season would be (50 kg * 5 hrs *60 days) 15,000 kg of red cherries. The conversion ratio of red cherries to parchment is 5:1. It is expected that one hand pulper would serve the needs of about 10 farmers, though would probably be owned by an individual farmer or a small group working together. The exact position for Ethiopia is that 5 farmers were allocated 1 hand pulper. The owner of the farm where the hand pulper is located served as the manager of the hand pulper.

All the hand pulpers processed less red cherries compared to the expected processing capacity during the first agricultural year. This situation improved in the subsequent years. Relatively less parchment was obtained from the amount of red cherries. This means that the theoretical conversion ratio of 5:1 for red cherries to parchment was not achieved indicating inefficiency in processing in the first project year. The technical inefficiency reported here is attributed to one or all of the factors: Bad adjustment of the discs of the hand pulpers, poor selection of the red cherries and overall limitation in the technical know how. This means that additional training is required for the farmers with regard to operating the hand pulpers and selection of the red cherries for processing. In the subsequent seasons good separation efficiency was achieved.

Profitability (commercial viability) of the hand pulpers

Profitability analysis involved assessment of the costs and benefits of the hand pulpers. The disaggregated costs considered were storage costs, transport and loading costs, maintenance and repair costs. In this initial phase no maintenance and repair costs were incurred. Other costs are for wire mesh, sacks/bags (sisal and synthetic), other drying materials, plastic/polythene sheets, fencing wire and posts. The operating costs included labour costs for pulping and drying, transport costs and security costs for the hand pulpers. Table 4 provides the costs and benefits derived from the hand pulpers in Ethiopia. These costs and benefits are averages having been obtained from all the hand pulpers in all the woredas. Labour costs were mainly family labour in Ethiopia. Investment costs for each of the hand pulpers were US$ 3127.56 (Table 5).

The commercial viability of the hand pulpers is determined by the ability of the hand pulpers to generate returns in excess of what is required for operation and maintenance as well as the labour and other overhead costs. Since all the fixed costs were taken care of by the project during this initial phase, assessment of the

commercial viability was undertaken based on variable costs only. The assessment was meant to indicate whether or not the farmers benefited from using the hand pulpers. Results show that the hand pulpers are commercially viable with a mean positive net benefit of US$ 375.29 and a minimum of US$ 20.88 per season for individual coffee growers. This confirms that the coffee growers benefited from the use of hand pulpers. For the sun-dried coffee farmers the minimum was US$ 16.20 and the mean was US$ 830.03. The difference in net benefits from pulped and sun-dried coffee is because pulped coffee processing has not yet entrenched itself.

Assessment of the variable costs of pulped coffee and variable costs of sun-dried coffee indicates that the costs for pulped coffee are twice the costs for sun-dried coffee that is an average of US$ 0.20 per kg of sun-dried coffee compared to an average of US$ 0.40 per kg of pulped coffee. Analysis for all the farmers using a paired sample t-test indicate that the costs are significantly different ($t_{0.05}$=3.76). However, price per kg of parchment (US$ 1.56) is more than twice the price per kg (US$ 0.65) of sun-dried coffee, which indicates that it is more profitable to produce pulped coffee. This means that exclusive production of pulped coffee would be more profitable and that pulped coffee farmers are likely to benefit more if they produce larger quantities of parchment

Economic viability of the hand pulpers

Economic viability of the hand pulpers was assessed using the net present value (NPV), benefit cost ratio (BCR) and the internal rate of return (IRR). NPV of a project is equal to the sum of the present value of all cash flows associated with it. In the computation of NPV and benefit-cost ratio (BCR) a discount rate is used. The discount rate to be used normally is the real rate of interest, which is the market (observed) rate of interest net of the expected rate of inflation (Bruce, 2007). The decision rule associated with NPV is to accept the project if its NPV is positive and reject if its NPV is negative. If NPV = 0 it is a matter of indifference (Chandra, 1998; Gittinger, 1984). In the computation of net present value (NPV) and benefit-cost ratio (BCR) for the hand pulpers a discount rate based on the rule of thumb is used. According to the rule of thumb discount rate is set equal to the 'required yield' (Frick, 2007). For purposes of this study 10%, which was the required yield, was used for the hand pulpers in Ethiopia.

$$NPV = \frac{CF_o}{(1+r)^0} + \frac{CF_1}{(1+r)^1} + ... + \frac{CF_n}{(1+r)^n} = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t} \quad (1)$$

Where CF_t = cash flow at the end of year t, r= discount rate, n= life of the project.

The hand pulpers have a useful economic life of 15 years according to the model specification. No figure is indicated for depreciation rate. The salvage value is assumed to be zero at the end of the useful economic life of the hand pulpers. Straight line depreciation method is used in the cost computations. The resulting annual depreciation is 650/15 that is US$ 43.33. Depreciation, which affects cash flows only because it is a tax deductible expense, is not a cash expense and is therefore not included as a cash flow when using the NPV and internal rate of return (IRR) methods (Lee et al., 1988). Hence, depreciation figures are not used in the computation of NPV and IRR. NPV obtained from Equation 1 for the hand pulpers is US$ 1230.91. The corresponding BCR is 1.20 for the hand pulpers. This means that the hand pulpers are economically viable. Inspection of repayment capacity of the farmers using the benefits above what they receive from ordinary sun-dried processing shows that they are benefiting and are able to repay. Thus, farmers can borrow money or obtain credit and invest in hand pulpers on their own. The government may also consider investing in the hand pulpers to benefit the farmers.

To ascertain the economic viability of the hand pulpers further IRR was computed. IRR of a project is the discount rate which makes its net present value equal to zero. It is the maximum interest that a project can pay for the resources used if the project is to recover its investment and operating expenses and still just break even (Gittinger, 1984; Chandra, 1998). In the computation of IRR the discount rate is not required because IRR is the discount rate that makes NPV equal to zero. When using the IRR, the selection criterion is to accept all independent projects with an IRR greater than the cut-off rate, which is generally the opportunity cost of capital, the commercial (market) interest rate. It is the discount rate (r) in Equation 2.

$$0 = \frac{CF_o}{(1+r)^0} + \frac{CF_1}{(1+r)^1} + ... + \frac{CF_n}{(1+r)^n} = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t} \quad (2)$$

IRR was computed using the Equation 3; although it is appreciated that even Equation 2 would also suffice.

$$IRR = r_1 + (r_2 - r_1)\frac{|NPV_1|}{|NPV_1| + |NPV_2|} \quad (3)$$

Where r_1 = the commercial interest rate, r_2 = the interest rate at which the NPV_2 is negative, NPV_1 = the net present value at the current commercial interest rate, NPV_2 = the net present value at a higher interest rate (r_2)

In the computation of IRR, the commercial (market) bank rate (r_1) of 14.0% (ETR, 2007) used in NPV calculations was used at the initial stage.

$NPV_1 = (-3127.56) + (1.14)^{-1}(1034.38) + (1.14)^{-2}(1749.82) + (1.14)^{-3}(2624.73)$
$= -3127.56 + 907.35 + 1346.43 + 1771.62$
$= 897.84$

NPV_2 has to be negative so we arbitrarily choose r_2 that will generate a negative NPV. The selected r_2 is 30% and the corresponding $NPV_2 = -101.80$.
IRR = 14 + (30 – 14) [897.84/ (897.84 + 101.80)] = 28.37%

The computed IRR is 28.37%, which is much higher than the commercial interest rates. This means that it is worthwhile for an investor to invest money in the hand pulpers.

Sustainability of the hand pulpers

Sustainability of the hand pulpers is determined by a combination of operational efficiency, commercial viability and farmers' acceptance of the processing technology. This involves an assessment of the farmer perceptions of the hand pulpers and their willingness to use the hand pulpers. It is also determined by the buyers' preference for the coffee processed by the hand pulpers compared to the other processing methods. The hand pulpers are financially sustainable and have clear indications of technical efficiency. Given the growers' preference for the hand pulpers it is apparent that they will be sustainable in the long run.

Break-even analysis was carried out to determine the break-even quantity and price levels below which pulped coffee processing would become unprofitable in the context of sustainability. Break-even analysis was conducted at two levels; using the given prices for green coffee equivalent to compute break-even amounts and using the total costs to establish break-even price. The break-even quantity is obtained using the formula:

$$Q = \frac{FC}{P - VC} \quad (4)$$

Where: Q = quantity of parchment in kg needed to breakeven, FC= fixed costs, P = price per kg of parchment, VC= variable costs per kg of parchment
Rearranging Equation 4 gives break-even price as total cost divided by break-even quantity, which for computational purposes is:

$$\Pr ice = \frac{Total\cos t\ per acre}{Farmers' average\ yield} \quad (5)$$

The price per kg of green coffee equivalent was US$ 1.95 birr, which means that the price per kg of parchment coffee = (1.95*0.8) = 1.56. Using Equation 4, and the fixed costs (Table 5) distributed for individual farmers and the unit price of parchment of US$ 1.56 and variable cost per unit of US$ 0.40, the number of units of parchment needed to break-even is given as [3127.56/5* (1.56-0.40)]= 539.24 kg. The variable costs per kg of parchment were computed from data obtained from the farmers during the survey. The average quantity of parchment produced by all the farmers was 323.53 kg while the minimum and maximum quantities of parchment were 18 and 1822 kg respectively. For sun-dried coffee the average minimum quantity processed was 36 kg while the mean and maximum quantities were 1844.51 and 10,500 kg respectively. The high quantity of parchment is for the farmers that exclusively produced pulped coffee as intended in the project. Some farmers produced less than the requisite 539.24 kg of parchment meant to cover total costs, that is fixed and variable costs. This is because farmers designated for pulped coffee also produced substantial quantities of sun-dried coffee. The breakeven figures mean that for sustainability purposes farmers have to process at least 539.24 kg to be able to cover total costs at the current prices. Alternatively, prices of parchment have to be raised if less quantity is to be produced. High volumes of pulped coffee produced in some cases show that potential exists and that all farmers will benefit given timely start of processsing using the hand pulpers. Given the current production levels where the average quantity of parchment produced is 323.53 kg and using formula 5 above the breakeven price is US$ 2.25 per kg of parchment. Sensitivity analysis reveals that coffee growers who produce relatively less pulped coffee would require higher prices to able to breakeven. Higher prices may not be tenable given the current marketing system. For sustainability purposes farmers will require to produce greater quantities of pulped coffee. Indeed there is potential for production of higher volumes of pulped coffee as attested to by the maximum quantity of 1822 kg of parchment achieved in this initial phase albeit with pulped coffee farmers also producing sun-dried coffee. The farmers' perceptions and production potentials show that the hand pulpers are sustainable.

There are some challenges to sustainability of the hand pulpers. The challenges are marketing of coffee processed by the respective hand pulpers, management of the hand pulpers and technical know-how. The coffee marketing structure in Ethiopia is such that the coffee farmers sell to coffee processors who in turn sell to the coffee supplier. The coffee supplier eventually sells to the exporter. There are over 700, 000 households involved in coffee farming. With regard to the coffee processors there are about 600 wet processing plants and about 400 dry processing plants. About 1000 active coffee suppliers are part of the coffee marketing structure and about 100 active exporters exist. Two private exporters and one cooperative union purchased the coffee processed by the

hand pulpers. The coffee produced by project farmers in Gomma and Sheko Woredas were purchased by SA Bagerish Plc; while that of Ale didu Woreda was purchased by Legesse Sherefa Plc. Yeki Woreda coffee was purchased by Tepi Cooperative Union. With respect to marketing; issues that require attention are pricing, timing of purchases, location of the purchasing points, storage and transport costs.

Lack of technical know-how to use the hand pulpers is another challenge to sustainability of hand pulpers. This was manifested through statements such as the hand pulper mixing pulp and parchment, breaking of red cherries during pulping and failure to remove all the pulp. Lack of technical know-how can be addressed through training of the farmers on adjustment of the hand pulpers according to the size of the red cherries as well as other processing skills. This in essence means that the training offered at the time the hand pulpers were supplied was not adequate and requires to be done again coupled with regular visits and back stopping by project staff.

Conclusions

The hand pulpers demonstrated capacity to be commercially viable in the first year of operation. Technical efficiency was less than the expectation given the underutilization of capacity. The reported initial profitability and technical efficiency levels coupled with the growers' interest and commitment indicate that the hand pulpers would be sustainable in the long run assuming all other factors do not change drastically. Profitability and technical efficiency may be improved further through capacity building in terms of training in labour management, technical and processing skills, good marketing and moral commitment to produce only pulped coffee. This means that all farmers selected for pulped coffee should be encouraged to produce exclusively pulped coffee during the subsequent season. Processing of more coffee through the hand pulpers will increase capacity utilization of the hand pulpers.

Preparation of adequate quantities of pulped coffee can provide economic profits to the farmers including repaying the investment required for the equipment. The organisation of farmers into groups for purposes of processing and marketing can produce significant gains for farmers. These include lump sum funds, which can be used for various activities, better bargaining power and economies of scale. More direct access to exporters by the growers can improve farm-gate prices and also the management of market risk. There is a growing potential market for the washed coffees from Ethiopia. Hence pulped coffee processing provides an avenue potential for utilising the potential market. Coffee harvesting is done almost the same time, meaning that there is a likelihood of competition for processing time. Timing of harvesting and processing has to be agreed among the group members.

Technical support needs to be provided to all the participating farmers to improve their harvesting and processing skills including selection of the red cherries and pulping. Organising farmers into business organisation will not only facilitate capacity building of members but also increase the organisations capacity to access credit (and therefore, more pulpers) and negotiate better for higher prices for their coffee. Binding agreements have to be made between the coffee growers and the buyers so that once the parchment is ready it is purchased timely. A ready market with good prices will serve as an incentive to the farmers. Marketing points or places where the parchment is collected from have to be close to the growers as much as possible. This would facilitate creating a niche for pulped coffee from Ethiopia.

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REFERENCES

Baumol JW (1995). Economic theory and operations analysis (4th Edition). New Delhi: Prentice–Hall of India Private Limited.

Bruce C (2007). Selecting the discount rate. http://www.economica.ca/ew13p3.thm

Chandra P (1998). Projects: planning, analysis, selection, implementation and review (4th Edition). New Delhi: Tata McGraw-Hill Publishing Company.

Charveriat C (2001). Bitter coffee: how the poor are paying for the slump in coffee prices. Oxfam GB

Ethiopian Reporter (ETR) (2007). Monetary and financial developments. http://ww.ethiopianreporter.com/modules.php?name=News&file=article&sd=11912

Ethiopia (2006). Coffee history, production and economy http://www.treecrops.org/country/ethiopia_coffee.htm

Ferris S, Muganda A, Matovu R, Kolijn S, Hagenimana V, Karuni E (2001). Marketing opportunities for starch and high quality flour production from cassava and sweet potatoes in Uganda. Resource and crop management monograph No. 29. Uganda: International Institute of Tropical Agriculture. http://www.foodnet.cgiar.org/Projects/starch%20Monograph.pdf

FDRE (2003). Comprehensive coffee development and marketing plan. Addis Ababa: Federal Democratic Republic of Ethiopia (FDRE), Ministry of Agriculture and Rural Development

Frick DR (2007). Time value of money concepts: discount rate. http://www.frickcpa.com/tvom/TVOM_Discout_Rates.asp

Gittinger JP (1984). Economic analysis of agricultural projects. Baltimore and London: The John Hopkins University Press.

Gutierrez PH, Dalsted, NL (2007). Long term repayment methods. http://www.ext.colostate.edu/PUBS/FRMING/03757.html

ICO (International Coffee Organization) (2006). Field processing. http://www.ico.org/field_processing.asp

IMF (2006). The Federal Democratic Republic of Ethiopia: selected issues and statistical appendix. International Monetary Fund (IMF) Country Report 6/122. Washington: IMF.
Lee WF, Boehlje MD, Nelson AG, Murray WG (1988). Agricultural finance. New Delhi: Kalyani Publishers.
LMC (2000). International Coffee Organization/ Common Fund for Commodities study of marketing and trading policies and systems in selected coffee producing countries: Ethiopia country profile. Study prepared by LMC International Ltd. Oxford: England.
Nicholas P (2007). Ethiopia's coffee sector: a bitter or better future? J. Agrarian Change, 7(2): 225-263.
Ostertag C, Wheatly C (1995). A financial model for the implementation and evaluation of small-scale agro-enterprises. In: Gregory JST (ed.) Prices, products, and people: analyzing agricultural markets in developing countries. London: Lynne Rienner Publishers. 361-383.
Oxfam (2002). Crisis in the birth place of coffee. Oxfam International research paper. http://www.maketradefair.com/en/assets/english/coffeecrisisKafaEthiopia.pdf
Petty C, Seaman J, Majid N (2003). Coffee and household poverty: a study of coffee and household economy in two districts of Ethiopia http://www.savethechildren.org.uk/scuk_cache/scuk/cache/cmsattach/1776_Ethiopia_study-final.pdf
Watkins T, Valley S (2006). An introduction to cost benefit analysis. http://www2.sjsu.edu/faculty/watkins/cba.htm.