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Socio-Economic Investigation of Improved Processing of Shea Nuts in Northern Ghana 19th February - 12th March 1997

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Project AO524

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Abbreviations

FASCOM	Farmers' Service Company
IRR	Internal Rate of Return
ITTU	Intermediate Technology Transfer Unit
NGO	Non-Governmental Organisation
NPV	Net Present Value
NRI	Natural Resources Institute
ODA	Overseas Development Administration
RNRRS	Renewable Natural Resources Research Strategy
SARI	Savanna Agricultural Research Institute
TAAP	Tamale Archdiocese Agricultural Project

Exchange Rate

£1 = 2 800 cedis (March 1997)

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The author would also like to thank the members of the villages who were involved in the trials of the bridge press, and the traders who participated in interviews.

Conversions

1kg nuts = 0.32 kg butter
One cocoa bowl of nuts = 2.5 kg
1 basin (batch) of nuts = 10 bowls (i.e. 25 kg)

EXECUTIVE SUMMARY

1. This report provides a financial and socio-economic appraisal of a hand operated bridge press for the extraction of oil from shea nuts in the North of Ghana.

2. Shea grows in Sahelian (arid and semi-arid) areas in sixteen countries across Africa, and processing of shea butter for use as cooking oil and skin pomade is an important income earning activity for many women.

3. The bridge press saves considerable quantities of water and fuelwood (90kg and 10kg respectively) and offers the potential to conserve these scarce resources.

4. The financial analysis shows that the profitability of producing shea butter is extremely low using the traditional process. Financial analysis shows a net cash flow of 3 000 cedis per year when labour and fuel costs are taken into account. From interviews with the women in Chansegwa village, it appears that the return on a batch of 25kg earned during the lean season would be wiped out by marketing costs such as transport and taxes.

5. The processing activity of the women is reduced during the lean season despite the fact that the demand for the butter at this time of year is highest due to the dry weather. This is because the price of nuts is high, and the women lack capital to buy them. Women are not able to save the nuts collected at harvest (June/July) for storage until the lean season, since the harvest coincides with a period of shortage of food and income. The women are therefore forced to sell the nuts unprocessed at this time in order to get income to feed themselves and their family.

6. Analysis of the costs of the two processes revealed that the processing cost using the bridge press, at 469 cedis per kilogram of nuts, is not significantly lower than the processing cost of the traditional method of 471 cedis per kilogram of nuts. Nonetheless, for an annual turnover of 5 tonnes of nuts, the NPV of the bridge press is positive at just over 58 000 cedis and the IRR of 26% is higher than the estimated opportunity cost of capital (20%). While substantial increases in returns per woman hour can be gained using the bridge press over the traditional process, a reduction in income per batch of nuts is also necessary. The likelihood of the women accepting reduced income per batch in order to gain time is discussed in the report.

7. It is concluded that since the processing costs of the two methods are not significantly different, the main difference lying in the fact that the bridge press is less labour intensive and more capital intensive, dissemination should be carried out with caution and should be accompanied by careful monitoring.

8. There is potential for expansion of the market for shea butter, both in its raw state and as a component in cosmetic creams, but there are complications in bringing the butter from the north to the south of the country. These problems are related to high transport costs and low margins on shea butter, and are especially severe in the more isolated areas of Northern Ghana.

9. The limited resources of the processors leave them with little surplus to invest in new technologies, and therefore a group approach would be necessary to spread the financial burden of the press over several processors. An alternative would be to encourage a private entrepreneur in the village to purchase the press for operation on a custom basis.

10. A small credit scheme is recommended in the villages where the press has been installed. The women are at present unable to store the nuts at harvest because income constraints at this time of year force them to sell the unprocessed nuts. A credit scheme through which the women could purchase the nuts during the harvest season would help them to store them for processing in the lean season.

BACKGROUND

11. This study was commissioned for the project "Improved Processing of Shea Nuts in Northern Ghana". This project has carried out field tests on an improved method of shea processing in three villages in the semi-arid area of Northern Ghana. The three villages chosen for the field tests were Chansegwa and Kanfiehili in the Northern Region, where the project was collaborating with the NGO Tamale Archdiocese Agricultural Programme (TAAP) and Tabiase in the Upper West Region, with Technoserve as the collaborator. The project is funded from ODA's Crop Post Harvest Programme.

12. This report presents the findings of the socio economist who visited Ghana in February and March 1997 to appraise the technology of the bridge press, and to describe the marketing systems for shea in Ghana.

TERMS OF REFERENCE

- Appraise the technology of the bridge press, with respect to existing shea processing activities and feedback received during field trials;

- characterise the demand for shea processing technology in the villages of Chansegwa and Kanfiehili in the Northern Region and Tabiase in the Upper West Region, and make an assessment of the aggregate demand in Ghana;

- analyse the institutional and social structures in the villages which are likely to influence the uptake and sustainable use of the technology;

- describe the marketing systems for shea in Ghana, possibly including subsistence use, local marketing for food oil, marketing as a cosmetic or for export;

- make recommendations on considerations and conditions which would positively influence uptake of shea processing technology.

METHODOLOGY

13. The visit was undertaken over a three week period in Tamale in the Northern Region, Wa in the Upper West Region, Kumasi in the Ashante Region and Accra.

14. Primary data collection was conducted using informal techniques during field trials in the three villages of Chansegwa, Kanfiehili and Tabiase. Markets were visited in the Northern and Upper West Region, and in Kumasi and Accra, and exporters of shea nuts and butter were also interviewed.

15. Discussions were held on a wide range of topics including the importance of shea processing as an income earning activity for the women, their willingness and ability to pay for the press, the costs and returns of shea butter processing, and the market potential for shea butter both domestically and for export.

16. In a previous four day visit to the North of Ghana in October 1996, markets in and around Tamale were visited, including Aboabo market in Tamale and Nyapala market and Kumbungu market. An initial assessment of the domestic market potential for shea butter was undertaken by interviewing processors and traders in these markets. The results of that assessment are included in the present report.

17. Secondary information of relevance was reviewed, including previous NRI reports and reports from Technoserve and the Savanna Agricultural Research Institute (SARI).

Principal Findings

APPRAISAL OF THE TECHNOLOGY

18. The natural distribution of the shea tree, *Butyrospermum parkii*, is the southernmost part of the Sahel and the adjacent Sudan and Guinea savannah (arid and semi-arid areas). It grows wild in sixteen countries in Africa.

19. Shea butter is processed from the seeds of *Butyrospermum parkii*, an activity traditionally undertaken by women. Lever Brothers in Ghana indicates that about 200 tonnes of shea butter is produced in Ghana each year.

Importance of Shea Butter Processing as an Income Earning Activity

20. The selling of shea nuts and shea butter are the main income earning activities in the villages of Tabiase, Chansegwa and Kanfiehili. Depending on the availability of shea nuts during the lean season (January to May), this activity can provide an income throughout the year. The nuts are collected by women and children. In cases where the trees grow on another farmer's land, then the women are restricted from collecting the nuts. Where the trees grow on their own farmland or outside the farming area there are no restrictions to their gathering the nuts.

21. The women use this income for the purchase of ingredients for soup or stew, which it is their responsibility to provide for the family, while the men provide staples such as maize, rice or sorghum. In many cases the women also have to find the income to clothe themselves and their children.

22. In Tabiase village the women were asked to indicate with 100 maize seeds the way in which their income is generated throughout the year. This was done first with overall income, which the women apparently took to mean all income except that generated from shea butter processing. The exercise was then repeated as a comparison of income earned from shea butter processing compared to other sources of income. The results of this exercise are shown in Figure 1.

Figure 1: Flow of Women's Income throughout the Year in Tabiase Village

	J	F	M	A	M	J	J	A	S	O	N	D	Total
most income			1	8	10	14	12	13	28	14			100
most income from farming				3	2	3	4	3	4	3			100
most income from shea nut selling/processing	13	13	7	5	5	5	5	5	5	5	5	5	

23. In Tabiase, as well as shea butter processing, the women also earn a small amount of income in April from processing the fruit of the Dawadawa tree (*Parkia biglobosa*) into flavouring for soups, and in other months from gleaning the fields after the harvests of maize (harvested in July-August), rice (harvested in September) and sorghum (harvested in October) for sale in the village market. Figure 1 indicates that most of their income throughout the year comes from collecting and selling shea nuts or processing shea butter for sale. They claim to get the highest income from shea butter processing in the months of January and February.

24. In Chansegwa and Kanfiehili the women also process groundnuts to make oil and *kulikuli* for sale, process rice (parboil and mill to remove the husk) which is harvested between December and January and make soap from shea butter for sale on the local market.

25. The women have little cash income during the time of the shea harvest in June and July, and they are busy working on the farm at this time since the period coincides with the planting time (rainy season) in the Northern Region. In Chansegwa and Kanfiehili the women and children gather nuts, parboil them and store the kernels, selling them a little at a time as they need money. Because of the shortage of income at this time of year, the women are forced to sell the nuts rather than keep them for processing in the lean season.

Processing of Shea Butter

Traditional Method

26. The description of traditional shea-butter production is based on data collected by Peiler (1994) and Swetman et al. (1995) and on information gathered from village visits. The initial appraisal of the technology carried out by Stringfellow is updated in this report in the light of new data collected during the field trials.

27. In the financial analysis, all data are related to the processing of one basin of nuts (i.e. 25kg) into shea butter. This quantity is referred to in the report as one batch.

28. The traditional production of shea butter involves around 11 processing steps. These are described by Swetman et al. (1995). The fruit is collected by women and children, the pulp is removed and the shell around the seed is cracked open to release the nut. Processors may collect the nuts themselves or purchase them in the market.

29. The nuts are pounded and roasted before milling in a powered cornmill. During the milling process the material reaches a sufficiently high temperature to cause the cells containing the oil to break down and release the oil. After milling, the paste resembles molten chocolate.

30. A small amount of water is added and the paste is beaten, forcing air into the mixture with the palm of the hand in a large basin (which holds about 8kg of paste) for around 45 minutes to one hour, or sometimes longer, until the processor judges that the butter is about to separate. Large quantities of cold water are added which causes the butter to float to the surface. More water is used to wash and rinse the butter which is finally skimmed off by hand.

31. The butter is boiled for more than an hour to reduce the moisture content. The oil once cooled sets solid and is either moulded into small pieces for immediate sale in the village or at the market, or placed in calabashes (local gourds). The amount of butter contained in a calabash can be up to 35 kg. The resulting product, shea butter, is sold to itinerant traders or to traders at the market.

32. The equipment needed for the traditional process is very simple, consisting of an enamel basin, a pestle and mortar, an aluminium pot, a calabash and a ladle. Most of these utensils are also used for general household activities such as cooking and fetching water, apart from the calabash which is purchased for the shea butter. The cost of this equipment per period of use is minimal, probably also being shared among the villagers, and has not been included in the financial since it is that it is needed for both the traditional and the bridge press process, and therefore need not be included in a comparison of the two processes.

Bridge Press Technology

33. The bridge press is a simple, manually operated press involving the use of a screw which drives a piston onto several plates which are contained in a perforated metal cylinder, which holds shea paste wrapped in cotton bags.

34. To extract the oil, the shea nuts are prepared in the same way as with the traditional process and milled to a paste.

35. The paste is divided between nine pieces of cotton cloth, in which it is wrapped. Three of these are placed into the metal cylinder and covered with a polypropylene sack and a metal plate is rested on top. The same procedure is followed for the remaining 6 pieces and once they are in place the piston is gently lowered onto the plate. The oil oozes out through the perforations into a tray and it runs from here into a calabash or bowl.

36. The press has the capacity of about 5 cocoa bowls of nuts (about 12-15kg) at one time and the whole operation takes between 35 and 45 minutes. Therefore it takes around one and a half hours to press one batch (25kg) of nuts.

37. The main inputs for processing by the traditional process are shea nuts, water, fuelwood and labour. With the new technology, the capital investment is the bridge press, which was manufactured at a cost of 450 000 cedis, and the main variable cost is the labour and the cotton and polypropylene bags used in the press. Substantial savings are made on water and fuelwood (of 90kg and 10kg respectively), which can considerably reduce processing time if accessibility to these inputs is limited. This also offers the possibility of conserving these scarce resources.

Financial Analysis

38. Table 1 shows the time inputs needed for the traditional process and the bridge press process, as is given by Swetman et al. (1995).

Table 1: Comparison of time taken to process one batch of nuts using the traditional process and the bridge press process

Activity	Time (hours)	
	Traditional Process	**Bridge Press**
Pounding	0.5	0.5
Roasting	1	-
Milling	1	1
Beating the paste	3	-
Rinsing and Separating	1	-
Boiling the oil	1.5	-
Pressing the paste	-	1.5
Moulding into bars	1	1
Collection of inputs		
Water*	1.5	-
Travelling to the mill	1	1
Total time	11.5 hours	5 hours

* Approximately 90kg of water are used to process 25kg of shea nuts, equal to about 3 headloads. As the women are assumed to walk about 1km to the water source, a round trip of about 0.5 hours, the total time spent collecting water is equal to 1.5 hours

Inputs

Labour

39. Shea butter extraction is labour intensive, and therefore women's labour is the major input after the purchase of the shea nuts. Since the village is not primarily a wage based economy, difficulties arise when an attempt is made to value women's labour for financial analysis. The daily rate for casual unskilled farm labour 1 000 cedis (about 170 cedis per hour), but the opportunity to do this type of work is only available for a few weeks each year. The returns per hour gained by processing shea butter by the traditional method were found to be around 90 cedis per hour, and this value is used in the financial analysis[1].

Water

40. Water is not purchased by the processors and estimates of time spent collecting this input is included in the financial analysis.

Fuelwood

41. The benefits of the press in terms of saving fuelwood may be converted to a cash saving where women have access to markets in which they can sell the fuelwood. Peiler (1994) estimated that 10kg of wood is needed to process 28kg of shea nuts. The market value of this amount of fuelwood (estimated at around 1000 cedis by women in Kanfiehili village), represents the opportunity cost of using the fuelwood for

[1] It must be noted that while the rate of 90 cedis per hour gives a useful benchmark for comparison of the two processes, the women are often involved in several other activities, such as cooking, washing clothes etc., at the same time as processing, this does not necessarily reflect the true hourly return to processing.

processing. When this value is used in the financial analysis, the returns to processing using the traditional method become negative, showing that the women would make more money by selling the unprocessed raw materials than by processing the butter. For this reason, the value of 1000 cedis has been treated with some scepticism, and a much lower value of 150 cedis has been used to value the fuelwood used to process one batch by the traditional method.

Price of the shea nuts and butter

42. At the beginning of the season (June and July) most women gather rather than purchase the shea nuts. Later in the season, many women purchase the nuts for processing. In the financial analysis the prevailing price in the lean season (January to May) for a bowl of shea nuts is used, since this also represents the opportunity cost of gathered nuts, which could otherwise be sold, unprocessed, on the village market.

43. The lean season price of shea nuts in Tabiase village was 800 cedis per cocoa bowl (about 2.5kg). During harvest time, the price would be around 300 cedis for the same quantity.

44. In Kanfiehili and Chansegwa the lean season price of the nuts was 1000 cedis per cocoa bowl and in the harvest season it costs 500 cedis. These prices are used in the analysis.

45. The selling price of shea butter is discussed in detail in the description of the marketing of the product (para. 108). For the financial analysis a lean season price of 1 475 cedis per kilogram of butter was used.

Working Capital

46. The working capital is the capital necessary to purchase goods and services that are used for the production activities and that are turned over during the production cycle. The working capital is recovered at the end of the life of the press. Since the women generally sell the shea butter within one to two weeks of production, the turnover period for the working capital is assumed to be two weeks. Given that the press is assumed to be in operation for 40 weeks of the year, the capital will be turned over 20 times a year. The figure for working capital was then calculated by dividing the variable costs by the number of times the capital is turned over in the year (20 times).

Turnover

47. The women are not involved in processing the shea butter for 52 weeks a year and they do not generally process butter during the harvest season in July, since this coincides with the planting season in the Northern Region, when they are busy working on the farms. Later on in the season their processing activity is also constrained by the lack of capital to buy nuts for processing. For this reason the financial analysis used an estimated turnover of 5 batches of 25kg of nuts a week for 40 weeks, giving a total annual turnover of 5 tonnes of nuts.

Yield

48. In the report by Swetman et al. (1995) a yield of 0.43kg of butter per 1kg of shelled shea nuts was reported for the traditional process and of 0.36 kg of butter per kilogram of shea nuts for the bridge press process. In recent field observations using the bridge press, however, a yield of between 0.32 and 0.30 kg of oil was realised[2], and the women felt that this was a higher yield than they would have obtained using the traditional method. For this reason a yield of 0.32 kg of oil per kilogram of nuts is used in the financial analysis for both processes.

Opportunity cost of capital

49. According to the Agricultural Development Bank, the state charges 40% interest rate on loans to the agricultural sector. While this is a high nominal interest rate, given that inflation in Ghana is around 70%, the real interest rate is in fact negative. Since the interest rate does not accurately reflect the opportunity cost of capital, a rate of 20% is assumed.

Results of the Analysis

50. Appendix 1 shows a comparison of shea butter processing costs of the two methods when the press is assumed to have a useful life of 10 years. These costs are summarised in Table 2:

Table 2: Cost comparison of the two methods

	Bridge Press	Traditional Method
Fixed Costs		
Total annualised capital costs	107 335	0
Maintenance (5%)	5367	0
Interest on working capital	223	0
Total fixed costs per batch	565	0
Variable Costs		
Shea nuts	10 000	10 000
Milling	600	600
Bags	111	0
Labour	450	1 035
Fuelwood	0	150
Total variable costs per batch	11 161	11 785
Total costs per batch	11 726	11 785
Quantity processed (kg)	25	25
Total processing cost per kilogram nuts	469	471

[2] This lower yield is probably due to the fact that it is late in the season and the nuts have been in storage for some months, thus reducing the oil content of the nut.

51. The potential savings offered by the bridge press[3] are in terms of water, fuelwood and time. Therefore the value estimated for these three components is key to the viability of the bridge press.

52. Table 2 shows that the processing cost using the bridge press, at 469 cedis per kilogram of nuts, is not significantly lower than the processing cost of the traditional method of 471 cedis per kilogram of nuts.

53. The analysis in Appendix 2 shows a positive Net Present Value (NPV) of just over 58 000 cedis when the press is used for an annual turnover of 5 tonnes of nuts (i.e. 5 batches of 25kg nuts per week for 40 weeks of the year). This shows that the technology is viable at this level of turnover.

54. The Internal Rate of Return (IRR) shows the discount rate that just makes the net present value of the incremental net benefit stream equal zero (i.e. the maximum interest rate that can be paid for the press if the investment and operating expenses are to be covered and still just break even). For an annual turnover of 5 tonnes of nuts, an IRR of 26% is obtained. This is higher than the opportunity cost of capital, which is assumed to be 20%, and confirms that the press is viable at an turnover of 5 tonnes of nuts.

55. In Appendix 3 the financial analysis is used to show the relative labour productivity of different technologies (i.e. returns per unit labour) rather than attaching a value to labour itself. A measure of net income per kilogram of raw material is also provided, showing the net cash returns to cash expended on purchased inputs. The assumptions used were the same as in the previous analysis (i.e. that the press has a useful life to 10 years, the opportunity cost of capital is 20% and the turnover is 5 tonnes of nuts per year). The results are summarised in Table 3.

Table 3: Returns to Labour of the Two Processes

	Bridge Press	Traditional Method
Returns to labour per batch (25kg) of nuts	524 cedis	1049 cedis
Returns to labour per kilogram of nuts	21 cedis	42 cedis
Returns per woman hour	105 cedis	91 cedis

56. The return to labour per kilogram of shea nuts is 42 cedis (1049 cedis per 25kg batch) using the traditional processing method. This compares to a return to labour of 21 cedis per kilogram of nuts (524 cedis per batch) using the bridge press.

57. Expressed in terms of returns per woman hour, the traditional process yields 91 cedis per woman hour, lower than the returns of 105 cedis per woman hour using the bridge press.

58. This shows that in order to use the press the women would forego an income of 525 cedis (50%) per batch, while labour input is reduced by around 57% and hourly

[3] It should be noted that these savings were anticipated by the team. The women in the villages had a different impression of the main benefits offered by the press (see para 76).

returns to labour increase by 15%. They therefore have a choice of foregoing a large proportion of their income from processing in order to save time. In this case they may only be willing to adopt the technology if there are opportunities to use the extra time for other productive purposes.

Sensitivity Analysis

59. Sensitivity analysis was carried out to indicate the expected changes in NPV, IRR and returns to labour resulting from changes in different variables. The effect of variables such as time spent collecting fuelwood and water by the processor, the cost of the bridge press, the turnover of the bridge press, seasonality and improvements in yield using the press are analysed. These changes are compared to the standard case that is presented in the financial analysis. The results are shown in Table 4, where the NPV has been rounded to the nearest thousand cedis.

Table 4: Sensitivity Analysis

	NPV	IRR	Increase in returns per woman hour for the press c.f. traditional method
Standard Case	58 000	26%	15%
Labour inputs increased by 20% with traditional process	233 000	47%	38%
Cost of the press reduced by 33%	215 000	59%	56%
Price of nuts and butter reduced by 20%	58 000	26%	-45%
Production reduced by 20%	47 000	15%	-15%
Yield of press increased to 35%	986 000	269%	258%

Increase of Labour Inputs

60. The returns to labour using the traditional process will vary in different locations given that time spent collecting water and fuelwood and travelling to the mill will differ. In cases where fuelwood or water are far from the village, then time taken to collect these inputs will increase, which will in turn increase their cost. Since the bridge press process requires no fuelwood and very little water, an increase in distance from these inputs will only affect the returns of the traditional process.

61. Sensitivity analysis shows that relative returns of the bridge press increase substantially when access to fuelwood and water is limited.

62. If the time taken to collect fuelwood or water increases by 20%, then the NPV of the press increases to over 233 000 cedis and the IRR increases to 47%. The returns to labour of the traditional process fall to 76 cedis per hour, while those of the bridge press remain unchanged at 105 cedis per hour. This means that adoption of the bridge press increases returns to labour by 38%, but the 50% reduction in income per batch remains unchanged in this scenario.

63. In Table 5 an attempt has been made to indicate what a 20% increase in labour inputs means in terms of distances from fuelwood and water. The total processing time excluding the collection of fuelwood and water is 10 hours for the traditional process,

and the standard case used in the financial analysis was 11.5 hours (1.5 hours to collect water). Fuelwood was not valued in terms of time taken to collect it in the financial analysis, but a price was estimated to reflect its value. In the analysis below the costs associated with differences in distances to collect fuelwood and water are estimated in terms of a labour cost. It should be noted that 3 headloads of water are needed, meaning 3 return trips to the water source (of 0.25 hour per kilometre), and one headload of fuelwood is needed for processing by the traditional method.

Table 5: Estimate of Processing time with the traditional process with Differing Access to Fuelwood and Water

Distance of fuel wood from village (km)	Distance of water from village (km)	Time taken to collect fuel wood (hours)	Time taken to collect water (hours)	Total processing time	% increase in labour inputs from standard case
0	0	0	0	10	-13%
7	0	3.5	0	13.5	17%
0	3	0	4.5	14.5	26%
2	2	1	3	14	22%
10	20	5	30	45	291%

64. Table 5 shows that when fuelwood is 7 kilometres from the village, labour inputs for the traditional process will be 17% higher than in the standard case scenario. Likewise, when water is just 3 kilometres from the village labour inputs will be 26% higher. When both water and fuelwood are 2km from the village, labour inputs will be 22% higher than in the standard case scenario.

65. The question arises as to how realistic these distances are in the case of Northern Ghana. A survey of 138 rural women conducted by Williams et al. (1991) suggests that many women in the Northern Region in Ghana are obliged to walk long distances for water and fuelwood. In three districts in the Northern Region, it was found that 96% of respondents use wood fuel, over half walking between 3 and 11 km to obtain it. In the same survey women claimed to walk between half and 24 km for water. These distances may have increased since the study in 1991. If it is assumed that fuelwood is 10 kilometres from the village and water 20 kilometres, then Table 5 shows that labour inputs would increase by 291% compared to the standard case used in the financial analysis.

Cost of the bridge press

66. The collaborating NGO in Tamale, Tamale Archdiocese Agricultual Project (TAAP) believes that it could have three more presses manufactured at a cost of 900 000 cedis, that is 300 000 cedis per unit. If the cost of the bridge press could be reduced by 33% to 300 000, then the NPV of the press increases to just under 215 000 cedis and the IRR increases to 59%. The returns to labour using the press increase to 142 cedis per woman hour, i.e. a 56% increase in returns to labour compared to the traditional process, where the returns remain at 91 cedis per hour.

Reduction in the price of nuts and butter

67. In the harvest season the price of shea nuts will fall, as will the price of shea butter. In the sensitivity analysis, a fall of 20% is examined in the price of both commodities. This reduction gives a harvest season price of nuts of 800 cedis per bowl (320 cedis per kg), and a harvest season price of butter of 1 180 cedis per kilogram. At these prices the NPV and IRR remain the same as in the standard case scenario, but the returns to labour fall to 60 cedis per hour with the traditional process and 33 cedis per hour with the bridge press. This means that the returns to labour per hour of the traditional process are reduced by 45% with the use of the bridge press at harvest season prices.

Reduction in Turnover of the bridge press

68. The financial analysis assumes a utilisation rate for the press of 5000kg in one year, equivalent to 5 women each processing 25kg of nuts in one week for 40 weeks of the year. If the amount of butter processed with both methods is reduced by 20% to 4 processings per week for 40 weeks of the year, then the NPV of the press becomes negative at minus 47 000, and the IRR falls to 15%, below the estimated opportunity cost of capital of 20%. For monitoring purposes this would imply that for the press to be viable, a minimum average of 5 batches of 25kg per week would have to be processed for 40 weeks of the year (or 4 batches a week for 52 weeks of the year).

69. At the time of the study the processing activity of the women had been reduced owing to the fact that it was late in the season and there were fewer nuts available. In theory the maximum capacity of the press of about 30 batches of 25 kilograms of nuts a week (assuming that 5 batches are pressed per day for 6 days a week for 52 weeks of the year). This is much higher than the minimum required for the press to be viable.

70. In practice the potential for increasing usage of the press to its maximum capacity may be limited for several reasons. Firstly, the women follow a regular daily time table which can only be modified a small amount to fit in with the availability of the press. Interviews with the women revealed that much of their day is occupied with household chores and the have some time in the afternoon when they can work on their own farm, process shea nuts or go to the market to sell the shea butter. If the press were to be used to its maximum capacity, then women may be obliged to interrupt activities such as cooking and farming, which they may not be able to do.

71. Secondly the women are not involved in processing the shea butter for 52 weeks a year.

72. The usage of the press may also be limited by the availability and accessibility of the corn mill. The shea nut paste must be pressed soon after milling so that there is sufficient heat in the paste to facilitate oil extraction. Mill operators generally prefer to mill the shea nuts after the corn milling has finished since time is needed to clean the mill after the nuts have been through it. Therefore, women can only mill the nuts in the afternoon or on a specified day of the week. Unless a way of reheating the paste is developed, then the limited accessibility of the corn mill will also limit the use of the press.

73. Nonetheless, it is likely that it is possible for the villages to achieve the minimum turnover of 5 batches a week for 40 weeks of the year.

Improvements in Yield

74. The women in Chansegwa village noticed that if they process the nuts when they are still very hot from the mill, then they managed to extract one gallon of oil (4kg) from 4 bowls of nuts instead of the usual 5 bowls. This gives a much higher yield of 40%. This yield seems improbably high, but if usage of the press enables the women to achieve a higher yield of 35%, then the NPV of the press is over 986 000 cedis and the IRR becomes 269%. In this case the returns to labour become 258% higher than with the traditional method.

THE MARKET FOR THE TECHNOLOGY

75. The financial analysis shows that the press is viable at a turnover of 5 tonnes of nuts per year, and that substantial increases in returns per woman hour can be gained using the bridge press, but a reduction in income per batch of nuts may also be necessary.

76. The women in the villages were asked which benefits of the press they considered most important. The main benefits which they perceived were that they did not have to endure the smoke and heat from roasting the nuts, and that they did not have to use their hand to beat the paste, which is a laborious task. They also mentioned that an important benefit was the fact that less water is needed to extract oil using the press. They only mentioned the benefits of saving time once they were prompted.

77. The demand for the technology will be influenced by the decision of women to forego some income in order to save time and discomfort. They may not be willing to do this since it appears that they are willing to accept very low returns to labour since they have limited means of obtaining a cash income for necessary household acquisitions. The low return to labour and capital appears to be of little importance as long as labour capacity is available. In this case, time saved by use of the press may only be of value to the women if it can be put to some productive use.

78. The women were asked to what use they would put the time saved by using the press. In Chansegwa and Kanfiehili they said that with the extra time they would collect more fuelwood or glean rice or groundnuts from the fields for sale.

79. Another possibility is for women to increase the volume of butter processed per week. The two principal constraints to increasing production are lack of capital and lack of access to markets.

80. The women in the villages have limited capital, and generally can only buy between 10 and 30 bowls of nuts for processing. This constraint is less severe in the shea nut harvest season, when the women collect rather than buy the nuts. However, the harvest season coincides with a period of shortage of other food commodities, such as maize and rice, and therefore household income is very low at this time of year. In this case the women's capacity for processing is limited by the volume of nuts that they can collect, and other income constraints which oblige them to sell the nuts

immediately rather than store them for processing. Time constraints are also relevant at this time of year, since it is the planting season and women's labour is needed on the farm.

81. In remote villages where the returns to labour are potentially highest, due to time saved in collecting inputs, it is also more likely that access to markets is limited. In this case the women may be unwilling to increase production of butter if they feel that they will be unable to sell it.

82. This was observed in Tabiase Village in the Upper West Region, where some of the women claimed to process only around 4 bowls of nuts (10kg) every two weeks, mainly for their subsistence use. They said that if they produced more they would not be able to sell it on the market. Despite the fact that the women had access to a corn mill, at a cost of 200 cedis per bowl of nuts, they felt that it was not worthwhile to use it for small quantities. They therefore preferred to use the more time consuming traditional method of rubbing the pounded nuts between two stones until a smooth paste is formed. If the majority of women in the village are mainly involved in processing small quantities of butter, it is unlikely that they would be willing to pay a charge to press one basin of nuts, unless a larger market can be found for the butter.

83. The demand for the press is likely to be higher in places where women have access to markets in which they can sell fuelwood so that the benefits of the press in terms of saving fuelwood may be converted to a cash saving.

84. However, the opportunity to sell fuelwood is not available in all the villages. For example, the women in Chansegwa did not feel that there would be a possibility of selling the fuelwood saved by using the press in order to pay for the technology. They claimed that often they are obliged to use dung or rubbish as fuel and this does not have a market value.

85. This demonstrates that many factors influence the woman's decision to process shea butter rather than sell the nuts, and shows that a low rate of return is acceptable when there are few other income generating alternatives. Furthermore it is possible that the social aspects of traditional processing, whereby several women get together and chat while making the butter, are also considered to be important. This may explain to some extent their willingness to process even when the returns are extremely low.

Charge rate for the press used on a custom basis

86. There are several private investments which are relatively large in Tabiase Village, including two privately owned corn mills (purchased at a cost of around 2 million cedis each), and two tractors (purchased at a subsidised price of 28 million cedis each). There are no such investments in Kanfiehili, and the only investment in Chansegwa is a corn mill. The fact that there are these investments in Tabiase and Chansegwa larger than that of the bridge press shows that there are entrepreneurs in the villages who are willing to undertake investments of that scale. It may therefore be possible to find private entrepreneurs who are willing to purchase the press and operate it on a custom

bases. If this is not possible, then an NGO could take the place of a private entrepreneur and install the press in the village and charge the villagers per use.

87. If the press is installed in a village and used on a custom basis, the question arises as to how much to charge for each use of the press. This depends on a number of factors, such as the turnover, the time in which the owner wants to recover costs and the return to investment expected by the owner. Table 6 shows an example of different charge rates needed to repay the cost of the press in one year. If the press costs 450 000 cedis to buy, and is taken on a loan repaid in equal monthly instalments with an interest rate of 40%, then the total amount to repay will be 537 443 cedis. Assuming that it takes 1.5 hours to process one batch of 25kg, the maximum capacity of the press if it is used for 8 hours a day is 5 batches of 25 kg in one day equal to 30 batches in one week and 1 560 batches in one year[4]. If the press were used to its maximum capacity, then a minimum charge per batch of 345 cedis would ensure that the press and interest on the loan was fully repaid in one year. This charge per use would fall to 155 cedis per batch at the maximum utilisation rate if the repayment of the press was spread over three years. It should be noted that these charge rates reflect the minimum margin necessary on processing the nuts into butter in order to make the press viable.

Table 6: charge rates required to recover the cost of the press for different levels of utilisation

No. of women processing 25kg batch per week	No. weeks press used in 1 year	No. of batches pressed per year	Price per batch to break even in yr 1	Price per batch to break even in yr 2	Price per batch to break even in yr 3
2 women	52 weeks	104	5 168	3 015	2 324
5 women	52 weeks	260	2 068	1 206	930
10 women	52 weeks	520	1 034	603	465
20 women	52 weeks	1 040	517	302	233
25 women	52 weeks	1 300	414	242	186
30 women	52 weeks	1 560	345	201	155

88. Women in Kanfiehili and Chansegwa villages are at present paying 600 cedis to mill 10 bowls of nuts. The women from Kanfiehili have to walk to neighbouring villages to mill the nuts, but the women in Chansegwa have access to a mill in their village. They are evidently willing to bear this expense since none of them use the more traditional method of rubbing the pounded kernels between two stones to produce the paste. When asked how much they would be willing to pay per use of the press, the women in Kanfiehili said that they would be willing to put between 200 and 400 cedis aside every market day to pay for the press. Since the market day occurs every six days and the women generally process about one batch, that means that they would be willing to pay between 200 and 400 cedis per batch.

[4] It must be noted that this may be constrained by the use of the corn mill and by the time constraints of the women.

89. Women in the two villages are already accustomed to saving small amounts every week. Both villages have a *susu* group, a savings scheme into which the women pay 200 cedis every market day to the magazia (village women group leader), and allocate the total to individual members in turn. The groups have a membership of about 30 women, and the money saved in this way is used to buy clothes and other household goods.

90. The situation is different in Tabiase village where the processing of shea butter by the women appears to occur on a small scale. It is unlikely that the women would be willing to pay 200 cedis per use of the press. Despite these impressions of the author, the team was approached during the trials in Tabiase village by men expressing an interest in buying the press for operation on a custom basis.

91. The women should be able to experiment with using the press with little risk to themselves, and this would be possible if a trial period of 3-6 months is allowed in all the villages where the press is installed, in which time the use of the press is monitored. During this time information could be collected each week, including the usage of the press, the price at which each processor bought the nuts, the selling price of the butter, and time it took to sell. From this data a clearer understanding of the potential turnover of the press can be calculated with slight adjustments for seasonal changes in utilisation. This could then be followed by a period in which the press is used on a custom basis, with continuous monitoring of utilisation.

92. Such monitoring has already begun in the villages of Chansegwa and Kanfiehili, and the results are shown in appendix 4.

INSTITUTIONAL AND SOCIAL STRUCTURES IN THE VILLAGES

93. The women in Chansegwa and Kanfiehili have some experience of working in groups and there is an active *susu* group in both villages. Income earning activities are, however, carried out on an individual basis. One woman processes a batch of shea nuts with the help of 5-6 friends or relatives. The owner pays the helpers in small amounts of the butter, and she also helps them in turn when they have nuts to process. This suggests that there is potential for group activity to work successfully in the villages, provided it is carefully administered by an NGO based in the area. The use of the press needs to be organised in such a way that women take turns to use it.

94. The NGO Tamale Archdiocese Agricultural Project (TAAP) are already active in the villages of Chansegwa and Kanfiehili, and are already involved in monitoring the use of the press in these villages. It is possible that with support they could also administer a loan to the women.

95. Technoserve are already working in Tabiase together with the Farmers' Service Company (FASCOM), the commercial wing of the Government Agricultural Development Programme. There is also an American Peace Corps volunteer, attached to Technoserve, based permanently in the village who could become involved in monitoring the use of the press and ensuring that repayment of the loan is devised in such a way that the women are able to pay.

96. Tabiase has already received some equipment on loan administered by FASCOM. They have a corn mill, a crusher and a groundnut sheller. This equipment was given to the village on the requirement that one third of the purchase price was raised by the villagers and the rest was to be repaid at 42% interest. There have, however, been problems of management. The operator of the corn mill receives a wage from FASCOM, and has the responsibility of recording the volumes milled and the charge per use. Apparently much of what is milled is not recorded and the money does not get back to FASCOM as repayment for the loan. This occurs despite the fact that a group of literate men in the village have been allocated responsibility for keeping a check on the use of the mill. These men are not paid for their services and are too busy with other work to monitor the use of the mill.

97. This illustrates the fact that many difficulties can arise when equipment is given on a loan basis to a village by the government or NGO, if there is not sufficient capacity to monitor and check the use and repayment of the equipment. In the case of Chansegwa and Kanfiehili, TAAP are already visiting the villages every week, and would therefore be well placed to monitor record keeping.

98. In other villages where proficient NGOs or extension officers are not able to visit regularly, then caution is needed in installing the press on a loan basis.

Domestic Marketing

Uses

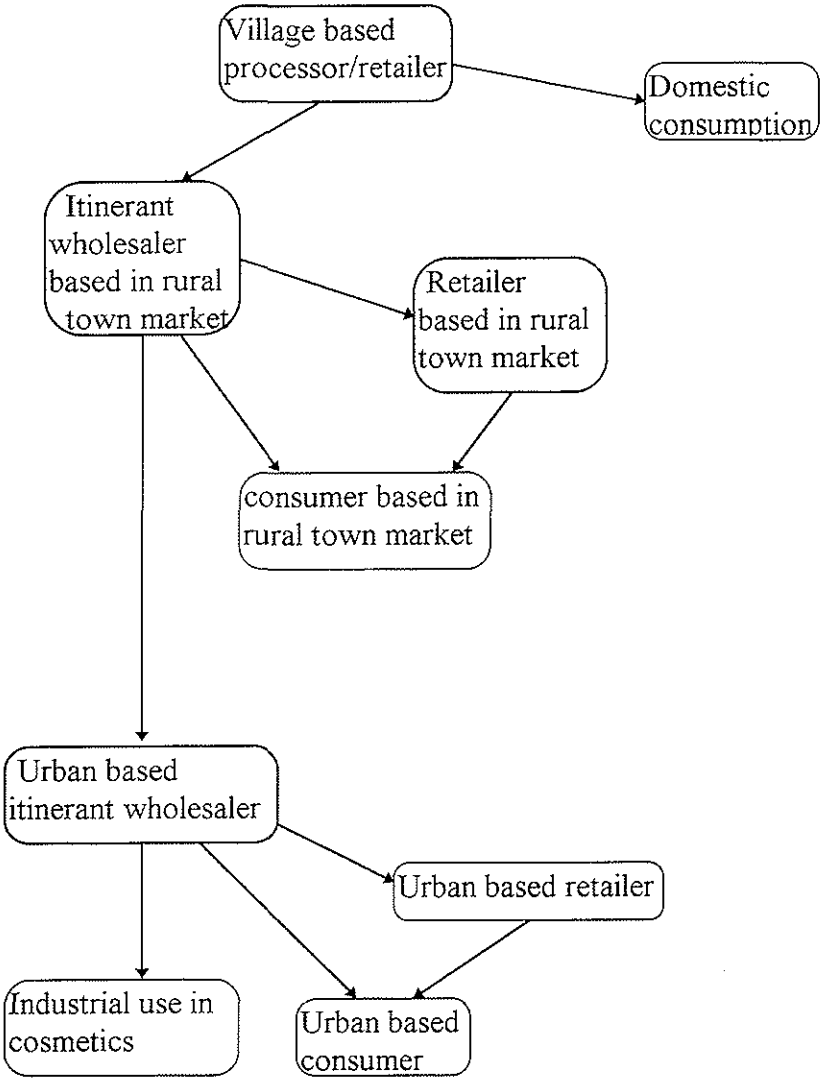
99. At the village level shea butter is mainly used in northern Ghana for cooking, but it is also used as a moisturiser for the skin, especially during the dry months of the Harmattan (December to February). Further south, around Kumasi, the principal use of shea is as a cooking oil, with smaller quantities being used as a skin care product. In Accra shea butter is mainly used as a skin cream, mainly in its raw state, but some small companies are developing shea butter based products marketed under the name of 'Nobi Cream' 'Acobalm' and 'Mercy Cream'.

100. One small company, Jebacoci Enterprise produces about 13 beauty products which are sold on both local and international markets. The company is presently conducting research into the use of shea butter and cocoa butter for the treatment of wrinkles and stretch marks.

Marketing Channels

101. Figure 2 describes the marketing channels for shea butter in Ghana. Most of the households in the villages of Northern Ghana are involved in processing shea butter for subsistence use, and some also market the surplus.

Figure 2: The Marketing Channels for Shea Butter in Ghana



102. Many of the processors in the villages around Tamale sell a surplus on the local village market. The nearest market to Chansegwa and Kanfiehili is Kumbungu market which takes place every six days. The village women go there to sell calabashes of butter (usually one calabash of 10-20 kg each) to itinerant wholesalers, or they retail the butter in balls.

103. The women in Chansegwa claimed that they paid 500 cedis to transport 10 bowls of nuts from the market, 200 cedis tax (market ticket) for every 10 bowls of butter processed and 500 cedis to purchase the calabash.

104. Financial analysis shows that the women receive a low return to labour of around 1000 cedis per batch of 25kg processed. This would be effectively wiped out by marketing costs.

105. The itinerant wholesalers in Tamale market travel to the different village markets and purchase between 10 and 30 calabashes each, depending on their perceptions of

the buoyancy of the market. They transport the calabashes to Tamale market for sale to itinerant traders from Kumasi and Techiman. Some traders from Tamale also take the butter to the southern markets for sale.

106. No traders were seen selling on a wholesale basis around Wa market in the Upper East, suggesting that the market is fairly small.

107. Itinerant traders in Kumasi said that they procure shea butter from various markets around Tamale, including Kumbungu market. They explained that they went first to Tamale market, and only if there was not enough butter there would they go to the village markets.

Price

108. There is no secondary data available on shea butter prices, but observation in the market revealed that shea butter is retailed in balls of butter weighing an average of about 33.8g each (ranging from about 29g to 38g each). At the time of the study, in the lean season, each ball was selling for 50 cedis (1 479 cedis per kg). In the harvest season the price was reported to fall to 50 cedis for four balls of the same size. This gives a retail price of 1 479 cedis per kilogram of butter.

109. Some of the traders in Wa market assemble batches of butter, apparently buying in retail units and mixing these together and packing them in large baskets covered in sack cloth to transport to the south. Traders come from Kumasi and Accra, and some traders also go from Wa to the southern markets.

110. In the week preceding the visit to Kanfiehili village (on 4th March 1997), the women had sold 9 gallons of butter (36kg) for 6 400 cedis per gallon (1 600 cedis/kg). In Chansegwa the women had sold 1 gallon of butter for 5 400 cedis (1 350 cedis/kg) in the previous week. This gives an average price of 1 475 cedis per kg which is used in the financial analysis, and is similar to the price in the Upper West Region. However, unlike the women in the Upper West Region, the women in the villages visited around Tamale moulded the butter into calabashes of between 4 and 10 kg, rather then selling them in retail units of small balls[5].

111. Some examples of the wholesale price for butter sold in calabashes in Tamale market in March 1997 are:

27 000 cedis for a calabash weighing 17.2kg (1 570 cedis/kg),
32 000 cedis for 22.3kg (1 435 cedis/kg),
50 000 cedis for 34.5kg (1 450 cedis/kg),
18 000 cedis for 10.9kg (1 651 cedis/kg).

112. There appears to be a lower per unit price for bulk purchases, but the butter was being sold for an average wholesale price of 1 526 cedis per kg.

[5] The women in Chansegwa said that at this time of year, in the lean season, when the price of nuts and butter is high, they would have to charge a high price for individual balls of butter in order to make a profit, but they claimed that customers would not be willing to pay a high price per ball.

113. In Kumasi market traders sell the butter on both a wholesale basis (in calabashes) and a retail basis (the butter is cut into slices or cubes for sale. A selection of calabashes full of butter were taken from different traders and weighed. The results varied widely between 1 645 and 2 666 cedis per kilogram as the following shows:

40 000 cedis for a calabash weighing 18.5kg (2 162 cedis/kg),
25 000 cedis for 15.2kg (1 645 cedis/kg),
40 000 cedis for15kg (2 666 cedis/kg),
35 000 cedis for 19.2kg (1 823 cedis/kg)

114. There is no difference in quality between the calabashes, and with the traders' experience it is highly likely that they are aware of weight differences. The variation is probably due to the difficulties of getting accurate information from traders who are protective of their business.

115. Two retail slices of shea butter were bought in Kumasi and weighed, one of which came to an equivalent of 1 978 cedis per kg and the other came to 2 219 cedis per kg.

116. In Accra the retail price of butter varied between 3 130 cedis per kg and 1 728 cedis per kg. This was compared with a retail price of 5 056 cedis per kg of cocoa butter. Also, shea butter's price of 648 cedis for 300 ml is higher than the price of palm oil which was retailing at 400 cedis for 300 ml.

Quality

117. There is no distinction between different levels of quality in the butter on the domestic market, indicating that there is no premium for quality.

118. Sometimes there is a colour variation produced by adding herbs to the butter to make it yellow. This yellow colour is preferred in Accra, but in Tamale the white colour is preferred. The difference in colour does not affect the price of the butter.

119. For export the end user may impose certain quality standards in terms of acidity and moisture content.

Seasonality

120. The shea nuts are harvested between May and June. After this time the nuts which remain uncollected start to germinate and become unsuitable for use in cooking since the oil has a bitter flavour. The supply of nuts becomes very scarce between January and May.

Substitutes

121. The main domestically produced substitutes for shea butter as cooking oil are palm oil and groundnut oil. In Wa market, shea butter is cheaper than its substitutes, selling at around 400 cedis for 300ml, compared to 800 cedis for 300ml groundnut oil and 600 cedis for 300ml palm oil. In Kumasi market palm oil was the cheapest oil

available, selling for 400 cedis for 300ml, compared to around 550 cedis for 300ml of shea butter and 720 cedis for 300ml groundnut oil.

122. Other imported vegetable oils are also available, including a brand known as Frytol, which is refined palm oil from Malaysia.

The Manufacture of Beauty Products from Shea Butter

123. Several small scale enterprises use shea butter in the manufacture of pomades for the hair and skin. Well known brands on the domestic market include 'nobi cream', 'mercy cream' and 'akobalm'. These products are said to have medicinal properties to cure skin diseases such as rashes, pimples and ringworm.

124. On a potentially larger scale, Lever Brothers are developing a skin product which contains 90% shea butter, 10% petroleum jelly and perfume. They are planning to launch the product on the domestic market in June 1997, and consumer trials have shown a positive reception from a wide range of economic classes. The product appeals to consumers who believe in the beneficial qualities of shea butter, but generally use other pomades because they do not like the smell and texture of pure shea butter.

125. Lever Brothers are currently importing the shea butter from the Ivory Coast, since they are having difficulty in finding a locally based company which will process the butter to remove the odour. This is because they need a relatively small volume (50 tonnes in the first year, and maybe several hundred tonnes in future years[6]). While the butter can be processed using standard vegetable oil processing equipment which is currently available in Ghana, the careful cleaning required after processing shea butter deters these plants from becoming involved in this activity. Nonetheless, Lever Brothers are interested in procuring deodorised butter locally, since at present they must pay duty on the butter they receive from the Ivory Coast.

126. They are currently paying US$550 per tonne for refined shea butter (about 1 000 cedis/kg), lower than the price of unrefined shea butter sold in Tamale market. The price Lever Brothers are paying for shea butter compares favourably with the price of US$750 for a tonne of petroleum jelly (about 1400 cedis/kg).

127. They are looking for a locally based company which is willing to refine and deodorise the butter, and would also be interested if such a process could be carried out on an artisanal scale in the villages, if a sufficient volume of the product could be assembled in one place.

Potential

128. Discussions with traders in Kumasi and Accra reveal that there is potential for expansion on the southern markets. Most traders interviewed felt that they could sell more butter if they could procure it. However, in the local markets in the north it appears that demand is not sufficient to absorb substantial increases in supply. The

[6] The processing plant in the Ivory Coast only processes the butter for 2-5 days a year, and this is sufficient to satisfy the total annual demand for deodorised butter.

major constraint to getting the butter to the southern markets appears to be the cost of transport, and only if the profitability of marketing shea butter is increased (for example by its use in value-added products such as good quality soap or skin cream) will more traders go from the south to procure shea butter from the north.

129. There is potential for expansion of a value added product using shea butter in the cosmetics industry. Several locally based companies are successfully manufacturing products containing shea butter.

130. Furthermore, if the product launched by Lever Brothers in June 1997 containing 90% shea butter proves to be a success, then there may be potential for women's groups from the north to refine the butter they produce and sell in large quantities to Lever Brothers in Tema.

Export Marketing

131. Shea butter is commercially used on the export market as a cheap substitute for cocoa butter and in the preparation of cosmetics.

132. Ghana exports large volumes of shea nuts, and in 1996 13 000 tonnes of shea nuts were exported at US$186 per tonne (*source*: Ghana Export Promotion Council). The main destinations for the nuts were Japan and Europe.

133. A major exporter of shea nuts in Ghana, Kassardjian, have started to produce shea butter on a commercial scale and in 1996 exported 56 tonnes of butter to Japan By March 1997 they had exported a total 150 tonnes of butter to Japan since they started the extraction unit.

134. The extraction unit uses both the traditional extraction method and a mechanised method using a kneader which was developed jointly by the Intermediate Technology Transfer unit (ITTU) in Tamale and TCC. The plant is in operation for eight to nine months of the year and the current capacity of the unit is 8.5-10.5 tonnes of nuts per day, producing between 14 and 15 drums containing 180kg butter (i.e. a total of around 2.7 tonnes of butter per day). Assuming the plant operates for 6 days a week for eight months of the year, then around 600 tonnes of butter would be produced in one year. Kassardjian intend to increase production to around 3.6 tonnes of butter per day (about 800 tonnes per year).

135. Kassardjian do not, however, see a potential for procuring butter from the villages, owing to its poor quality. This is despite the fact that they already obtain the shea nuts from the villages. Another exporter Johnson Farms Complex Limited in Tamale, on the other hand, felt that there is a possibility of procuring the processed product direct from the villages. Johnson Farms are not, however, as yet involved in exporting shea butter, but are considering expanding their shea nut export to include the export of shea butter.

136. A major cosmetics company, The Body Shop, have been purchasing shea butter form 10 women's organisations since 1991, co-ordinated by the Intermediate Technology Transfer Unit in Tamale. They bought 5 tonnes in February 1996 for a

price of 2 250 cedis per kilo, and bought a further 7 tonnes in November 1996. The small volumes purchased suggest that shea butter is a minor component of the Body Shop's products.

Quality

137. The quality of the butter exported to Japan by Kassardjian is determined by its acidity and its moisture content. Kassardjian test the butter to ensure that it meets the quality standards demanded in the Japanese market.

138. The Managing Director of Kassardjian did not see a potential for buying the ready processed butter from the villages, owing to quality considerations. The 31st December Women's Movement, a local NGO working with women's groups processing shea butter, approached Kassardjian with samples of butter for export. These were rejected on the grounds that the butter was not of a suitable quality.

Potential

139. Kassardjian are currently researching potential markets for shea butter, and they believe that they could expand to Holland, Sweden Switzerland and the UK.

CONCLUSIONS

140. Financial analysis shows that the profitability of producing the shea butter with the traditional process is very low. The press offers a more capital intensive way of processing while the traditional process is more labour intensive, but the costs of processing are very similar. Increases in returns per woman hour of labour can be gained by using the bridge press, but the women must accept a reduced income per batch of nuts processed. The NPV of the bridge press is positive for a turnover of 5 tonnes of nuts per year, and the IRR (26%) is higher than the estimated opportunity cost of capital of 20%. However, the women place a low value on their own time, and few income earning alternatives are available. For this reason caution should be taken with dissemination of the press.

141. Sensitivity analysis shows that the NPV and IRR of the press increase substantially when distances to collect water and fuelwood increase, since it means that relatively greater savings are made in terms of labour input. Also, if the cost of the press can be reduced to 300 000 cedis, the NPV increases to 215 000 cedis and the IRR increases to 59%. When the volume of nuts processed is reduced by 20% to 4000 tonnes of nuts per year, then the NPV becomes negative and the IRR at 15% is lower than the opportunity cost of capital of 20%. This suggests that a minimum volume of 5 batches per week should be processed for 40 weeks of the year in order for the press to be viable.

142. Given that the costs of processing are not greatly reduced by use of the press (about 2 cedis per kilogram of nuts processed, which is about 10 000 cedis per year), caution should be taken when introducing the press to villages.

143. The demand for the technology will be influenced by the decision of women to forego some income in order to save time and discomfort. Time saved by use of the press may only be of value to the women if it can be put to some productive use. The women themselves felt that they could use the extra time gleaning the fields after harvest. There may also be a possibility of increasing production of shea butter in some areas where there is easy access to a market. Increasing the volume of shea butter to the market may involve the development of alternative products made with shea butter, such as soap.

144. From the point of view of introducing the presses to the villages, all three of the villages have close contacts with NGOs capable of monitoring the use of the presses and managing loan repayments. Furthermore in both Chansegwa and Tabiase the private investments of a larger scale than the bridge press, indicate that if a private entrepreneur perceives that the operation of the press is viable, then they may have the capital to purchase the press and run it as a business operation.

145. It appears as though there is potential for expansion in demand for shea butter in the south of the country, although various constraints such as the high cost of transport and low margins on the shea butter are preventing traders from procuring more butter in the north.

146. There is potential for expansion in the export market for shea butter in Japan and Europe, but only one locally based company, Kassardjian, have recently become involved in exporting the butter, all export previously being limited to shea nuts. However, Kassardjian choose to process the butter on their premises rather than procuring ready processed butter from the villages. They state that the reason for this is that the quality of the butter produced in the villages is not suitable for export. The Body Shop are also buying small quantities of butter each year for use in skin products.

RECOMMENDATIONS

147. It is recommended that a small credit system is established in selected villages in the Northern Region, possibly administered by an NGO such as TAAP. The credit scheme should be established both for the purchase of the press and for the purchase of the nuts. The women's group would receive a loan (from project funds) to buy the nuts during the harvest season and store them for re-sale during the lean season.

148. If this is successful, then the process could be taken a step further by providing small individual loans to the women on commercial terms (with group guarantee) to purchase nuts during the harvest season for processing later in the season when the price is high. In this case assistance may be needed with storage facilities and training would be needed in loan administration.

149. This activity could be developed in conjunction with an examination of market opportunities for value addition to the shea butter. For example, TAAP are looking into the possibility of developing a quality soap which would sell for a higher price on the local market. They found on a recent visit to Burkina Faso that neem oil is added to soap because of its medicinal qualities, and TAAP are considering training women in adding neem oil to their soap.

150. Furthermore, Lever Brothers are interested in the possibility of buying domestically produced shea butter for their products if it can be refined in Ghana. They are willing to send a sample of the butter they use to NRI to establish whether the butter could be refined using simple technology in the villages. It is recommended that Lever Brothers are contacted to pursue this possibility.

151. The press may also be used to extract oil from groundnuts, and if it were used for both activities turnover and therefore the viability of using the press would be increased. Swetman et al. (1995) showed that the press was not viable when used exclusively for groundnuts, owing to the fact that there are no advantages in terms of reduced inputs, and time savings are very small. However, some of the women in the villages have used the press to extract oil from groundnuts as well as shea butter.

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Appendices

Appendix 1: Comparison of Shea Butter Processing Costs by the Traditional Method and Using the Bridge Press

Turnover

No. of women processing/week:	5	
No. of batches processed by each woman:	1	
No. of weeks processing takes place per year:	40	
(1 batch = 25kg nuts which produces 8kg butter)		
Therefore the analysis assumes that the women process:		200 batches/year
	i.e.	5000 kg nuts/year
	i.e.	1600 kg butter/year
	Therefore 1 batch =	0.50% of total turnover

Variable Costs

Labour input

Bridge press	5 hours
Traditional Process	11.5 hours
labour (cedis per hour)	90 cedis

Purchase Price of shea nuts

one bowl	2.5 kg
price/bowl	1000 cedis
price/batch	10000 cedis

Milling costs

Weight of shea nut paste	24.5 kg
conversion shea nuts to shea paste	0.98
weight unmilled shea nuts	25 kg
milling cost/batch	600 cedis
milling cost/kg nuts	24 cedis

Conversion rates

conversion of shea nuts to butter	
shea nuts (kg)	25
butter (kg)	8
yield	32%

Other variable costs: Bridge Press

Cost per cotton sack	1 000
Number of cotton sacks	4.5
Number of batches per cotton sack	50
Cost of cotton sacks per batch	90
Cost per polypropelene bag	700
Number of polyprop. sacks	1.5
Number of batches per polyprop. sack	50
Cost of polyprop. sacks per batch	21
Total cost of bags per batch	111
Total cost of bags per kg nuts	4

Other variable costs: Traditional Method

fuelwood (per batch)	150	i.e.	6 cedis/kg nuts

Fixed Costs

Cost of press	450 000 cedis
Life (Years)	10 years
Opportunity cost of capital	20%
Interest on working capital (2% of variable costs)	223 cedis

Appendix 1: Comparison of Shea Butter Processing Costs by the Traditional Method and Using the Bridge Press

Comparison of the Costs of the Two Processes

	Bridge Press	Traditional Method
Fixed Costs		
Total Annualised Capital Costs (per year)	107 335	0
Maintenance (5% per year)	5 367	0
Interest on working capital (per year)	223	236
Total Fixed Costs per batch (25kg nuts)	565	1
Variable Costs per batch		
shea nuts	10 000	10 000
milling	600	600
bags	111	0
labour	450	1 035
fuelwood	0	150
Total variable costs per batch	11 161	11 785
Total costs per batch	11 726	11 786
Quantity processed (kg)	25	25
Total processing cost per kg nuts	469	471
Total processing cost per kg butter	1 466	1 473

Appendix 2: Financial Analysis of the Bridge Press

Turnover

No. of women processing/week:	5	
No. of batches processed by each woman:	1	
No. of weeks processing takes place per year:	40	
(1 batch = 25kg nuts which produces 8kg butter)		
Therefore the analysis assumes that the women process:		200 batches per year
	i.e.	5000 kg nuts per year
	i.e.	1600 kg butter per year

Summary of Costs

Cost of Bridge press	450 000	cedis
Maintenance of press	5%	of capital cost
Processing time (traditional)	5	hours
Processing time (bridge press)	11.5	hours
Labour cost per hour	90	cedis
Price of 1 bowl of nuts	1000	cedis
Price of 1 kg of nuts	400	cedis
Cost of bags to process 1kg nut	4	cedis
Milling cost per kg nuts	24	cedis
Cost of fuelwood per kg nuts	6	cedis

Revenue

Price of 1 kg butter	1475	cedis
Yield (nuts to butter)	32%	
Revenue from 1 kg nuts	472	cedis

Appendix 2: Financial Analysis of the Bridge Press

Traditional Process

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Inflow (revenue)	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000
Investment costs	0	0	0	0	0	0	0	0	0	0
Working capital	117 850	0	0	0	0	0	0	0	0	-117 850
Total investment costs	117 850	0	0	0	0	0	0	0	0	-117 850
variable costs										
nuts	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000
milling cost	120 000	120 000	120 000	120 000	120 000	120 000	120 000	120 000	120 000	120 000
fuelwood	30 000	30 000	30 000	30 000	30 000	30 000	30 000	30 000	30 000	30 000
labour	207 000	207 000	207 000	207 000	207 000	207 000	207 000	207 000	207 000	207 000
Total variable costs	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000
Total costs	2 474 850	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000	2 357 000	2 239 150
Net Cash Flow	- 114 850	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	120 850

Bridge Press

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Inflow	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000	2 360 000	2360000	2360000
Investment costs	450 000	0	0	0	0	0	0	0	0	0
maintenance (5%)	22 500	22 500	22 500	22 500	22 500	22 500	22 500	22 500	22 500	22 500
Working capital	111 610	0	0	0	0	0	0	0	0	-111 610
Total investment costs	584 110	22 500	22 500	22 500	22 500	22 500	22 500	22 500	22 500	-89 110
variable costs										
nuts	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000	2 000 000
milling cost	120 000	120 000	120 000	120 000	120 000	120 000	120 000	120 000	120 000	120 000
fuelwood	0	0	0	0	0	0	0	0	0	0
labour	90 000	90 000	90 000	90 000	90 000	90 000	90 000	90 000	90 000	90 000
bags	22 200	22 200	22 200	22 200	22 200	22 200	22 200	22 200	22 200	22 200
total variable costs	2 232 200	2 232 200	2 232 200	2 232 200	2 232 200	2 232 200	2 232 200	2 232 200	2 232 200	2 232 200
Total costs	2 816 310	2 254 700	2 254 700	2 254 700	2 254 700	2 254 700	2 254 700	2 254 700	2 254 700	2 143 090
Net Cash Flow	- 456 310	105 300	105 300	105 300	105 300	105 300	105 300	105 300	105 300	216 910
Incremental costs	341 460	- 102 300	- 102 300	- 102 300	- 102 300	- 102 300	- 102 300	- 102 300	- 102 300	- 96 060
Incremental Benefits	0	0	0	0	0	0	0	0	0	0
Incremental Net Cash Flow	- 341 460	102 300	102 300	102 300	102 300	102 300	102 300	102 300	102 300	96 060

Results of Analysis

NPV	58 082
IRR	26%

Appendix 3: Calculation of Returns to Labour

Summary of Costs

	Bridge Press	Traditional Method
Total Fixed Costs per batch (25kg nuts)	565	1
Variable Costs		
shea nuts	10 000	10 000
milling	600	600
bags	111	0
fuelwood	0	150
Total variable costs per batch (excluding labour)	10 711	10 750
Total Costs Per Batch (excluding labour)	11 276	10 751

Total Costs per kg nuts	451	430
Total Costs per kg butter	1409	1344

Revenue

Price of 1 kg butter	1 475 cedis
Yield (nuts to butter)	32%
Revenue from 1 kg nuts	472 cedis

Returns

	Bridge Press	Traditional Method
Returns to labour per batch (25kg) of Nuts*	524 cedis	1049 cedis
Returns to labour per kg Shea Nuts	21 cedis	42 cedis
Returns per woman hour	105 cedis	91 cedis

* Note: The amount of time needed to produce one batch of nuts with the bridge press is 5 hours compared to 11.5 hours with the traditional method.

Appendix 4: Itinerary:

19th Feb	Arrival in Accra
20th Feb	Meeting with Dr. Stephanie Gallat
21st Feb	Flight to Tamale
	Meeting with Mr. David Miller, Tamale Archdiocese Agricultural Project (TAAP)
22nd Feb	Meeting with Lawrence Wumbedow, extension officer, TAAP
	Visit to Zaccarini Village, where TAAP have installed a corn mill and bridge press.
24th Feb	Travel to Wa
	Meeting with Mr. Wusa Manga of Technoserve
25th Feb	Visit to Tabiase Village, interview with women shea butter processors
	Visit to Wa market, interview with shea butter processors and traders
26th Feb	Visit to Tabiase Village, PRA interview with women shea butter processors.
	Visit to Kajoperi Village market
27th Feb	Travel to Tamale
28th Feb	Meeting with Ms. Stella Nitori, Regional Coordinator, Christian Mothers' Association
	Meeting with Seidu Tikumah (shea butter technician), Mr. Jacob Bukar (technician) and Mr. Nana Akomua (workshop supervisor) Intermediate Technology Transfer Unit (ITTU)
	Meeting with Mr. M Donigiar and Mr H Kassardjian, Kassardjian Trading Company
	Meeting with Dr. Helmut Albert, Savanna Agricultural Research Institute
1st March	Visit to Aboabo market in Tamale, interview with shea butter traders
3rd March	Meeting with Mr. Sumaila Billa, Accounts Manager, Johnson Brothers

	Meeting with Mr. David Miller and Mr. Lawrence Wumbedow, Tamale Archdiocese Agricultural Project.
4th March	Visit to Chansegwa and Kanfiehili villages, interview with women processors
5th March	Travel to Kumasi
	Visit to Kumasi Central Market, interview with shea butter traders
6th March	Travel to Accra
7th March	Visit to the Ministry of Agriculture, meeting with Ernestina Agyiri
	Visit to the Trade Fair Centre, Accra
	Visit to the Ghana Export Promotion Council
10th March	Visit to Timba and Makola markets
	Visit to the Ghana Cocoa, Coffee and Shea Nut Farmers Association, meeting with Mr. Asamoah
11th March	Interview with Ms. Olivia Sanders, Lever Brothers, Tema (telephone communication)