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PRODUCTION OF VEGETABLE TANNINS FROM WATTLE BARK

SI/SWA/75/810

SWAZILAND

Terminal report

5 - JUN 1978

Prepared for the Government of Swaziland

by the United Nations Industrial Development Organization,

executing agency for the United Nations Development Programme

Based on the work of G. Koteswara Rao, leather chemist and technologist

United Nations Industrial Development Organization
Vienna

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Explanatory notes

A comma (,) is used to distinguish thousand and millions.

A full stop (.) is used to indicate decimals.

References to "tons" are to metric tons, unless otherwise specified.

References to dollars ($) are to United States dollars, unless otherwise stated.

The monetary unit in Swaziland is the emalangeni (E). During the period covered by the report, the value of the E in relation to the United States dollar was $US 1 = E 0.867.

The following abbreviations of organizations are used in this report:

CSO	Central Statistical Office
NIDCS	National Industrial Development Corporation of Swaziland
SAWEMA	South African Wattle Extract Manufacturers Association
SAWGU	South African Wattle Growers Union
SEDCO	Small Enterprises Development Company
SMC	Swaziland Meat Corporation

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ABSTRACT

The project entitled "Study of Production of Vegetable Tannins from Wattle Bark" (SI/SWA/75/810) arose from a request made by the Government of Swaziland in May 1975 for the United Nations Development Programme (UNDP) assistance in a study of the feasibility of exploiting wattle bark. The request was approved in July 1975, with the United Nations Industrial Development Organization (UNIDO) serving as executing agency and the Ministry of Industry, Mines and Tourism as the Government co-operating agency. The six-month mission, which was extended a further three months to enable the expert to deal with some allied problems concerning the tanning industry, began in March 1977.

The main conlusions of the report include the following:

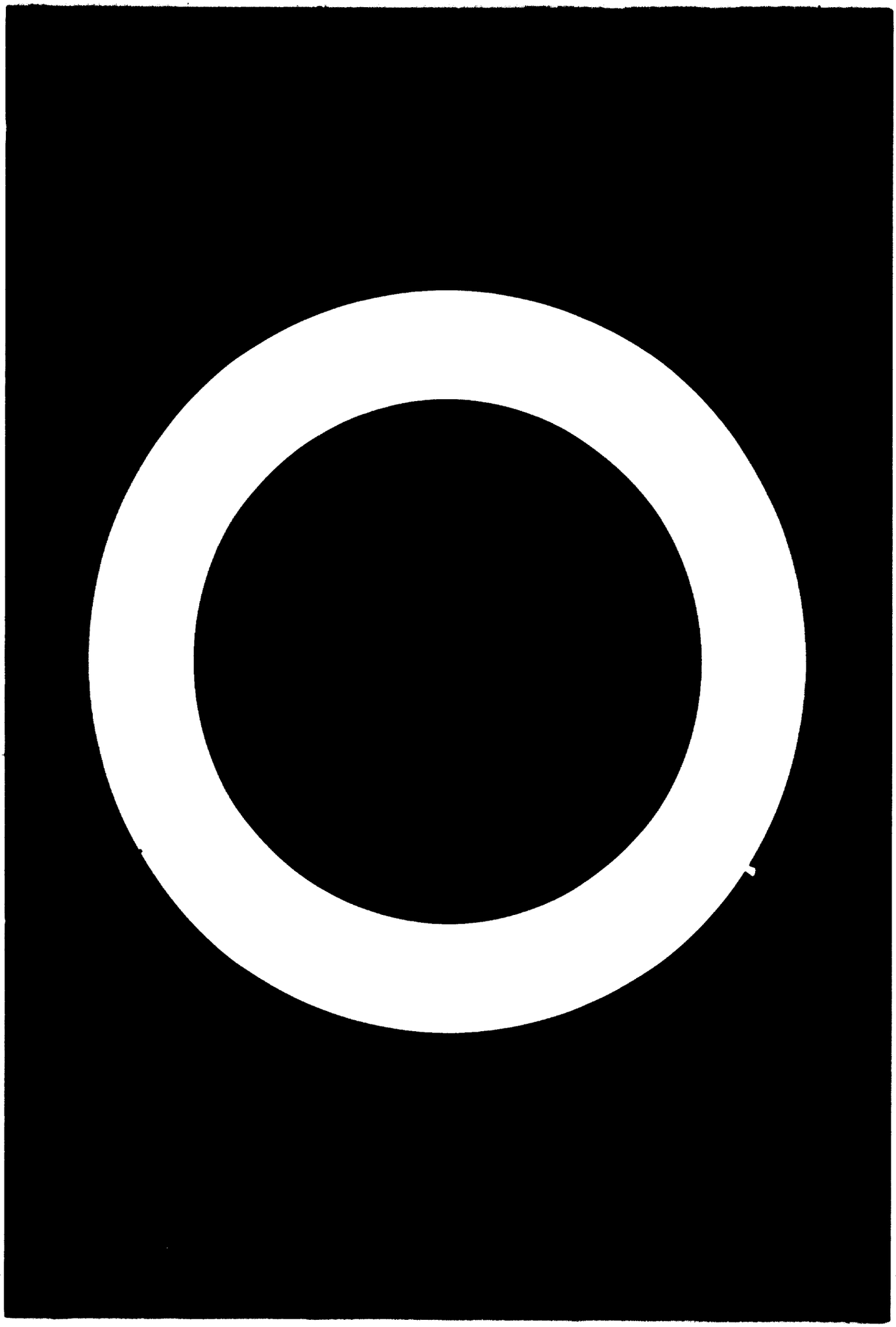
1. Not all the bark available in Swaziland is marketed at present. Better utilization could be achieved by starting a bark mill or an extract factory for export purposes and for internal demand when the leather industry is developed. A commercial unit with five tons of solid extract per day is economically viable according to the present study.

2. A bark mill may only help in the initial stages of development, but an extract factory could meet the desired objectives of maximum utilization of local resources and yield added value to the farmer and the nation. An intermediate solution would be to set up a pilot plant.

The following recommendations are also noteworthy:

1. Swazi farmers engaged in wattle farming should be formed into co-operatives under the Ministry of Commerce in order to assist them in establishing plantations, harvesting and the marketing of bark and wood. As forestry is one of the development priorities of the nation, the co-operatives should play a significant role in the development of wattle extract and allied industries.

2. Outlets other than South Africa for the sale of wattle bark should be explored.



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I. INTRODUCTION

Wattle (Acacia mollissima/mearnsii), also known as black wattle, is grown on about 5,000 ha of Swazi Nation land and about 2,500 ha of private title-deed lands in Swaziland. Dry wattle bark from these plantations, amounting to about 1,500 tons per year, is exported to wattle bark mills and extract factories in South Africa, earning about E 80,000. Wattle bark is supplied to South Africa on a quota basis, which is regulated by the South African Wattle Growers Union (SAWGU). Although Swaziland could produce an estimated 4,000 tons of dry bark per year, farmers and wattle growers in Swaziland would not be able to market such quantities. The profitable utilization of bark would become feasible by setting up a solid extract plant with a capacity of five tons/day, involving the 600 small Swazi wattle growers organized in co-operatives, along with the National Industrial Development Corporation of Swaziland (NIDCS) and the Small Enterprises Development Company (SEDCO), and any other interested promoter, with a total investment of E 520,000. Such a level of production will not only help the growers with greater returns and output of bark, but the country could also earn about E 450,000 per year by marketing it outside Swaziland, especially in developing countries.

So far no wattle bark processing unit or tanning base which could utilize wattle bark has been available in Swaziland. In view of the potential availability of bark, the Ministry of Finance and Economic Planning decided to explore the possibility of exploiting the local resources for the production of tanning extract. In May 1975 the Government of Swaziland therefore requested United Nations Development Programme (UNDP) to provide assistance in a study of the feasibility of exploiting wattle bark. The request was approved in July 1975 and led to the project entitled "Study of Production of Vegetable Tannins from Wattle Bark" (SI/SWA/75/810), with the United Nations Industrial Development Organization (UNIDO) designated as the executing agency and the Ministry of Industry, Mines and Tourism serving as the Government co-operating agency. The mission, originally planned for six months but extended to nine months to enable the expert to deal with some allied problems concerning the tanning industry, began on 1 March 1977. The budget provided for a UNDP contribution of $40,350 and an input of $2,280 by the Government of Swaziland.

The expert was attached to SEDCO, under the Ministry of Industry, Mines and Tourism. He had the following specific duties:

(a) To quantify the production potential of wattle bark in Swaziland and make recommendations on the most profitable form of processing given present and future supplies of wattle bark and the demand in consumer countries;

(b) To make recommendations on contact with possible investors in the industry;

(c) To make recommendations on the location of a plant and on the organization of the industry as regards the collection and transportation of bark from the producers, pricing and general marketing arrangements.

The short-term objective of the project was to utilize potential supplies from the existing wattle stands in the most economically viable form, and the long-term objective was to investigate the prospect of increasing the production of wattle by small Swazi farmers and the Government and of undertaking local processing.

During the mission the expert prepared a preliminary report and work plan, two progress reports, and a report on visits made to wattle bark mills and extract factories in South Africa together with personnel of the host country. These reports are on file at UNIDO headquarters and at the UNDP office in Mbabane.

I. FINDINGS

A. Raw material

Wattle forests

Out of a total geographical area of about 1.7 million ha (17,000 km^2), about 53% of the land is held by the King in trust for the Swazi Nation and the rest is held by private title-deed land-owners, also known as tenure farmers. The forest area is about 6% of the total land area and it is mostly man-made forest. Almost 73% of the land is used for grazing and about 12% for crops.

Wattle plantations are established in both the Swazi Nation land and in private title-deed lands, covering about 5,000 ha and 2,400 ha respeotively. In Swazi Nation land the distribution is about 1,500 ha in Hhohho distriot, 1,000 ha in Manzini and 2,500 ha in Shiselweni district.

Wattle stands in title-deed lands are found mostly in the Shiselweni district. The places of occurence of wattle are given in annex II. Most of the plantations are less than 13 years old. The spacing varies from 1 m x 1 m to 2.75 m x 2.75 m. Thus, the number of trees per ha vary from 600 to 1,200. The size of trees varies from 8 cm to 25 om in girth and 7 m to 12 m in height. There is a lack of scientific management of wattle stands. Most of the stands are dense and very few farmers resort to thinning and weeding. Plantations in title-deed lands are better managed. The present costs for raising wattle is estimated at about E 50/ha over a ten-year cycle. The total forest area under wattle now stands at about 7,400 ha.

Plantations, in future, can be raised in marginal or miscellaneous lands that are adjacent to existing plantations in areas such as Nkaba, Sigangeni, Mhlosheni in Hhohho district and Lundzi, Luyengo in Manzini Distriot. Green and silver wattle are almost insignifioant compared with black wattle (Acacia mollissima/mearnsii).

Among man-made forests (title-deed lands) wattle represents 2.5%, the other species being pine (78.6%) and euoalyptus (18.9%). Wattle acoounts for about 0.45% of the total geographical area. Among the title-deed lands under wattle, about 56% is grown for mining timber, about 25% for firewood and the rest for other purposes. Hence, the wattle is not grown exclusively for its bark.

Wattle growers

At present about 650 farmers and 12 title-deed land-owners or registered oompanies possess wattle stands. Most of the farmers own less than 10 ha. There are two farmers in Shiselweni owning about 1,000 ha as title-deed land. All the wattle growers in Swazi Nation land are small farmers. Wattle growing as an occupation is secondary to subsistence farming, although there is one farmer who is a chief in the Nkaba area and who owns about 97 ha under wattle.

Harvesting and collection of bark

During the March-June period the wattle trees are harvested for bark. Some of the farmers employ hired labour for felling and stripping the bark. Very small farmers do the operations themselves during their free time. Normally men are employed for felling the trees and women for debarking. One man and one woman oan fell and debark about 10-12 trees per day. Wages for hired labour vary from plaoe to place. In the Motshane area, men are either paid at E 1/day or at E 0.10 per 100 kg of bark produced and women at a flat rate of E 0.40/day. In Nhlangano area, men are paid at E 2/day for felling the trees and E 0.30 per 50 kg of bark debarked. In some areas, wages, as low as E 0.05 per day with some food were also noticed. For felling, big farmers and title-deed land-owners employ chain-saws while other use hand saws. Mechanically-operated ohain-saws have twice the felling oapacity of hand saws.

Grading

Wattle bark is graded into 3 types based on visual observations in respect of maturity of bark, colour of bark, insect or mould damages on bark and thickness. These grades are prime, average and merchandise. Price variations between the grades vary from E 5 to E 10 per ton. Almost all the bark supplied by Swazi farmers is graded as "average" in South Africa.

Farmers with means of transport, such as title-deed plantation owners, try to market the wet bark as early as possible after stripping to avoid loss of weight due to drying. But most of the Swazi farmers producing small quantities cannot obtain transport easily. As such, the bark is sun-dried by exposing only the outer side (grain side) to the sun. After drying and being packed in 30-kg bundles, they are stored in thatched sheds, or at times left out in the open, until delivery to the consumer's premises.

Transport

The wattle bark bundles are carried from wattle stand to homesteads or to the forest road head. Lorry transport is mostly through dirt roads and

hilly tracks. From the forest road head to the railway station or the consumer's premises in South Africa the bark is transported by lorries or pick-up vehicles. The transport distance varies from 60 km to 100 km. Lorry transport costs E 10.00 for a distance from 40 km to 60 km and about E 20.00 for 100 km per ton of bark. Swazi farmers find it extremely difficult to keep to the schedules of bark delivery because of the lack of transport. Farmers producing less than 10 tons find it all the more difficult to obtain lorry transport.

Wattle growers co-operatives

There are unofficial associations of wattle growers in Shiselweni district and in Manzini district. These are at Nhlangano and Dwaleli. Another association is being formed in the Nkaba area. These associations assist their members in quota distribution, the sale of wood etc., with the co-operation of the forest department.

Field survey

The expert, along with the forest officers, visited almost all the wattle-growing areas, held discussions with individual Swazi farmers, associations, title-deed plantation owners, government officials and other interests connected with wattle. The findings in this report, particularly those concerning the quantification of bark and present and future supplies, are based on this field survey, in addition to information obtained from the publications of the Central Statistical Office (CSO) and SAWGU.

Present production of wattle bark

The publications of the CSO, Mbabane, give insufficient information concerning wattle bark, in particular its production and export to South Africa.

As all the wattle bark produced is at present sold in South Africa under quotas established by SAWGU, more appropriate and correct information was obtained from SAWGU. The quotas established and the deliveries made to South Africa over the last four years are given in table 1. These deliveries are taken as the present production of wattle bark in Swaziland. Their net prices are given in table 2.

Presently, about 1,500 tons (dry bark) is produced annually both from Swazi Nation land and title-deed plantations. This production is tied up with quotas established by SAWGU and is given detailed consideration below in the section dealing with marketing. The individual quotas of some of the title-deed land owners during 1976 are given in annex II. The total quota established for Swazi Nation growers by the Ministry of Agriculture of

Table 1. Production and deliveries of wattle bark during the period 1972-1976
(Tons of wet bark)

Year (Season)	Quotas			Production and deliveries		
	Swazi Nation growers	Title-deed growers	Total	Swazi Nation growers	Title-deed growers	Total
1972/73	766	1,808	2,574	557	1,300 (Estimate)	1,857
1973/74	700	1,425	2,125	469	1,200 (Estimate)	1,669
1974/75	951	1,529	2,480	1,017	1,419	2,436
1975/76	600	1,836	2,436	646	1,157	1,803

Source: SAMCU, Pietermaritsburg, through the Central Statistical Office, Mbabane.

Table 2. Net price of wattle bark delivered to the Iswepe extract factory in South Africa (Emalangeni per ton of bark)

Year (Season)	Grade of dry bark			Grade of wet bark		
	Prime	Average	Merchandise	Prime	Average	Merchandise
1976/77	94.88	85.90	76.92	56.93	51.54	46.15
1975/76	89.32	80.87	72.42	53.59	48.52	63.65
1974/75	69.65	62.98	56.32	41.79	37.79	33.79
1973/74	50.02	44.92	39.82	33.00	29.84	26.68
1972/73	43.97	39.44	34.91	29.95	27.08	24.21

Swaziland was about 970 tons (wet bark) for the season (1976/77). Shiselweni district accounts for 60% of present production.

Future production

As mentioned above, the wattle stands vary in spacing and growth. The stands in Swazi Nation land are estimated to yield a minimum of about six tons of wet bark and those in private lands yield about 15 tons of wet bark per ha. The expected annual production, taking into account the ten-year cycle, is about 6,500 tons of wet bark, which is equal to about 4,000 tons of dry bark on a 10:6 conversion basis (wet to dry bark). This estimate is on the assumption that the existing area under wattle is maintained. In fact, there will be an increase in area under wattle when full exploitation of existing resources are put to better use.

Other tanstuffs

The main man-made forest is under coniferous species such as Pinus patula, Pinus elliottii and Pinus taeda, amounting to about 74,000 ha. Of these species Pinus taeda accounts for about 6% of the total area (4,500 ha). Pinus taeda is a well known tanstuff. The bark yields, however, extracts of darker colour.

There are jungle forests in Lubombo and other lowveld areas consisting of mainly acacia species. About four varieties of acacia have been noticed including Acacia nilotica, Acacoa arabica and Acacia farnesiana. The pods of these trees, varying in shape, are in use as tanning material in some of the African countries such as Chad, Sudan etc. The bark of Acacia arabica is a most valuable tanstuff in Asia, particularly in India and Pakistan. The extent of the area under acacias was not estimated. Tanstuffs of Pinus taeda and acacias are very much inferior to wattle tannins. They can, however, be used in blending with wattle when conditions warrant such a use.

Wattle in South Africa

In view of the geographical situation of Swaziland and its economic ties with South Africa, it is necessary to examine the wattle industry in South Africa in order to visualize the impact on wattle in Swaziland.

South Africa is the major producer of wattle bark and wattle extract in the world. About 60% to 70% of world production of wattle extract emanates from South Africa. According to information published in the South African

Wattle Growers Union Journal, the total area oovered by wattle plantations in 1974 was about 162,000 ha, whioh oan produce about 240,000 tons of dry bark per year, almost meeting the requirements of the wattle extract industry. But afforestation was going at a pace of 10,000 ha per annum while the aotual need of the industry for future survival is about 15,000 ha of afforestation per annum. Moreover, about 50,000 ha under wattle are expected to be phased out in future. Thus, there is an apprehension that suffioient supplies of bark may not be forthooming in future to meet the requirements of the extract industry. Suoh a situation developing in South Afrioa would result in greater demand for wattle bark from Swaziland.

Availability of wattle wood

For every ton of dry bark, about six or seven tons of dry wattle wood is obtained. Thus, the present availability of wood is about 6,000-7,000 t/a. When the existing wattle plantations are regularly and fully exploited, the potential production of wood will be about 25,000 t/a. The marketing of wood is dealt with later.

B. Teohnology and produotion

The possible methods of utilization of wattle bark and the teohnologioal and production faotors involved are indioated and examined in this seotion.

In view of the current raw materials situation, it is possible to produoe ohopped wattle bark or wattle extraot initially on a pilot soale, or to produoe wattle extract on a oommeroial soale.

Chopped wattle bark

Wattle bark is stripped into 1.2 m x 0.10 m strips. These strips are bundled and sold as wet bark. Wet bark may oontain about 40% moisture. In the oase of dry bark whioh is also known as stiok bark, the stripped pieoes are dried in the sun or shade and bundled into 30-kg paoks. Thus, the bark is sold both as dry and wet bark.

The dried bark is used for making chopped bark, whioh is easier to transport and oompaot in volume. The bark mills prooess only the dry bark. The bark is reduoed to a size of 1 om to 2 om in hammer mills and baled into 100-kg paoks, using a hydraulioally operated baling press. During ohopping, the wastage of bark is about 2% as dust and powder.

The machinery required for a bark mill are a hammer mill or disintegrator and a baling press. The investments required for a bark mill to produoe about 10 t/day of ohopped bark are shown in annex III.

Wattle extract process

Wattle extract is commercially produced in the form of both solid and spray-dried powder. The process of manufacture is the same, except in final evaporation. The process consists of size reduction of the bark, extraction of water soluble matter (including tannins) in open vats or in diffusers operated under pressure by counterourrent extraction, evaporation of the extracted solution from 10% solid content to about 50% of solid content in evaporators working under vacuum, and further concentration/drying of 50% solid solution to about 85% solids in vacuum pans to obtain a solid extract or to about 95% solid in a spray drier to obtain a spray-dried extract. The solid extract or powder extract are packed in double gunny bags or in polythene lined hessian bags.

The extract solution with 50% solids, obtained by evaporation of about a 10% solids solution, is also called liquid extract. Liquid extracts are marketed in wooden barrels, particularly when the consumers are in the vicinity of the factory.

Process selection

Extract can be produced either by using an open vat system or diffusers, and by using a vacuum pan for solid extract. All these processes are in vogue in most of the extract-producing countries. The open vat system can employ wooden vats or stainless steel vats. It is simpler and more economical for new units to use an open vat system with a vacuum pan. A process flow sheet is given in annex II (figure II).

Scale of production

It is estimated that about 4,000 tons of dry bark per annum could be made available from the existing wattle stands over a 10 year cycle. This amount of bark is enough to produce about 5 t/day of solid extract. Such a unit is economically viable.

Investment and production costs

Detailed investment analyses for a factory producing 5 t/day of solid extract (three shifts) are given in annex III. The cost of production, as shown in table 3, works out at E 230/ton, return on investment at about 15%, and return on equity at about 40%. The cost of production is based on paying an economic price to the primary producer of bark, namely the farmer, at E 60/ton at his wattle stand. Table 4 contains a cash flow statement. The total investment is about E 520,000. The layout for such a unit is given in annex II, figure III.

Table 3. Cost of production and profitability statement
(Total production and sales per annum - 1,500 t)

Item[a]	Year 1	2	3	4	5	6	7	8	9	10
Sales turnover at E 300/t for 1,500 t	450	450	450	450	450	450	450	450	450	450
Production cost at E 228/t for 1,500 t	342	342	342	342	342	342	342	342	342	342
Interest[b]	54	54	54	47	40	34	27	20	13	7
Total (production cost + interest)	396	396	396	389	382	376	369	362	355	349
Depreciation[c]	34	34	34	34	34	34	34	34	34	34
Total operational cost	430	430	430	423	416	410	403	396	389	383
Operating profit	20	20	20	27	34	40	47	54	61	67
Tax on profit[d]	-	-	-	-	-	-	-	-	-	-
Profit after tax	20	20	20	27	34	40	47	54	61	67
Profit after tax before interest	74	74	74	74	74	74	74	74	74	74
Return on investment (%)[e]	14	14	14	14	14	14	14	14	14	14
Return on equity (%)[f]	19	19	19	26	33	40	45	55	60	64

[a] Unless otherwise stated, figures are in thousands of emalangeni for an assumed production of 1,500 tons.

[b] Interest calculations per year:

(i) At 13% on E 312,000		E 40,560
(ii) At 13% on E 104,000		13,520
For the first and second year		54,081 (or 54,000)

But repayment of a loan of E 104,000 will be completed in the third and fourth year, each year at E 52,000. Repayment of E 31,200 will start from the fifth year and be completed by the tenth year.

c/ Depreciation at 10% on E 235,700 of plant and machinery and at 5% on E 213,720 of buildings: E 34,256 (or E 34,000).

d/ Tax on profit: the present tax concession works out at 44% on buildings and about 60% on plant and machinery. These concessions amount to about E 235,000 per year. As the unit will not make profits in excess of the above, there is no taxable income.

e/ Return on investment (%) = $\frac{\text{Profit after tax before interest x 100}}{\text{Total project investment}}$

f/ Return on equity (%) = $\frac{\text{Profit after tax x 100}}{\text{Promoters capital}}$

Table 4. Cash flow statement
(In thousands of emalangeni)

Item	Year									
	1	2	3	4	5	6	7	8	9	10
Source of funds										
Operating profit before interest	74	74	74	74	74	74	74	74	74	74
Share capital	–	–	–	–	–	–	–	–	–	–
Loans	–	–	–	–	–	–	–	–	–	–
Depreciation	34	34	34	34	34	34	34	34	34	34
	108	108	108	108	108	108	108	108	108	108
Application of funds										
Capital expenditure	–	–	–	–	–	–	–	–	–	–
Working capital	–	–	–	–	–	–	–	–	–	–
Current assets	–	–	–	–	–	–	–	–	–	–
Repayment of loans	–	–	52	52	52	52	52	52	52	52
Payment of interest	54	54	54	47	40	34	27	20	13	7
Tax	–	–	–	–	–	–	–	–	–	–
	54	54	106	99	92	86	79	72	65	59
Cash position										
Opening balance	–	54	108	110	119	135	157	186	222	265
Surplus	54	54	2	9	16	22	29	36	43	49
Closing balance	54	108	110	119	135	157	186	222	265	314

Pilot scale production

Although extract manufacture is a well-established process, the pilot plant is useful to study the scale of production, to train the technical personnel and to understand the marketability of the product, in addition to infusing confidence in the prospective investors. It will also help to create an awareness among small Swazi farmers that their produce can be profitably employed in Swaziland. The pilot plant suggested here is also suitable for expansion into a commercial unit, in which pilot equipment such as disintergrators and leaching vats would be used. Even other equipment such as boilers and evaporators could be used to some extent when the pilot plant is expanded into a commercial unit.

The investments involved are given in annex III. For a plant producing about one ton of solid extract per day, equipment and machinery costs are about E 110,000, and buildings and working capital about E 130,000. UNDP may be requested to help set up the pilot plant. UNDP could provide machinery, technical experts and fellowships for training Swazi personnel abroad. The total amount of UNDP assistance necessary may be about E 178,000 ($207,000), with the Government contributing about E 130,000.

Counterparts and training

Two Assistant Forest Officers from the Ministry of Agriculture and one Project Officer from the National Industrial Development Corporation of Swaziland (NIDCS) were associated with the work of the expert. The Forest Officers were fully involved in the field survey to various forest areas in Swaziland and, together with the NIDCS Project Officer, in a study tour to bark mills and extract factories in South Africa. Various aspects of wattle production and its utilization were explained to the host country project personnel when necessary.

As there is no wattle extract industry in Swaziland so far, no one has been exposed to the technology and production of wattle extract. Hence, it is necessary to train two forest officers in silvicultural and plantation techniques and in the collection and marketing of wattle, and one technically-qualified person (in chemistry of engineering) in wattle-extract manufacturing techniques abroad. Countries such as India (Central Leather Research Institute, Madras) and Kenya, where the industry in all its aspects has already been developed, may be suitable places for such training. There will be additional advantage in plant training in extract factories in these countries.

Local managerial and administrative organization

The Small Enterprises Development Company (SEDCO) and NIDCS, under the Ministry of Industry, Mines and Tourism, have sufficient managerial and administrative capabilities to organize and promote the wattle industry. However, the Ministry of Agriculture will have to be involved in exploiting the wattle resources.

The Ministry of Commerce and Co-operatives may also assist the other ministries in organizing the farmers into co-operatives and supplying wattle bark to the bark mill or extract factory.

Labour

To overcome the severe shortage of skilled labour, training programmes are to be organized within the industry.

Utilities

River water sources are in the vicinity of wattle-growing areas and the water is suitable for extraction. Power and coal are also available locally.

Machinery and construction materials

Most of the machinery and construction materials have to be imported. Leaching vats in wood can be manufactured locally. The list of companies which can supply machinery for the bark mill or extract factory is given in annex III. All the quotations received from various suppliers of machinery are on file with SEDCO.

Location of the factory

Wattle extract factories require a copious supply of water, the daily requirement being about 30,000 gallons (136,380 litres). During the field survey a number of places were considered. Taking into account transport costs, water supply and the proximity of raw materials and rail head, it is considered that Mashongeni near Nhlangano in Shiselweni district or Nkaba in Hhohho district may form suitable sites for the location of a bark mill or extract factory. Shiselweni distrio accounts for 60% of total wattle in Swaziland, but is very undeveloped. Incentives are therefore being offered to the industry.

Infrastructure

NIDCS and SEDCO offer a number of facilities, such as building construction, leasing and transformer use on a rental basis in the factory premises. The

Government allows tax concessions to pioneer industries, particularly in very undeveloped areas.

Investment prospects

One Swazi wattle grower who owns about 97 ha in Nkaba area and is a chief and Assistant Minister in the Government, one of the largest wattle growers holding about 700 ha as title-deed lands in Nhlangano, another private wattle grower in the Dwaleli area and a businessman-medical doctor showed considerable interest in the wattle extract project and had personal discussions with the UNIDO expert. The wattle growers union have also shown interest in the proposed factory and are willing to supply bark at lower prices than what they obtain from South African factories because there will be more turnover of bark and sales.

In addition to the above-mentioned local entrepreneurs, a large tanning extract company in India has expressed interest in a joint venture. The relevant papers are on file with SEDCO and NIDCS.

C. Marketing

Present marketing methods in Swaziland

Wattle bark is marketed by Swaziland to the approximately six bark mills and six wattle extract factories in South Africa. The wattle bark is mostly sold to bark mills at Lothair and Piet Retief and to the extract factory at Iswepe. SAWGU allots quotas to all wattle growers in South Africa and Swaziland for the supply of wattle bark. SAWGU allots the quota directly to the individual growers under title-deed lands and a bulk quota to the Ministry of Agriculture of Swaziland for distribution among the wattle growers in Swazi Nation land. The Swazi farmers get quotas varying from 5 to 20 tons of wet bark per grower.

The individual growers organize felling and stripping which may cost about E 10/ton (dry bark) and arrange their own transport for delivery at the bark mill or extract factory. Transport may cost E 10-20/ton (dry) depending on the distance. At the bark mill or extract factory, wet bark is sold at E 53/ton and dry bark at E 83/ton; they are graded as average. The payment is made by cheque after one or two weeks. Bark mills buy only the dry bark, while extract factories buy both wet and dry bark.

Over the past three or four years, there has been an increase of over 100% in bark price. Swaziland sells about 1,500 tons of dry bark per annum. The net price of wattle bark delivered at the Iswepe factory during 1972-1976 is given in table 2. The price in 1965 was about E 26 per ton of dry bark (average quality).

Marketing in South Africa

In South Africa all the wattle trade is organized by SAWGU and the South African Wattle Extract Manufacturers Association (SAWEMA). The quotas for bark supply each year are determined in advance by forecasting the demand for bark and extract in the ensuing year. These are known as basic bark quota deduced from the annual quota set for each grower some years ago. The basic bark quota is about 70% of the annual quota for each wattle grower. The sale price of extract and bark is subject to variations, depending on the country to which they are exported. It seems that the chopped bark price is about E 110-120/ton, that of solid extract E 400/ton, and spray-dried extract E 450/ton (all o.i.f.) on export markets. South Africa is exporting about 8,000 tons of chopped bark and about 50,000 tons to 60,000 tons of wattle extract. Most of wattle extract (60-70%) is in spray-dried powder form. The actual production capacity is higher than 60,000 tons. The internal consumption is about 3,000 tons to 4,000 tons of extract per annum. South Africa, as already mentioned, is the largest supplier of wattle extract on the world market, accounting for about 60% of world production. South Africa's export earnings from the wattle extract trade rose to about E 18.5 million in 1976 from E 11.0 million in 1973.

Wattle extract production in other countries

In addition to South Africa, countries such as Brazil, India, Kenya and United Republic of Tanzania produce wattle extract from their own resources. Spain, the United Kingdom and the United States manufacture with imported bark but are not significant. The annual production of wattle extract in Kenya is about 18,000 tons, in United Republic of Tanzania about 9,000 tons and in India about 3,000 tons. Brazil produces about 30,000 tons of extract known as Brazilian wattle from species of Acacia negra, slightly different from black wattle (Acacia mollissima). Thus the world's production capacity is about 150,000 tons a year. For example, in 1969, according to an International Trade Centre publication, the world production of wattle extract was about 116,000 tons.

World trade in wattle extract

South African extract is marketed in almost all the countries in the world, except those under trade blockade. The major consuming countries are Western Europe and North America. The world market is controlled by a wattle extract producers federation located in the United Kingdom. Kenya exports to the following countries the quantities indicated below (tons).

Egypt	4,000
Hungary	750
India	9,000
Pakistan	2,750
Others	2,000

Similarly, The United Republic of Tanzania is exporting to countries such as China, Egypt and India. In addition to its local production, India imports about 16,000 tons per year. In other words, developing countries mostly in Asia and countries in Eastern Europe obtain their supplies from East Africa, and other countries are served by South African and Brazilian wattle extract. The cost of extract is almost the same in the world market. The landing price of solid wattle extract in India and the United States is about E 400/ton.

The retail price of locally-made solid wattle extract in India is about E 580/ton (ex factory), while the retail cost of imported solid extract is about E 780/ton (ex storehouse). The consumer in some of the importing countries is paying more than double the price of the producing country because of duties and the commission of middle men (agents). The price of wattle bark received by the primary producer in East Africa is much less than what one gets in South Africa or Swaziland. Wattle growers are organized in co-operatives to give protection to extract manufacturers in East Africa.

World trade in other vegetable tanning extracts

The other important vegetable tanning extracts in the world market are quebracho, chestnut, mangrove and myrobalan. Extracts of minor importance are divi-divi, valonea, eucalyptus, oak and pine. The present world production of quebracho, wattle and chestnut is estimated to be about 230,000 tons. Of these, quebracho extract may account for about 100,000 tons, wattle about 100,000 and the rest consists of chestnut extract. The other extracts, including mangrove and myrobalan, are estimated to account for about 150,000 tons. Thus, the total world production of all extracts is currently estimated at 380,000 tons per annum. Quebracho extract is mainly produced in Argentina and Paraguay,

myrobalan extract in India, chestnut extract in France, valonea in Turkey, and others in Columbia, Czechoslovakia, the Federal Republic of Germany, Romania, Spain, the United Kingdom etc.

Consumption and demand

Consumption of extracts is dependent mainly on heavy leather manufacture, which in turn depends on the meat industry for the supply of hides. Vegetable extracts are mostly used for sole and heavy leathers, lining leathers, vegetable crust for export, and retanning of chrome leathers. Of these, sole and heavy leathers, which include industrial leathers, account for the major amount of extract. In some countries, most wattle extract is consumed in the vegetable tanning of skins and lining leathers from rejection quality hides and skins. Wattle extract is also used for other purposes as an adhesive component in the plywood industry, and this consumption is growing.

The leather industry is also undergoing drastic changes. Sole leather is being increasingly replaced by synthetics. Competition for hides is increasing from the manufacturers of light leathers for shoe uppers, clothing leathers etc. At the same time, some countries, particularly those with developing economies which were traditionally exporters of raw hides and skins, are now trying to tan them at the source for added value. The increased cost of labour and treatment of tannery effluents are forcing the developed countries to cut down their leather production and even resort to export of hides and skins. Thus, there is a shift in the leather industry from developed to developing countries. This shift will naturally increase tanning activity in developing countries.

Against the above background the demand for extracts, including wattle extract, in different economies has to be analysed.

In developed countries, the consumption of major extracts (quebracho, wattle and chestnut) is currently declining at a rate of from 3% to 1% per annum. But in developing countries there is no decline in consumption. Centrally planned economies, including China and the countries of Eastern Europe, show irregular trends in extract consumption. It is expected that consumption in developing countries, particularly in Africa and Asia will go up. For example, the growth of extract consumption annually is about 4% to 6% in India. The development of a leather industry in Africa will also lead to increased consumption of extracts. Whether the decline in developed countries will be

compensated for by the increase in developing countries is doubtful beoause the developed countries consume at present more than 50% of major extracts produced in the world. This trend may affect the production of extracts from developed economies, including South Africa. But South Africa foresees constant demand in the next ten years. The developing countries may on the other hand try to increase local production with their indigenous materials.

Market for wattle extract from Swaziland

This is an important aspect for decision makers in deciding to set up a wattle extract factory in Swaziland. From the foregoing it should be noted that the envisaged production is 1,500 t/a, which accounts for about 1.5% of world production of wattle extract, and about 0.4% of world production of all types of extracts.

About 28,000 tons of wattle extract is exported annually from East Africa to China, Egypt, India, Pakistan, etc. There has recently been a shortage in India. Swaziland is also seriously contemplating setting up its own tannery for processing raw hides and skins. Many other African countries are also developing a tanning industry based on vegetable extracts. It is feared that in South Africa sufficient supplies of bark may not be available after a number of years, as the rate of afforestation, which should be 15,000 ha/a, is actually about 10,000 ha/a. Swaziland will have the advantage of marketing the product in any part of the world. The sale of extract will make it possible to increase export earnings from E 100,000 per annum, through the sale of bark, to about E 450,000 per annum, apart from better utilization of resources and creation of large employment potential both in factory and plantations. Further, the decline in developed oountries, at the rate of 3% to 4% per annum, may not have an impact on the production of 1,500 t/a, taking into account the vast market in developing oountries.

Wood marketing

At present from 6,000 to 7,000 tons of wood is produced by wattle plantations. The wood costs E 2 to 3 per ton at the forest site and the return from wood would normally compensate for the cost of the felling and stripping of bark, In this way, the farmer gets his bark almost as net crop. Small farmers are not in a position to market the wood, because of transport and the lack of market. Wattle wood is used mostly as fuel and mining timber. If a factory is set up, the total wood production will be about 25,000 t/a.

NIDCS is making an effort to convert the wood into charcoal for export to Middle East countries and also to put up additional sawmills. South Africa is exporting wattle wood chips to Japan, possibly for viscose pulp. As such, additional markets for wattle wood are to be explored.

III. CONCLUSIONS AND RECOMMENDATIONS

A. Conolusions

1. Not all the bark available in Swaziland is marketed at present. Better utilization oould be aohieved by starting a bark mill or an extraot faotory for export purposes and for internal demand when the leather industry is developed. A oommeroial unit with five tons of solid extraot per day is eoonomically viable.

2. A bark mill may only help in the initial stages of development, but an extraot faotory oan meet the desired objeotives of maximum utilization of local resources and yield added value to the farmer and the nation. An intermediate solution would be to set up a pilot plant. For a oommeroial plant an investment of E 520,000 has been envisaged with a return of about 15%. The export earnings from an extraot plant with an output of 5 t/day are expeoted to be about E 450,000 per year. The extraot faotory may be implemented through joint ventures or with funds made available by the World Bank through industrial organizations such as NIDCS and SEDCO and the proposed co-operative of wattle growers. The faotory may be located in the Nhlangano or Nkaba area.

3. Legislative or statutory measures are to be taken by the Government to ensure sustained supplies of bark to the proposed extraot faotory. Certain safeguards in respect of quantity and prioe are to be given to the prospeotive promoters of the industry.

4. The produotion of oharooal, sawn timber, wood ohips for visoose pulp, rulers eto. for export are possible ways in whioh farmers oould overoome the diffioulties of marketing their wood.

5. UNDP teohnical assistanoe and funds would be neoessary for the establishment of the proposed pilot plant and the implementation of follow-up projeots. Assistance might also be obtained through technioal oo-operation among the developing oountries. India and Kenya oould offer suoh assistanoe. For example, the Central Leather Researoh Institute, Madras, India is aotively engaged in teohnology transfer as a paokage deal, and the Direotor of the Institute may be requested to provide information ooncerning assistanoe in all aspeots of wattle and allied industries.

B. Reoommendations

1. Swazi farmers engaged in wattle farming should be formed into oo-operatives under the Ministry of Commeroe in order to assist them in establishing plantations,

harvesting and the marketing of bark and wood. Outlets other than South Africa for the sale of wattle bark should be explored. As forestry is one of the development priorities of the nation, the co-operatives should play a significant role in the development of wattle extract and allied industries. They could be involved in equity participation in the extract factory or bark mill.

2. NIDCS and SEDCO should serve as a base for promoting and organizing the wattle extract industry. The necessary administrative skills are available in these organizations.

3. The Forestry Department should be strengthened to enable it to plan and supervise the scientific development of wattle on Swazi Nation Land. A systematic survey of the holdings of each farmer should be conducted to obtain a clear picture of the extent of land under wattle. New areas for future wattle plantations should be mapped out. The services of a botanist familiar with silviculture and wattle plantation techniques could be obtained with UNDP assistance. This is, however, a long-term objective.

4. The CSO should collect information on the production and sale of wattle bark from the title-deed farmers and the Ministry of Agriculture. The data so obtained must be compared with information from SAWGU, Pietermaritzburg, which could be asked to provide the list of persons to whom quotas were issued and the deliveries made to factories in South Africa.

5. Two forest officers and one technically qualified person should be sent for training in wattle plantation techniques and allied subjects and in extract manufacture, including in-plant training. For example, the Central Leather Research Institute, Madras, and the Forestry Department, Kenya, would be suitable for this purpose.

6. If a decision is made to set up the extract factory, two top-level government officials could be sent to the Federal Republic of Germany, India, South Africa and the United Kingdom to select machinery suppliers. For training abroad, UNDP assistance could be sought.

7. Priority should be given to the local processing of hides and skins, which, although produced in large quantities, are currently being wasted. As a first step, processing into pickled and wet blue hides for export and the processing of lining leathers from rejection quality skins may be undertaken. Subsequently, the industry could be expanded to produce finished leathers for both internal and external markets. Lining leathers need wattle extract.

Annex I

HOST COUNTRY STAFF

A. Project personnel

W. Lukhele, Assistant Forest Officer, Ministry of Agriculture

S.B.M. Mkhatshwa, Assistant Forest Officer, Ministry of Agriculture

R.S. Msibi, Project Officer, NIDCS

B. Project associates

A.S. Brass, Chief of Operations, NIDCS

D.Z. Dhlamini, Formerly Permanent Secretary, Ministry of Agriculture

G.F. Dhlamini, Managing Director, SEDCO

A.R. Khoza, Permanent Secretary, Ministry of Agriculture

Flaye, Economist, Ministry of Finance and Economic Planning

S.M. Phefile, Operations Manager, NIDCS

R. Riesbeck, ILO Project Manager, SEDCO

L. Sithebe, Managing Director, NIDCS

Annex II

BASIC DATA ON WATTLE PRODUCTION AND EXTRACT MANUFACTURE

Places of occurrence of wattle

MANZINI[a]	HHOHHO[a]	SHISELWENI[a]
1. Mangoongoo	1. Mbabane	1. Magubheleni
2. Sandlane	2. Nkaba	2. Gege
3. Dwalile	3. Mhlosheni	3. Mbukwane
4. Lundzi	4. Polonjeni	4. Nhlangano
5. Manzini	5. Nkoyoya	5. Mhlosheni
6. Mahlangataha	6. Ekupheleni	6. Hluti
7. Mankayane	7. Sigangeni	7. Sombodze
8. Luyengo	8. Siphoosini	8. Nyamane
9. Sigombeni	9. Maphalaleni	9. Hlatikulu
10. Kukhanyeni	10. Mbuluzi	10. Jerusalem
	11. Ndlangeni	11. New Haven
		12. Mahlalini
		13. Madulini
		14. Sicunusa
		15. Ngasini

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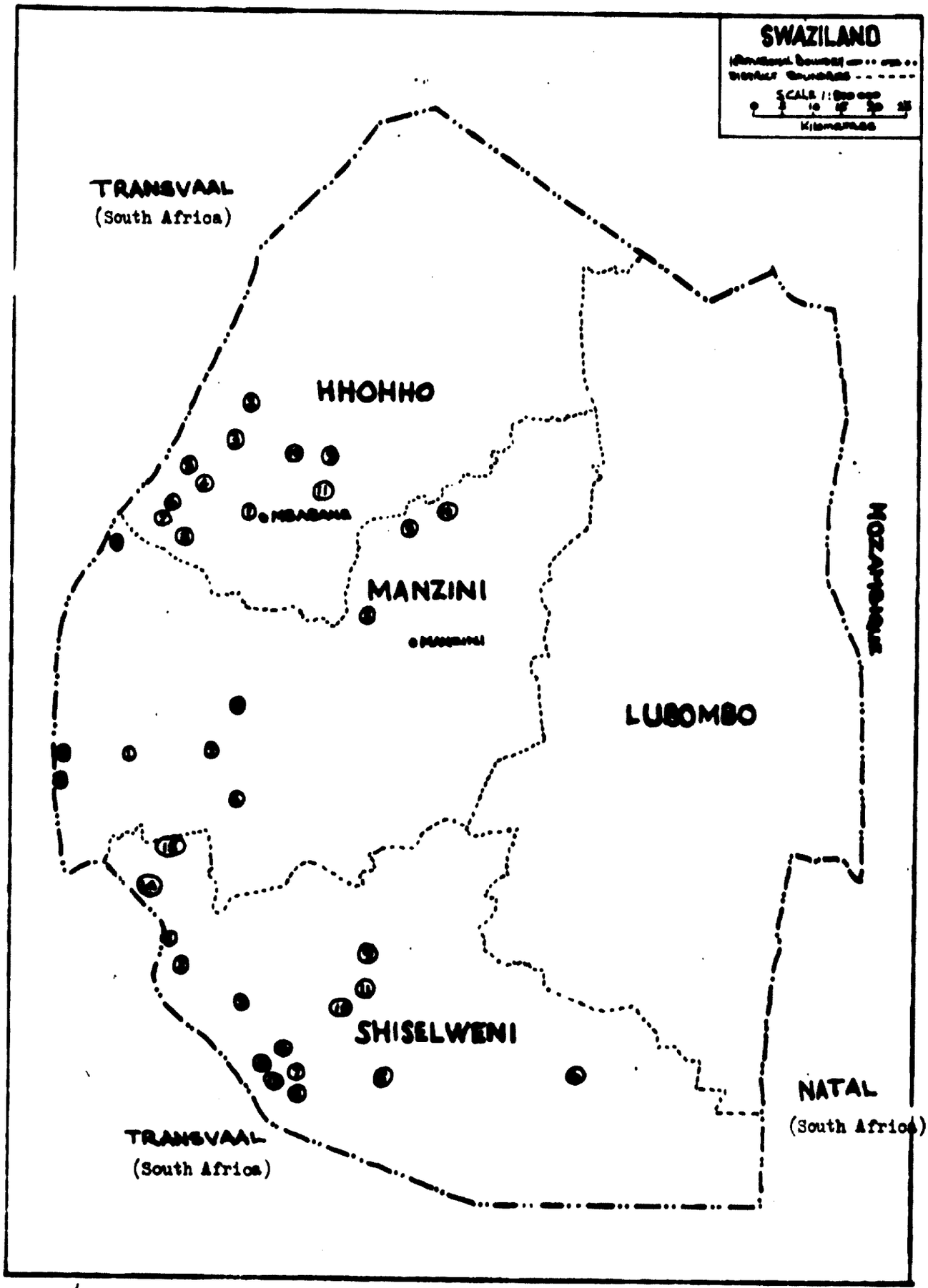
[a] Each numbered locality listed for this district is indicated by the same number in figure I below.

Figure I. Location of wattle-growing areas[a/]



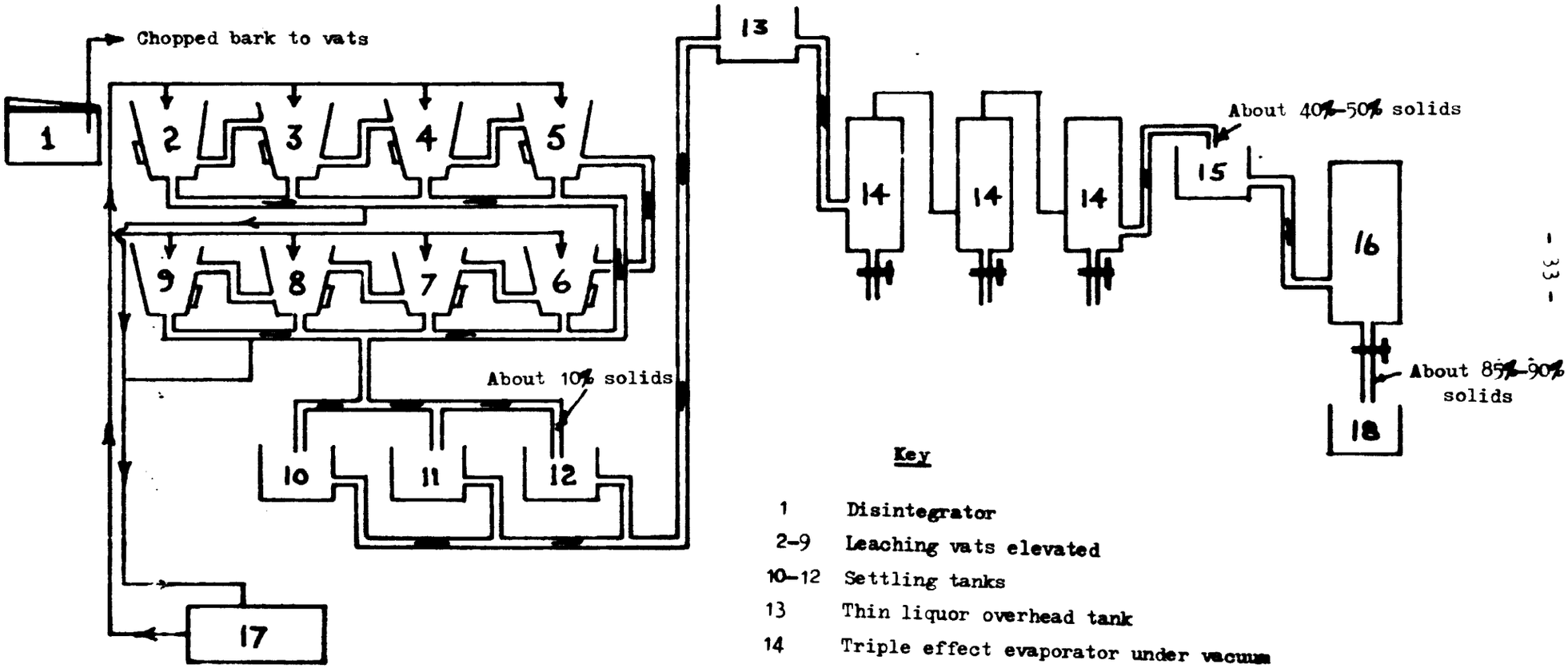
[a/] Circled numbers refer to localities listed above as places of occurrence of wattle.

Wattle bark quota applied to title-deed land growers for the 1976 season

Grower	Quota established by SAWGU (millions of tons of wet bark)[a]
Baxter bros.	14
Botha, T.E.	2
Bonwer, J.T.	3
Diamond, M.	848
Dittroh, E.E.	8
Lunt, R.D.	10
N.A. Manson and Son	41
Martin, E.A.	7
Martin, E.A. and F.A.	86
Murphy, J.S.	10
Nel, G.M.	13
Usutu Pulp Co.	194
Swazi Government (Swazi Nation growers)	600
Total	1,836

[a] 10 tons of wet bark = 6 tons of dry bark.

Figure II. Flow diagram of tanning extract manufacture



Key

1	Disintegrator
2-9	Leaching vats elevated
10-12	Settling tanks
13	Thin liquor overhead tank
14	Triple effect evaporator under vacuum
15	Thick liquor overhead tank
16	Vacuum pan
17	Spent liquor tail tank for recycling, sunk below floor level
18	Bagging and packing

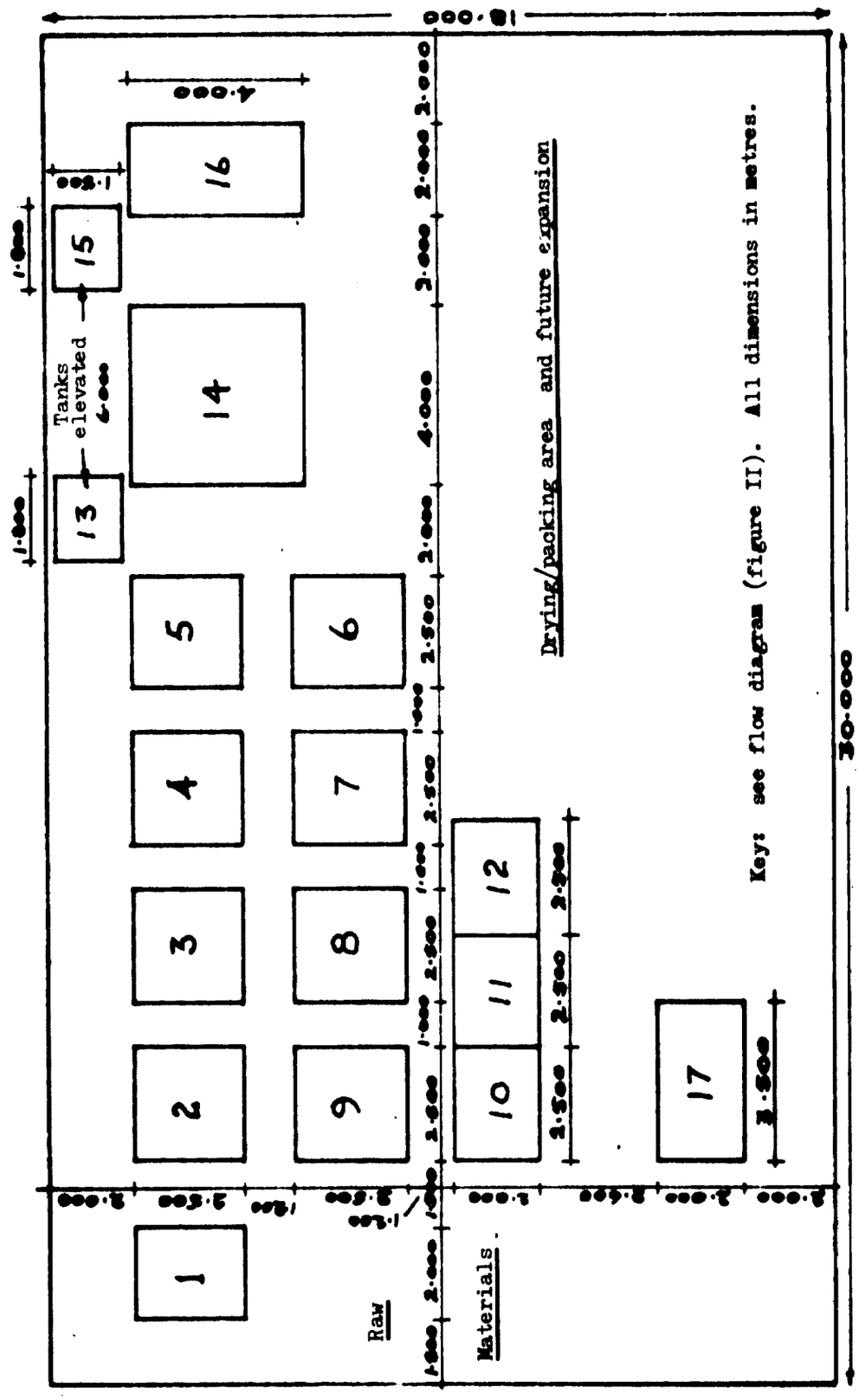


Figure III. Layout of extract factory (5 t/day)

Annex III

INVESTMENT AND PRODUCTION

A. Investment estimates for wattle bark mill

Investment estimates are given below in a summary form. The general approach is the same as that adopted in the following section devoted to an investment cost analysis of a commercial wattle extract factory. The dry bark price is assumed to be E 70/ton at the factory site.

Item		Cost (E)
Quantity:	10 tons of chopped bark per day in one shift	
Land:	0.5 ha	2,000
Buildings:	Main building of 150 m^2 and raw material storeroom of 150 m^2	20,000
Machinery:	Disintegrator - 1.5 to 2 t/h	2,000
	Hydraulic baling press - 1.5 to 2.0 t/h	8,000
	Miscellaneous equipment	2,000
	Installation transport, electrical wiring etc. at the rate of 10%	1,200
		13,200
Working capital:	(two months - 50 working days):	
	Labour - 10 persons (2 skilled and 8 unskilled)	1,340
	Manager - E 300 per month	300
	Raw materials - 500 t at E 70 per month ex factory	35,000
	Overheads, packing, power, office management etc.	2,000
		38,640
Total capital:	Land and buildings	22,000
	Machinery	13,200
	Working capital	38,640
	Total	73,840

Production cost (in E) of one ton of chopped bark:

Working capital for 500 tons	38,640
Interest at 13% for two months	800
(assuming 50% of capital is borrowed)	
Total	39,440

Cost per ton: $= \frac{39,440}{500} = E\ 78.8$

Sale price:

Prevailing price in South Africa from E 110 to 123 per ton (c.i.f.)

Ocean freight and insurance costs about E 40/t

Expected operating profit = E 2/t (minimum)

Expected return on investment = 14% (minimum)

B. Investment and cost analysis for a commercial plant

The capital structure, production cost, profitability, cash flow statement and break-even point of a commercial plant are analysed below. The following assumptions and conditions formed the basis of the analysis.

1. The scale of production is five tons of solid wattle extract per day in 3 shifts. Total working days are taken at 300/year.

2. Extract yield is taken as 50% for dry bark (33% for wet bark) and cost of raw bark at E 60/t is almost the same price presently obtained by Swazi farmers from South African mills.

3. The building cost is based on prevailing prices, using a type of corrugated sheet for roof construction. It is considered that low-cost structures will make only a marginal difference.

4. Machinery costs are based on quotations and on the expert's experience. The costs include import duties.

5. The factory shall be located near river water sources in the Shiselweni or Hhohho district.

6. The sale price of solid wattle extract is taken at E 300/t (ex-works) and is comparable with the prices prevailing in consumer countries as landed cost and imported from countries such as Kenya and South Africa. The present sale price of solid wattle extract in South Africa for use in Swaziland is E 292/t, f.o.r. Pietermaritzburg directly from SAWEMA. The unit is expected to market the product directly. The retail price in Swaziland for wattle solid extract supplied by a Mbabane chemical firm is E 430/t.

7. The promoter is to obtain loans from NIDCS and the Swaziland Development and Savings Bank up to 80% of the total capital.

8. The promoters may have to get an assurance from the Government of Swaziland that all the bark produced in the country will be supplied to the factory to the extent required by the unit.

9. In wages, rations of E 3.40 per week are included for those drawing less than E 90.0/month.

10. Spent bark will be used as fuel in the boiler along with coal.

11. It is assumed that the cost of production will remain the same over the years. Discount cash flows are not shown, on the assumption that fluctuations the value of money will be compensated by an increase in product cost etc.

12. The purohase of lorries and oars is not shown separately, as transport oosts are inoluded in the oost of produotion.

It must be noted that the prioe of raw bark and the sale price of extraot are kept at almost the same level as those ourrently prevailing in South Africa. But the factories in South Africa are from 25 to 30 years old, when the investments in buildings and maohinery were muoh lower as oompared with present rates. As suoh, the return on investment is obviously low. This oan only be obviated by organizing the Swazi farmers into oo-operatives and involving them in shareholdings of the company in order to obtain bark at muoh lower prioes than what is aotually shown in this analysis. Suoh an arrangement will enable the Swazi farmer to sell more bark and also get a part of the profits from the faotory whioh will ultimately maintain his total return on the same level as that of his oounterparts in South Africa.

Capital investment estimates and cost analysis

Plant output: 5 tons of solid wattle extraot per day (3 shifts).

Fixed capital	Cost (E)
Land: 2.5 heotares	10,000
Building:	
(a) Main factory shed with oorrugated sheet roofing and oement flooring - 30 m x 18 m with 12 m height at E 110/m^2	59,400
(b) Finished goods storage area; oement flooring oorrugated sheet roofing - 18 m x 9 m at E 110/m^2	17,820
(o) Raw material storage area, oement flooring, oorrugated sheet roofing - 30 m x 18 m at E 95/m^2	51,300
(d) Office room - 12 m x 5 m at E 140/m^2	8,400
(e) Laboratory - 12 m x 5 m at E 140/m^2	8,400
(f) Amenities (toilets eto.) - 12 m x 5 m at E 140/m^2	8,400
(g) Overhead tank at about 12 m height, 175,000 oapaoity with pump shed	40,000
(h) Site works, road works, eleotrioal work eto.	20,000
Maohinery and equipment:	213,720
(a) Eight leaohing vats, open type, stainless steel, 3.5 m x 2.5 m	16,000
(b) Disintegrator, 1.5 t/h capaoity	1,500

		Cost (L)
(c)	One triple effect evaporator with 2,000 kg water/h evaporation and one vaouum pan with 250 kg of water/h evaporation, both working under a pressure of 0,33 bar, with all contact parts made of stainless steel	140,000
(d)	One boiler, fire tube/water tube, 2,000 kg of water/h evaporation, maximum working pressure of 150 p.s.i.	50,000
(e)	Shipping, freight, insurance and installation, electrical connections, steam piping etc., on main machinery at 10% of E 207,500 (a + b + c + d + e)	20,750
(f)	Accessories and supporting equipment:	
	(i) Three settling tanks, each 2.5 m x 2.0 m x 1.5 m, 8,750 l capacity, cement construction	1,000
	(ii) Two overhead tanks for thin and thick liquor, wood construction, 1.8 m x 1.5 m, 3,750 l capacity	700
	(iii) One tail tank for storing exhaust liquors from leaching vats, cement construction - 3.5 m x 2.0 m x 1.5 m, 11,250 l capacity	650
	(iv) Office and laboratory equipment	3,500
	(v) Three trolleys for carrying the spent bark, hand operated	600
	(vi) Two weighing machines	1,000
Total fixed capital		235,700
Land		10,000
Buildings		213,720
Machinery and equipment		235,700
	Total	459,420 (or 460,00)

	Cost (E)
Working capital (for 2 months, or 50 working days)	
Raw material, 10 tons of dry wattle bark/day at E 60/t	30,000
Utilities:	
(a) Electricity, 500 units/day at E 0.036/unit	900
(b) Coal for steam, 3 t/day (plus 3 t of spent bark/day) at E 11.0/t	1,650
(c) Water, 30,000 gallons/day (pumping charges only)	500
(d) Packing materials, bituminized hessian bags and polythene sheets at 0.35/bag of 50 kg, for 100 bags/day	1,750
Salaries and wages:	
(a) Works manager at E 500/month	1,000
(b) Production and laboratory chemist at E 265/month	530
(c) Accountant cum office manager at E 265/month	530
(d) Technical sales representative at E 95/month	190
(e) Mechanic cum electrician at E 95/month	190
(f) Two office and laboratory assistants, at E 85/month	340
(g) 15 operators (inoluding boiler attendant) at E 95/month	2,850
(h) Three supervisors at E 120/month	720
(i) 60 unskilled workers at E 60/month	7,200
(j) Three watchmen at E 52/month	312
Transport from forest areato factory site at E 10/t	5,000
Miscellaneous expenses: office stationery, postage, telephones, conveyance, advertisements etc.	500
Maintenance:	
(a) Main plant and equipment at 5% per annum on total cost (a + b + c + d of fixed capital entry for machinery and equipment) of E 207,500 for 2 months	1,730
(b) Buildings (a to f of fixed capital entry for buildings) at 2% per annum on total cost for 2 months	512
Insurance on total fixed capital of E 460,000 at 2% per annum for 2 months	766

	Cost (£)
Total working capital (for 2 months)	
Raw materials	30,000
Utilities	4,800
Salaries and wages	13,862
Raw material transport	5,000
Miscellaneous	500
Maintenance	2,242
Insurance	766
	57,170 (or 57,000)
Cost of project	
Total fixed capital	460,000
Total working capital	57,000
	517,000 (or 520,000)
Means of financing	
Promoter equity (20%)	104,000
Term loan from NIDOS - 60% of total project cost at 13% interest	312,000
Loans from financial institution - 20% of total project cost at 13% interest	104,000
Total	520,000
Cost of production of one ton of solid wattle extract	
Total working capital for 12 months	342,000
Total production (tons) in 12 months	1,500

Cost of production of one ton:

$$= \frac{342,000}{1,500} = 228/\text{ton}$$

Break-even analysis

	Cost (E)	
Fixed cost/annum		
(a) Interest at 13% on loan of E 312,000 and 13% on loan of E 104,000	54,000	
(b) Depreciation on plant and machinery at 10% and on buildings at 5%	34,000	
(c) Indirect labour (items (a) to (j), excepting (i), under "Salaries and wages", in section of this annex dealing with working capital)	40,000	
(d) Maintenance of buildings	3,072	
(e) Insurance	4,596	
	135,668 (or 136,000)	
Variable cost/annum		
Raw materials	180,000	
Utilities	28,800	
Wages (item (i), under "Salaries and wages" in section of this annex dealing with working capital)	43,200	
Miscellaneous expenses	3,000	
Maintenance of plant and machinery	10,380	
	265,380 (or 265,000)	

Total cost per annum (fixed costs + variable costs) = 401,000

Unit variable cost per ton of extract = $\frac{265,000}{1,500}$ = E 176

Break-even point = $\frac{\text{fixed cost}}{\text{(unit sales cost - unit variable cost)}}$

= $\frac{136,000}{(300-176)}$ = 1,097 t/a

= or say 1,100 t/a

= 73% production

The above break-even point is a conservative estimate. Actually it will keep on decreasing year after year due to reduced interest payments.

C. Pilot plant for production of solid wattle extract

Justification and objectives of the pilot plant

At present Swaziland sells all its wattle bark to South Africa in unprocessed form. It would be more profitable to convert the bark into extract at the source. Such processing requires a certain degree of experience in the collection of bark, and in processing and marketing, in addition to a large investment of E 520,000 ($600,000) for an extract plant with a capacity of 5 t/day.

Although wattle extract technology is well established, the necessary skills are not at present available. In view of these factors, and in case no promoter comes forward to set up a commercial unit, an alternative could be a pilot plant producing 1 ton/day in three shifts. When established, the pilot plant could collect the necessary information on the scale of production, and the problems involved in organizing the industry, marketing the product, and developing technical staff. The pilot plant envisaged should be suitable for conversion or expansion into a commercial unit with maximum utilization of pilot plant equipment and other infrastructure.

Government participation and industrial framework

NIDCS and SEDCO could be co-ordinating agencies for the pilot plant. The Government will have to provide buildings, personnel and utilities and the raw materials, in addition to management services.

Work plan

The work plan can be divided into the following activities, which may be completed in two years time in order to set up and commission the pilot plant.

(a) Establishment and execution of building plans, placing orders for machinery;

(b) Arranging fellowship training abroad for two or three persons for six months in countries such as India and Kenya;

(c) Plant and machinery construction and commissioning;

(d) Production and marketing of extract.

UNDP inputs

Item	Cost ($)
Assignment of international expert (project manager) for 2 years (24 m/m)	108,000
Equipment:	
(a) Disintegrator: 1.5 - 2 t/h capacity	2,000
(b) Two leaching vats: 3.5 m x 2.5 m	5,000
(c) Boiler: 1 ton of water/h evaporation capacity	20,000
(d) One evaporator with an evaporation capacity of 500 kg of water/h under a pressure of 0.33 bar (25") one vacuum pan with an evaporation capacity of 100 kg of water/h, all contact parts in stainless steel	100,000
Total equipment	127,000
Fellowships and training:	
Three persons (18 m/m)	7,800
Travel at $2,000 and living allowances at $100 per month are assumed	
Total UNDP inputs	242,800 (or 243,00)

Government inputs (in E)

Item	Cost (E)
Buildings: 30 m x 9 m main factory and 10 m x 10 m godown factory	39,200
Office building: 75 m^2	8,250
Component total	47,450
Personnel (per year)	
(a) Technical (two)	6,000
(b) Operators and skilled workers (10)	11,400
(c) Unskilled (15)	10,800
Component total	28,200
Recurring expenses: raw materials at 2 t/day, utilities etc. per year	54,000
Total	129,650 (or 130,000)

Expected total sales: 300 tons of solid extract at E 300/ton, or E 90,000/year

With regard to the plant dealt with above, the following points should be noted:

(a) As the plant will be a pilot plant, no profit can be worked out;

(b) The cost of raw materials, labour, utilities are at the same rate as those given in the investment and cost analysis for a commercial plant in section B above;

(c) If a baling press costing E 8,000 (about $9,000) is also installed, the unit can make chopped bark in addition to extract;

(d) The capacity of the evaporator, boiler and vacuum pan is assumed to be high enough to enable them to be utilized when the unit is expanded for commercial operations.

D. Equipment and material supplies

Possible suppliers of various items of equipment and materials are given below for reference purposes only. Articles of similar quality obtained from other suppliers would also be suitable.

One triple-effect evaporator and vacuum pan

Alfa - Laval (Pty) Ltd
P.B. No. 187
Isando, 1600
South Africa

A.P.V. Engineering Co. Ltd
2, Jessore Road
Dum Dum
Calcutta, 700028
India

A.P.V. Kestner (Pty) Ltd
P.O. Box 9448
Johannesburg, 2000
South Africa

Blairs Ltd
143, Woodville street
Glasgow, G. 51
Scotland

Chemeoh Engineers[a] (Pvt.) Ltd
10, Montieth Lane
Egmore
Madras, 600008
India

Gansons[a] Ltd
46/c, Chowringhee Road
Calcutta, 700 071
India

Wiegand Karlsruhe GmbH
P.O. Box 1759
7505, Ettlingen
Federal Republic of Germany

Boiler and fittings

Chemech Engineers[a/] (Pvt.) Ltd
10, Montieth Lane
Egmore
Madras, 600008
India

Gansons[a/] Ltd
46/c, Chowringhee Road
Calcutta, 700 071
India

Mitchell Cotts Engineering (Pty) Ltd
P.O. Box 14038
Wadeville
Germiston, Transvaal
South Africa

Disintegrators and baling press

Batliboi & Co. (Pty) Ltd
Machinery Division
Forbes Street
Bombay, 1
India

Forest Engineering
P.O. Box 169
Isando
Transvaal
South Africa

Packing materials

Swaziland Packaging (Pty) Ltd
Matsapha
Swaziland

Spray dryer

A/S Niro Atomizer
305, Gladsaxevej
D.K. 2860 Soeborg
Denmark

[a/] This firm supplies machinery, including leaching vats, on a turn-key basis for the entire factory.

Annex IV

HIDES, SKINS AND THE LEATHER INDUSTRY IN SWAZILAND

As the leather industry in Swaziland does not form part of this report, detailed recommendations and suggestions are given separately and are on file at the offices of SEDCO and NIDCS.

Livestock

About 70% of the land is used for grazing purposes. The population of cattle is about 600,000, goats about 250,000, and sheep about 30,000.[a] There are a few cattle ranches.

Meat industry

There is one modern abattoir, the Swaziland Meat Corporation (SMC), which is a joint venture of the Government of Swaziland and a private company. The total kill of SMC is about 30,000 cattle per year. There are also about 50 country butcheries licensed by the Ministry of Commerce, the killing in each varying from 3 to 25 per week. There are about five butcheries which slaughter approximately 25 cattle/week, and the rest are mostly slaughtering 3 to 6 per week. Cattle are also slaughtered by homesteaders, for their own consumption.

There is no organized slaughtering of goat and sheep. These are mostly slaughtered by homesteaders for their own consumption but it is understood that Shamrock butcheries do slaughter about 20 to 25 sheep/month in addition to cattle.

Export of meat and meat products account for about 1,500 tons valued at about E 1.6 million per year. There is, however, some import from South Africa of meat and meat products worth about E 800,000 per year.

The butcheries are concentrated in the Matsapa and Siteki areas.

Hides and skins

The major producer of hides is SMC, which accounts for about 50% of total production. SMC produces about 30,000 hides, country butcheries about 10,000 hides and homesteads about 10,000 hides per year. In addition to these, about

[a] Source: Central Statistical Office publication, 1975.

30,000 cattle die annually. From 7,000 to 8,000 cattle are exported live to South Africa. Hides from dead animals appear to be wasted. Thus the total production of cattle hides is in the region of from 50,000 to 60,000 per annum. As regards sheep and goat skins, the available quantities are limited. Some of the skins are used by local people for their traditional wear, but most of them are wasted.

Curing of hides and skins

SMC is the only agency bestowing reasonable care in the preparation and curing of hides. They resort to both wet salting and dry salting. Some of the country butcheries killing about 25 cattle/week also practice wet salting. The other country butcheries do both wet and dry salting, and homestead hides are invariably sun dried. With the exception of SMC, no other butchery washes hides after flaying.

Skins after flaying are thrown on the ground, salt is applied on the flesh side, and they are stacked one over another with the grain touching the flesh side. Salt is repeatedly re-used, and no proper drainage or wooden platform is used for stacking. Drying is done directly on the ground, exposing first the flesh side and then the hair side to the sun. As regard skins, they are simply sun dried on the ground.

Quality of hides and skins

Hides from ranched cattle and those from SMC are of satisfactory quality and meet the international requirements. These hides are free from flay outs and most post-mortem defects.

All the hides, including SMC hides, have ante-mortem defects such as brand, horn, scratch and tick marks. The hides obtained from country butcheries and homesteads are not sufficiently cured, with traces of hair slip and flay outs, in addition to post-mortem defects.

Goat and sheep skins are defective with tick and scratch marks. The sheep skins are wooly and greasy and are not at all properly cured.

SEDCO training course

In order to create an awareness among butchers and rawhide merchants of the importance of proper curing of hides and skins, the expert organized a two-day course at the SEDCO Industrial Estate, Hlatikulu on 30 September and 1 October 1977, in co-operation with SEDCO and the veterinary department.

About 20 butchers attended this course. Lectures on defects and curing and a demonstration of the wet salting method were arranged.

Marketing of hides and skins

Raw cattle hides are in the weight range of 20 kg to 25 kg. Some of the SMC hides, about 20% of production, are of the heavier type (30 to 35 kg). Calf skins and kips are seldom available. SMC is marketing dry salted hides to Iraq at E 1.3/kg (c.i.f. Iraq), and wet salted hides, particularly heavier, to South Africa.

The SMC price of wet salted hide is not clearly known, but appears to be about E 0.70/kg, which is high. On inquiry, South African tanners offered E 0.50/kg (wet salted), ex-Matsapha. In any case the price of wet salted hides is in the region of E 0.50 to E 0.70/kg in South Africa, depending on the quality. Dry salted hides fetch about E 0.10 more per kg over wet salted hides. There is one big agent in Siteki who collects hides from all country butcheries and markets them to Italy and South Africa. There are two local agents who also collect hides from country butcheries and homesteads and sell them to SMC. These local agents buy dry salted or sun-dried hides at a cost of between E 2 and E 4 per hide, and sell them to SMC for a marginal benefit. It seems that SMC collects about 5,000 hides/year from the local rawhide merchants. SMC hides are classified in two grades. There is no systematic grading in case of other agents; the big Siteki agent is reported to collect about 10,000 to 15,000 hides/year. Some of the bigger of the country butcheries are selling their hides to the agents at E 5 to E 7 per hide (wet salted). Thus, the prices in all types are in the range of E 2.0 to E 12.0 per hide.

Tanning and leather industry

SEDCO has a rural tannery in its industrial estate at Hlatikulu, and one leather craft centre at Mbabane. There is no other organized tannery and leather manufactures industry. The SEDCO tannery is equipped with pits for liming and vegetable tanning, one paddle, one glazing machine, two shaving wheels, and two pieces of manual staking equipment.

These installations are primarily meant for training in rural techniques. There is considerable scope for improvements in the tannery. It was originally funded by the ILO. Now there is a demand for the tanning of hair on skins, snake skins and lining leathers. Additional equipment and chemicals required for making these leathers are listed in a separate note to SEDCO.

In homesteads some butchers try to make leather ropes by simply outting the rawhide into continuous strips and tying them to a tree to dry. Some also dry them in the sun and use them at home for various purposes. Leathercraft is also on a very small scale, and leather drums and leather articles made of sun-dried skins and hides can be found in the market.

As regards the marketing of skins, no one is buying them at present on a commercial scale. Skins can however be obtained at E 1-2/skin (raw).

For the benefit of tannery technicians and staff, the expert demonstrated in the SEDCO tannery the production of hair on skins with chromium salts, and lining leather from cattle hides and skins with wattle extract and snake skins with basic aluminium sulphate.

Future plans

At present, NIDCS is seriously considering setting up a tannery to process the locally available hides and skins. During the past one to two years, a number of international companies such as Turner Machinery Co. Ltd, Lonrho, England, C.I.R. of Torino, Italy and a Danish consultancy team have carried out feasibility studies commissioned by NIDCS for a viable tanning industry.

These studies indicated that a tannery with a capacity of 200 to 250 hides/ day for wet blue manufacture is feasible. Two types of wet blue processes are considered. One is with splits and sales on an area basis, and the other is without splits and with sales on a weight basis. This alternative makes a great difference in machinery costs. The first process requires setting, splitting and shaving machines, in addition to fleshing and sammying machines.

NIDCS prepared a feasibility report based on the first process and on the machinery costs and building requirements as given by Lonrho/Turner Machinery Ltd. The investment works out at about E 900,000. The export also assisted NIDCS in the preparation of the feasibility report. The prices of wet blue hide are taken at $0.55/sq ft (ex United Kingdom) and ohrome splits at $0.10/ sq ft (ex United Kingdom). It is understood that the average price of wet blue hides in South Africa is about $28 per hide (unsplit) weighing about 20 kg.

SEDCO is also anxious to expand its aotivities in the Hlatikulu Tannery. Some additional machinery to manufacture lining and hair on leathers on a pilot scale are being planned. The Ministry of Agriculture is to be assisted by the FAO in the improvement of hides and skins.

Suggestions

1. The SEDCO tannery could be strengthened with more machinery, including drums, and become a training centre for skilled workers, operators and technicians to meet the future needs of the leather industry. It could also be developed into a skins tannery.

2. Some type of restriction could be imposed on the butt branding of cattle, which could be replaced by branding on cheeks, legs or neck.

3. Training and demonstration in flaying and curing of hides and skins should be taken up on a priority basis.

4. The Ministry of Commerce and Co-operatives could organize country butchers in co-operatives for the collection of hides and skins. The co-operatives union could ensure their collection in a central storehouse where the hides are properly cured, stored and then marketed. The expert held discussions on this matter with the authorities concerned.

5. As there are alternative processes for wet blue manufacture and machinery of different types - mechanical and hydraulic at considerable difference in cost - to meet the processing requirements of 200 to 250 hides/day, the promoters of the tannery could visit some of the developing and the developed countries to choose the appropriate technology and machinery and to determine whether to introduce more labour intensive methods or more modern machinery. Sophistication has its disadvantages in a developing economy in terms of dependence on outside skills, replacement parts, equipment maintenance and local employment potential.

6. Goat skins, of which about 30,000 pieces are produced each year, could be processed into pickled skins for export. Although it may not be worthwhile to establish a separate factory, the production of pickled skins could form a part of the proposed wet blue tannery or the SEDCO tannery.

Training

It is essential that at least two Swazi nationals are sent out for training in the production of wet blue and other leathers. The Central Leather Research Institute, Madras, is one such place where the courses are designed to meet the specific requirements of trainees for periods varying from three months to a year. It is also necessary to obtain the services of an international expert to streamline the production and training activities of the SEDCO tannery. UNDP, UNIDO and the ILO could be approached for the necessary assistance.

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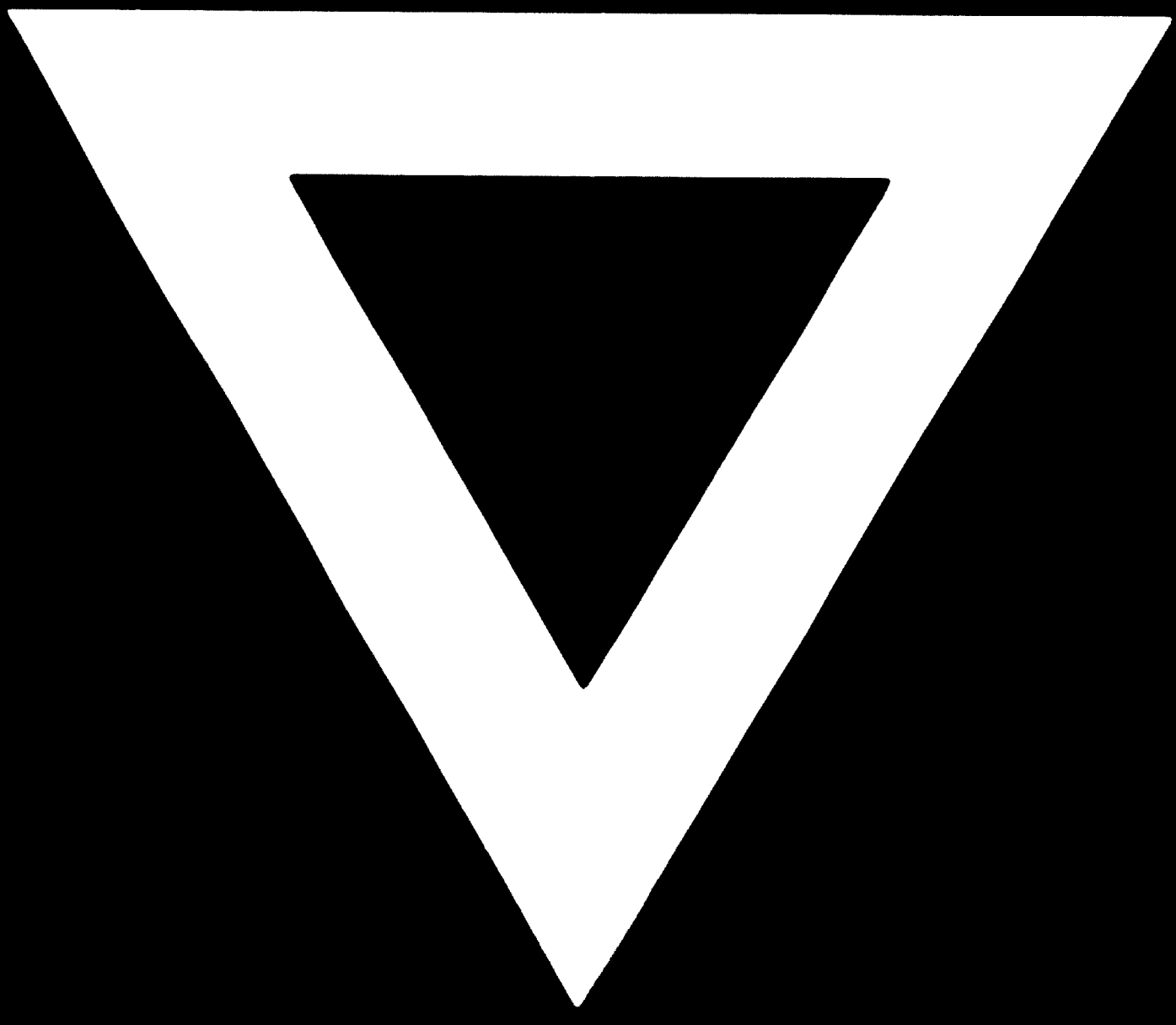

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