TECHNOLOGY CHOICE IN THE INFORMAL SECTOR: THE CASE OF SALT PRODUCTION IN SIERRA LEONE

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Finally I am grateful to my wife and children for their endurance, [illegible]

SUMMARY

Sierra Leone depends on foreign sources for about seventy five percent of its salt supply. This dependence on foreign salt has the double effect of drain on the little available foreign exchange and a lack of security of supply. In order to change this situation, policies are required to facilitate the local production of salt.

There are only two local sources of salt: The solar salt field at Suen and the traditional salt processing operations in the coastal settlements. (The Sierra Leone Salt Manufacturing Company does not produce salt. It only reprocesses imported salt). Therefore attempt should be made to identify the salt production technology that has the better potential to increase the availability of local salt. Once that technology has been selected policy instruments must be developed to promote it.

This report has carried out a detailed study of the salt trade and manufacture in the country, the effect of existing government policies on the local production of salt, and the economic parameters of the different salt production technologies in the country. The study involved interviews with government officials, salt processors, field data collection as well as a literature search on the criteria for technology choice in a developing country.

As a result of this study, it is recommended that government must adopt one of the traditional salt processing technology inorder to fulfil the objective of increasing the local salt supply. It was established that the solar salt field is not

economical because of its low productivity. The latter is due mainly to the unfavourable climatic conditions.

In order to assist in the gradual transformation, modernisation and increase in the output from the traditional salt processing industry, several policy instruments have been recommended in this report.

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CHAPTER ONE

INTRODUCTION

1.1 Background on Sierra Leone

Sierra Leone, with a population of 4.0 million (1985 census) is located between latitudes 7°N and 10°N on the west coast of Africa. The climate is dominated by two seasons: a dry season which extends over the period November - April and a wet season which starts in May and ends in October. Over the years the demarcation between the seasons have blurred to the extent where each season could last for as long as eight months in a particular year.

Sierra Leone has no organised commercial salt production facilities. This is so despite the long coastline which could make the exploitation of sea water for salt possible. Most of the salt consumed in the country is imported as either intermediate products or as refined product. The little that is produced locally is usually done by the small scale producers in the informal sector (or cottage industry) and a small solar salt works which is still struggling to survive. The need therefore exists for the examination of the local salt industry with a view of developing a policy on the choice of technology and the promotion of the selected technology.

1.2 Market for salt

In more industrialised countries the industrial demand for salt far exceeds that for human consumption. However in Sierra Leone, the situation is quite different, "with well over two thirds of the salt used being for human consumption." (IDU 1986).

Only a small quantity is used by industry and also as animal feed.

If we assume that the annual per capita demand for salt is 2.5 kilogram then the total human consumption of salt in Sierra Leone is at present 10,000 tonnes.

The total industrial demand for salt has been estimated at 1740 tonnes (IDU 1986) which was thought to be made up as follows.

Bakeries	1500 tonnes/year
Beverage	120 tonnes/year
Commercial salting of pork/fish etc.	60 tonnes/year
Others	60 tonnes/year

In the past, about 1000 tonnes/year of salt was used in the phase separation of glycerol from soap in the soap industry. However this processing step is now omitted in most soap industry (both small scale and large scale) because of savings in cost.

In the agricultural sector, there is very little salt consumption because of the lack of large scale commercial livestock farming. Traditional methods of livestock grazing do not involve the feeding of salt to animals.

Thus, the total market for salt in Sierra Leone can be estimated at 12,000 tonnes/year with most of the demand existing in the domestic sector. Within the domestic sector most of the salt is used for cooking. Hence table salt is not in great demand.

1.3 <u>Sources of salt</u>

There are two main sources of salt in Sierra Leone: The imported salt, and the locally produced salt. There are two types of imported salt: refined table salt and rock salt. The latter is an intermediate product which is reprocessed locally. Table 1.1

and 1.2 show the statistics of salt importation into the country over the last five years. The table shows the decline in the quantity of rock salt imported into the country over the last five (5) years. In the late seventies the quantity of rock salt was approximated 8000 - 10,000 tonnes/year. However, since 1981 this amount has dropped progressively to only a few hundred tonnes by 1986. This decline in the quantity of salt imported is clearly connected with the problem of acquiring foreign exchange which started towards the end of 1980. A similar decline is also noted in the small quantity of refined table salt imported annually.

The difference between the demand for salt and the quantity imported is made up by locally produced salt. This means that the amount of locally produced salt now in the market has increased considerably since 1982. Three to four years ago only about 3000 tonnes of local salt was sold each year. Now most of the salt in market places in most of the towns visited were local salt, thus confirming the increasing significance of this type of salt. Although there are two main sources of local salt, only the salt from the informal sector using traditional methods is significant. The quantity of salt from the solar salt industry is still very small.

Tables 1.2 shows the origin of salt by country. It is observed that the bulk of the rock salt used, comes from Senegal while the table salt comes from several European countries.

1.4 Significance and scope

The non-availability of foreign exchange to import large quantities of salt has created sporadic salt scarcities and forced the price continously upwards.

Table 1.1

(a) Quantity (tonnes) of salt importation into Sierra Leone

Type of salt	1982	1983	1984	1985	1986
Table salt	80.4	55.4	57.4	48.2	1.8
Rock salt	4473	3778.2	240.0	234	751.0
Salt liquors	0.8	0.1	0.2	-	-
Total	4554.2	3833.7	297.6	282.2	752.8

(b) Le value of salt imported into Sierra Leone

Year / Type of salt	1982	1983	1984	1985	1986
Table salt	48,694	25,212	54,173	35,507	22,981
Rock salt	1,527,532	1,043,092	312,643	180,067	811,410
Salt liquors	3,576	493	764	-	-
Total	1,579,808	1,068,797	367,580	215,574	834,391

Table 1.2

Sources of imported salt

(tonnes)

Country of origin	1982 Table salt	1982 Rock salt	1982 Salt liquor	1983 Table salt	1983 Rock salt	1983 Salt liquor
United Kingdom	10.0	70.0	0.39	7.08	6.34	0.1
United States	1.2	-	0.08	0.63	-	-
India	1.94	-	-	1.5	-	-
W.Germany	66	553.1	0.22	46.2	513.9	-
Senegal	-	3578.8	-	-	3214.1	-
Netherlands	0.81	271.2	0.12	-	43.89	-
Spain	-	-	-	-	-	-
Switzerland	0.34	-	-	-	-	-
Lebanon	0.1	-	-	-	-	-
Total	80.39	4473	0.81	55.37	3778.2	0.1

Country of origin	1984 Table salt	1984 Rock salt	1984 Salt liquor	1985 Table salt	1985 Rock salt	1985 Salt liq-uor	1986 Table salt	1986 Rock salt	1986 Salt liquor
U.K.	4.2	1.34	0.2	2.9	1.0	-	1.3	369	-
U.S.A.	0.7	-	-	0.5	-	-	-	-	-
India	-	-	-	-	-	-	-	-	-
W.Germany	51.8	85.3	-	44.5	232.3	-	-	191.3	-
Senegal	-	-	-	-	-	-	-	-	-
Netherlands	-	150.0	-	-	-	-	-	190.7	-
Spain	-	-	-	-	-	-	-	-	-
Switzerland	0.6	1.60	-	0.3	-	-	0.42	-	-
Lebanon	-	-	-	-	-	-	-	-	-
Total	57.5	238.8	0.2	48.2	233.3		1.72	751	-

This situation has clearly highlighted the need for the development of a local salt industry. To do so would require policies on the choice and promotion of a particular salt production technology. There are currently three (3) sources of common salt in Sierra Leone - imported salt, solar salt and salt from small scale processing. Government must therefore decide whether to promote solar or small scale production or simply encourage importation of this commodity. In order to be able to reach a decision as to whether to promote small scale salt processing it will be necessary to know the contribution of this industry to the national economy through savings in foreign exchange and generation of employment; it will be important to have an idea of the existing production capacity and the available resource potential for future expansion, and the level of economic profit. Furthermore it will be necessary to identify the various handicaps (technical and/or otherwise) involved in the process so as to focus attention on them in any policy for promotion of the industry. Similar studies should also be conducted for the solar salt industry. Thus a complete study of salt trade and production is essential for any policy development.

Previous studies on the development of salt industry have tended only to look at one aspect of the problem depending on the interest of the sponsors of the study. For instance Massaquoi (1984) in a project designed to improve the income of rural families, carried out a study of small scale salt processing and made recommendations on some technical improvements. Similarly, the Industrial Development unit of the Commonwealth fund for Technical Cooperation (1986) carried out a technical evaluation of the existing solar salt field at

Suen and collected evaporation and rainfall data at various coastal locations. A global view of the salt industry such as the one presented in this report has not been done before.

The overall aim of such a general study of the salt industry is to enable us to select a suitable technology for salt manufacturing and develop a set of policy instruments that will be used for the promotion of the selected techniques. More specifically the study is expected to achieve the following objectives:-

(1) Examine Sierra Leone's existing policies on salt importation and trade and their effect on the local salt processing industry.

(2) Determine the actual capacities of existing producers and make comparison with their potential.

(3) Determine the costs of small scale production and compare them with the sale prices of salt in Sierra Leone.

(4) Examine the relationship among prices, demand and motivation of the salt processing to produce more salt.

(5) Investigate the possibility of cooperative marketing by small scale processors and its effect on their income.

(6) Determine areas of activities requiring aid and how the aid can be provided.

(7) Determine the overall contribution of the small scale salt processing industry to the national economy.

CHAPTER TWO

M E T H O D O L O G Y

In order to appreciate the methodology adopted to fulfil the objectives of this work it is necessary to recast the problem as follows: First, the government must take a policy decision as to which industry they wish to promote; solar salt, traditional salt or neither. Second, the government must put into place policy instruments to achieve the policy objectives. Thus the first part of the methodology involves literature search on technology choice and technology policy. This literature review will provide the guidelines and objectives of any field data collection. Next, detailed studies of the different sectors of the salt industry will be carried out. Since traditional salt processing contribute the largest share of the locally produced salt, and because of the non-uniformity of its production problems, it received a large proportion of investigation effort. All field data were then brought together for analysis.

2.1 Data Collection on Small Scale Salt Processors

At the start of the project the research team made visits to all the major salt processing areas. Through this familiarisation trip it was possible to observe the operations and identify various activities involved in them. At the end of this first set of trips the team was now in strong position to formulate questionnaires covering different aspects of the operation. The questionnaire had five sections. One section gave a general background of the processors including ownership. The second section dealt with production and the questions covered raw materials used, the total salt produced and the amount of labour involved. This information was used to find the production cost and production capacity. The third section enquired into the possibility of cooperative marketing. Processors were asked to indicate their willingness to participate in such a scheme and to state the conditions under which they will do so. Another section asked questions on problems the salt processors have and the kind of aid they would require. The questions covered all types of problems (financial, social, marketing etc.). A final section on the questionnaire dealt with other matters not covered above.

During the visit to the processing sites some members of the team recorded responses to the questionnaires while others measured and recorded the amount of salt produced over a certain period by selected processors. The raw material and other inputs into the process were also measured and recorded.

It was observed during the visits, that all households in the major salt-processing areas are engaged in salt production. Thus the quickest and cheapest way of conducting a census of small scale salt industry was by using the relevant data of the national population census. Since each household constitutes a production unit, the number of households in the area represented the number of processors. Using this census data together with the information on the average production level of each processing unit it was possible to estimate the existing production capacity of the small scale industry sector.

Efforts were also made to identify new coastal areas suitable for salt production. Visits were made to several coastal areas in order to locate salt laden silts which could be used in the traditional salt production process.

All data collected were analysed in the direction of the objectives stated earlier. The average quantity of salt produced per processor and the typical cost of production were all calculated.

2.2 Data collection on other sectors of the Salt Industry

The other sectors of the salt industry investigated include the salt manufacturing company which reprocesses the imported salt and the solar salt fields of Suen in the Moyamba district. Information on these industries were collected through interviews with the managers. In the case of the Salt Manufacturing Company the study team also visited and inspected the factory. A similar visit to the solar salt fields was not possible because we were told by their head office that production ceased about two years ago and that even the infrastructure including road to the site was in poor state of repair. We were however able to obtain all the information we needed from their Freetown office.

2.3 Salt Trade Statistics

There were conflicting figures in the statistics of salt importation into Sierra Leone. The figures from the central statistics office, the customs department and the Bank of Sierra Leone were never in agreement. However after a close examination of all the figures it was decided that the central statistics offices were more reliable.

2.4 Interviews with Government Officials

In order to determine existing government policies relevant to the development of the salt industry, we conducted interviews with officials of the Ministry of Trade and Industry and the Ministry of Development and Economic Planning.

CHAPTER THREE

THE SALT MANUFACTURING COMPANY LIMITED

As was mentioned in chapter one, there are two types of salt imported in the Sierra Leone: refined table salt and rock salt. The latter is an intermediate product which is further processed by the Salt Manufacturing Company (SMC) Limited. This company was established in 1970 with capital investment of Le160,000, about UK £80,000 at the exchange rate prevailing at that time. It is the sole importer of rock salt which is an aggregate of large pieces of salt that is harvested from the solar salt fields of Ste. Nouvelle Des Salins Du Sine at Kaalack in Senegal. This imported rock salt, which come in 50 kilogram bags are crushed to finer particles by the SMC and then put on the local market. Thus the SMC is merely a large salt grinding mill.

The company has two twin roller mills and four bagging-off chutes connected to the mills through a hopper storage. The factory which is located at Kissy just outside Freetown has a large storage space to keep 4000-5000 tonnes. The company employs 28 permanent workers and about 100 casual labour.

The factory has a capacity to process 8000 tonnes/year of rock salt, which represents the demand for cooking salt at the time of its establishment in 1970. Although over the years the demand has increased considerably the non-availability of foreign exchange has forced them to operate below even this low capacity. For instance since April 1986 the company has only processed 1450 tonnes of salt and in the 1985/86 financial year the company processed only 3000 tonnes.

The crushed salt is packed into woven polypropylene bags of 32 lbs. (15 kilogram) capacity and sold as cooking salt. The current price for a bag of the salt was given as Le150/00. The company has no designated distributors and uses its factory as the only sales outlet. Anybody can go there and pay and collect any quantity of salt depending only on availability.

The manager assured the project team that there was no problem with the sale of the product. Everything they produced was sold immediately. He explained the reason for this was the high quality of its product relative to the locally produced salts. This is confirmed by the data in table 3.1 which gives the analysis of various salts on the Sierra Leone market. The table shows that the sodium chloride contents of the salt from Senegal which is reprocessed at SMC is 99.64% compared to 96-97% for other salts. There was also no problem with the availability of skilled manpower to operate the factory.

Table 3.1

Analyses of various salts in the Sierra Leone Market.

	1 SUEN 1980/81	2 SUEN 1982/83	3 FREETOWN MARKET	4 MOKIMBA VILLAGE	5 SENEGAL IMPORT: ex-Kaolac
Analysis: Sulphate(as $SO_4^{=}$ %)	1.032	0.539	1.505	1.814	0.201
(Dry Basis) Magnesium(as Mg++ppm)	4300	1580	2165	3540	150
Calcium (as Ca++ppm)	2000	1980	3020	3120	725
Potassium(as K+ppm)	1030	332	373	728	115
Insoluble Matter %	0.912	1.262	0.100	0.068	0.024
Assumed Calcium Sulphate (as $CaSO_4$%)	0.680	0.673	1.027	1.061	0.247
Composition Magnesium Sulphate	0.689	0.080	0.976	1.331	0.034
(Dry Basis) Magnesium Chloride	1.155	0.562	0.085	0.347	0.032
Potassium Chloride	0.196	0.063	0.071	0.071	0.139
Sodium Chloride	96.37	97.36	97.74	97.05	99.64

(Source: ref. IDU, 1986).

The company has seven resident mechanics with good stock of spare parts. All the machines at the factory were well maintained and in very good condition.

The biggest problem seems to be with the availability of foreign exchange. At the time of this study, the company had not received any shipment of salt for over six months and was not expecting anything in the foresable future. At the present price of $80 per tonne CIF Kaalack, the company would need about 640,000 dollars foreign exchange allocation each year to be able to buy and ship about 8000 tonnes/year of rock salt. Within the Sierra Leone foreign exchange context, this allocation to one industry is considerable especially when there are local substitutes for the product. This therefore explains the problem of the company.

CHAPTER FOUR

SOLAR SALT FIELD OF SUEN

4.1 Background

The only formal commercial salt production in Sierra Leone is that of the solar salt fields at Suen located in the Moyamba district (See figure 4.1 for the location of the solar salt fields on the map of Sierra Leone). The work is own and operated by Osman Thomas Sons and Brothers Limited. The exact size of the land lease holding is not known even to the company, presumably because no survey had been carried out. However it is estimated to be between 500 - 800 hectares. Only about a small fraction of this total area is currently been utilised.

The production of salt from the field started in 1975 and to date a total of well over Le2.0 million had been invested in plant equipment. The fields now have the capacity to produce 600 tonnes of salt per annum. However, no production has taken place since 1983 because the company still has a large stock of salt from previous years which they are still trying to sell.

The management of the company is completely Sierra Leonean with about 10 permanent staff and 30 casual employees. However the company has in the past used consultants from India, and Cuba to assist in improving the product quality.

4.2 Operation of the Salt Field

The salt field at Suen, like any solar salt works consists of a reservoir and a series of ponds which serve to concentrate

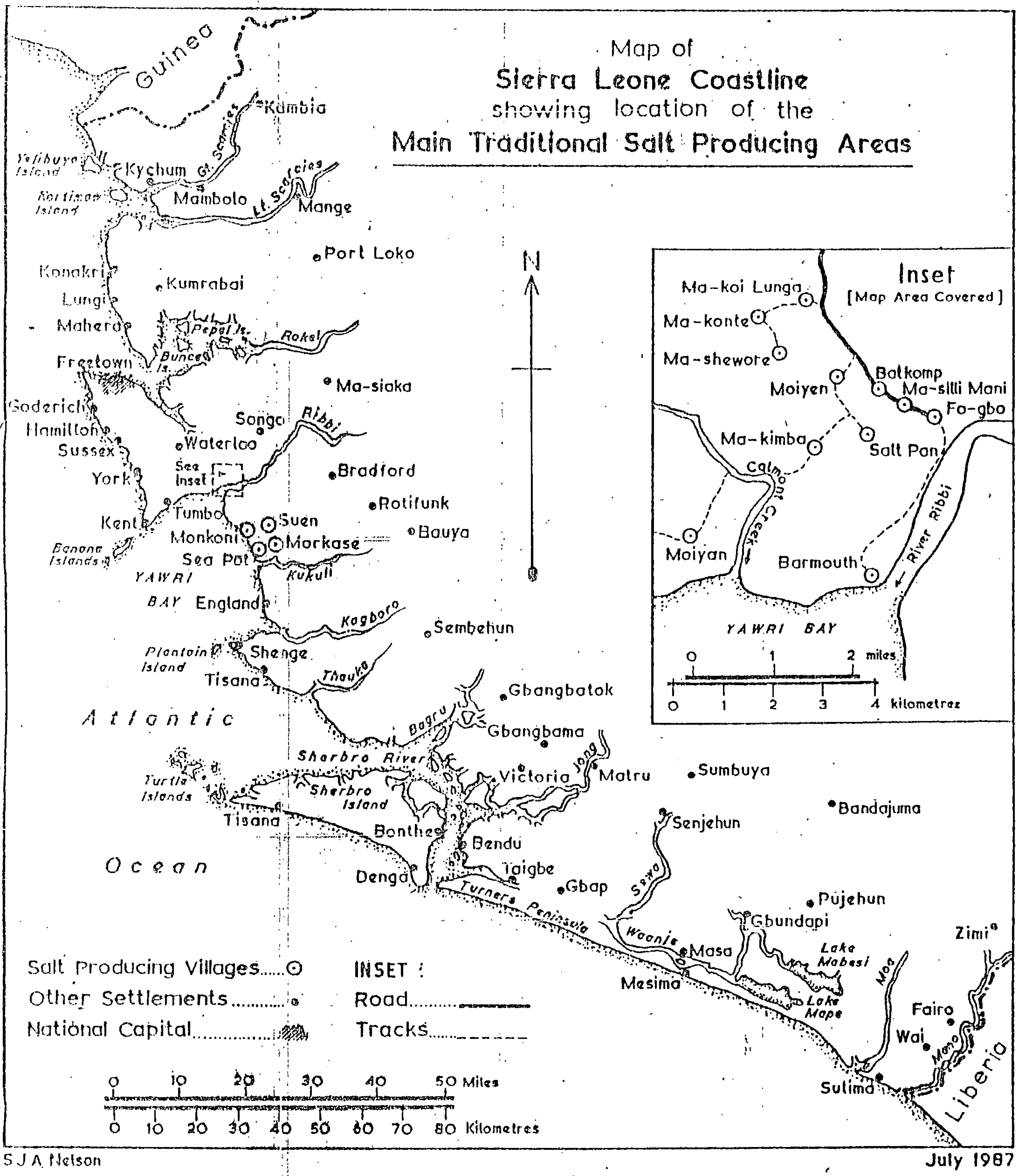

Map of
Sierra Leone Coastline
showing location of the
Main Traditional Salt Producing Areas
Guinea
Kumbia
Kychum
Gt. Scarcies
Mambolo
Lt. Scarcies
Mange
Port Loko
Konakri
Kumrabai
Lungi
Maherd
Pepel Is.
Rokel
Bunce Is.
Freetown
Ma-siaka
Goderich
Hamilton
Sussex
York
Songo
Ribbi
Waterloo
See Inset
Bradford
Rotifunk
Kent
Tumbo
Suen
Monkoni
Morkase
Bauya
Banana Islands
Sea Pot
Kukuli
YAWRI BAY
England
Kagboro
Sembehun
Plantain Island
Shenge
Tisana
Thauka
Gbangbatok
Atlantic
Bagru
Gbangbama
Sherbro River
Victoria
Jong
Matru
Sumbuya
Turtle Islands
Sherbro Island
Tisana
Bonthe
Senjehun
Bandajuma
Bendu
Ocean
Denga
Taigbe
Gbap
Sewa
Turners Peninsula
Pujehun
Gbundapi
Zimi
Waanje
Masa
Lake Mabesi
Mesima
Lake Mape
Moa
Fairo
Wai
Mano
Sulima
Liberia
N
Inset
[Map Area Covered]
Ma-koi Lunga
Ma-konte
Ma-shewore
Moiyen
Batkomp
Ma-silli Mani
Fo-gbo
Ma-kimba
Salt Pan
Calmont Creek
River Ribbi
Moiyan
Barmouth
YAWRI BAY
0 1 2 miles
0 1 2 3 4 kilometres
Salt Producing Villages
Other Settlements
National Capital
INSET :
Road
Tracks
0 10 20 30 40 50 Miles
0 10 20 30 40 50 60 70 80 Kilometres
S J A Nelson
July 1987

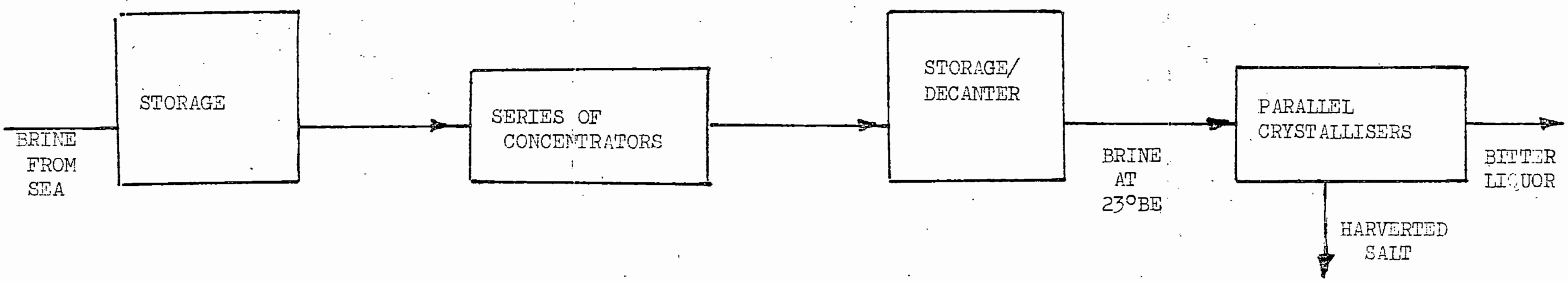
FIG 4·1

and crystallise the brine (Figure 4.2 is a sketch of the process flow sheet for the solar works at Suen). The brine is let into a reservoir on the forward tide of the sea and held there by a gate. The brine is then pumped to the concentrating ponds. There are eighteen (18) such ponds operating in six series of three ponds. The management indicated that the total area of the concentrating ponds is about 80 hectares. The brine which enters these concentrating ponds at about 3°Be is held there until its concentration reaches 20°Be at which point it is pumped to concrete storage tanks. These concrete tanks each of which measures about 90 meters 45 meters x 1.5 meters act as decanter to separate the mud that leaves the concentrating ponds with the brine and as a secondary evaporating pond. Brine which enters these concrete storage tanks at 20°Be are held there until 23°Be. The tanks also provide gravity flow of the concentrated brine to the crystallizers.

There are twenty three crystallisers arranged in three series. They are made of concrete and cover an estimated area of 0.75 hectare. The brine enters the crystalliser at 23°Be which is considerably less than the normal level (25.4 Be) at which saturated brine is fed into the crystalliser (Manner, 1982a). The feed of unsaturated brine to the crystalliser can have serious effect on the quality of the salt as we shall discuss later.

Furthermore during interview, it was revealed that once the brine enters the crystalliser no further monitoring of its concentration is undertaken. This also can affect the quality of the product.

After crystallisation the bitter liquor mixed with the salt



STORAGE
BRINE FROM SEA
SERIES OF CONCENTRATORS
STORAGE/ DECANTER
BRINE AT 23°BE
PARALLEL CRYSTALLISERS
BITTER LIQUOR
HARVERTED SALT

FIG 4·2

is discarded and the salt is manually harvested.

4.3 Technical Status

The company has not made any profit since its inception and has been out of production since 1983. Most of the problems it has experienced are either technical or involve marketing issues. Among the technical problems are issues that affect productivity and those that affect product quality.

4.3.1 Product quality: An analysis of the various salts was given earlier on in chapter three. Referring to the table (table 3.1) it is observed that the salt from Suen solar fields have very high insoluble matter content and a very high concentration of magnesium and calcium salts. The presence of magnesium salt gives the salt a very bitter taste which together with the presence of insoluble black particles will completely put off any customer. This makes the salt virtually unsaleable.

The poor quility of the salt can be traced more to the operational techniques used at the works rather than the design details. For instance, there is enough settling and decantation in the field to eliminate all insoluble materials from the harvested salt. Thus, it is very likely that the high content of insoluble matter present in the salt must have been introduced in post harvest handling operations. More care should be exercised in cleaning and preparing materials used in handling the salt.

The high concentration of calcium and magnesium salts in the product is due to the lack of proper control over the densities of the crystalliser brine. Brine should be fed to the crystalliser at

25.4°Be and the liquor discarded at 29° - 30°Be. At Suen, unsaturated brine at 23°Be is fed to the crystalliser and left there until its concentration has exceeded 30°Be. When unsaturated brine is fed to the crystalliser it takes along calcium sulphate (gypsum) which is deposited with the product. Similarly if the brine stays in the crystalliser until the density exists 30°Be, magnesium chloride starts to crystallise and contaminate the product. Table 4.1 shows the density ranges in which different components of sea water precipitate.

Table 4.1

Concentration at which more common salts begin to precipitate from brine

°Be at 21°C	Salt beginning to precipitate
3.5	Calcite (calcium carbonate)
14.00	Gypsum (calcium sulphate)
25.0	Common salt(sodium chloride)
26.5	Epsom salt (magnesium sulphate)
27.0	Magnesium chloride
30	Sodium brodine

Between 3^{o} - 13^{o}Be calcium carbonates precipitate; from 13.0 - 25.4^{o}C calcium sulphate crystallisers; sodium chloride (common salt) precipitates between 25.0 - 29.0^{o}Be. Above 30^{o}Be, potassium chloride, magnesium sulphate (Epsom salt) magnesium chloride and magnesium bromide precipitate in the order listed. Thus we see that inorder to obtain pure common salt the company must maintain careful control over the density of brine input to crystalliser and also that discarded from it. Furthermore if the salt is sprayed with some water, or exposed to some rain after harvest any magnesium chloride that may have been deposited will be leached from it.

4.3.2 Productivity: The last time any production took place was in the 1982/83 season. In that year about 100 tonnes of salt was produced. From the discussions, it was revealed that prior to 1982, production averaged at 200 tonnes/year. This represent a yield of about 250 tonnes per hectare of crystalliser or about 2 tonnes per hectare of total pond area. These yield figures are extremely small compared to those reported for some countries which have yields of 10 - 100 tonnes/hectare of total pond area (Manner 1982b).

There are several factors that could affect the productivity of a solar salt field. These include soil conditions, meteorological conditions and the salinity of the starting brine.

In Sierra Leone, the heavy rainfall during the wet season ensures that any residual brine left in the concentrating ponds for the next season is washed away. This can affect productivity because it robs the plant of the benefit of a head-start.

The factor that is likely to be most crucial in the productivity of the field is the climate, more specifically, the net evaporation during the dry season. This should be positive and at least 500 mm for the site to merit consideration. Analysis of rainfall and evaporation data (IDU 1986) shows that the net brine evaporation during the dry season is only 177 mm. This low net evaporation means that very shallow ponds or very high concentrator to crystalliser ratios will be used to produce salt in any quantity. Either way, a very large area of land is required for commercial salt production. Thus it is concluded that the climatic conditions in Sierra Leone are not favourable for commercial production of salt from solar salt fields.

4.3.3 Other Problems

In addition to the technical problems mentioned there are also others relating to the accessibility of the market and general infrastructure facilities. Suen is located in a remote coastal area about 120 kilometers from any major marketing centre. The road to the site is virtually unmotorable. This makes access to market very difficult.

4.4 Concluding Remarks

During this study, the management referred to plans to expand the operation in a joint partnership with a Cuban company. The plan would lead to the production of salt to satisfy the national requirements with possible export. However at the current yield of 2 tonnes/hectares an area of about 6000 hectares would be required for such level of production. This is not only in excess of the company's present lease holding, but also exceeds the total area of coastal land suitable for salt works in Sierra Leone.

Finally, in view of the poor quality of the salt, the low productivity of the field, the non-accessibility to the market, the solar salt project cannot be recommended.

CHAPTER FIVE

TRADITIONAL SALT PROCESSING METHODS

Several coastal settlements in Sierra Leone produce salt either directly or indirectly from sea water. On the map given in fig 4.1 some of the major salt producing areas are indicated. These are mainly located in the coastal area south of the Freetown peninsular with the exception of Tasso Island which is an islet in the estuary of the Sierra Leone River. A large concentration of the production sites are located in the area of the Yawri bay. It should also be mentioned that the solar salt works is located in the same area.

5.1 Description of the Basic Process

There are two types of traditional methods used for salt processing. One method (type 1) is the well known technique of direct production from sea water using traditional methods. The other method (type 2) produces salt from salt-laden silt. A brief description of both techniques will be given here.

5.1.1 Traditional Method Type 1: The technique here is very simple. Large quantity of sea water is stored in open drums or wells. Since the wells are dug in the path of the tide, they are automatically filled during the period of high tide. From these wells the brine is transferred in small quantities to a boiling pan. The other advantage of storing the brine apart from easy access, is that evaporation of water occurs during the period when the tide is low. In the dry season a daily evaporation of 4 mm of water (or approximately 3 mm of weak brine) is possible. Thus the next stage which is the boiling of the sea water, will progress at a rate faster than if fresh sea water was used. Some leaching of salt from salt-laden silts to the moving tide could increase the concentration of the brine.

The brine is usually boiled over a wood-fired stove. The traditional three stone stove is still popular but most salt processors in the Bonthe area where this technology is common, now use a U-shape mud stove which is several times more efficient than the open-fire stove.

After boiling, the salt crystals are put in a perforated basket and sprayed with some water and allowed to drain for a day or two and then dried in the sun. The process of spraying the salt with water will remove any magnesium salt deposited during boiling and hence improve the quality of the salt. This is something we referred to in chapter four which we indicated was not done at the solar salt works, and accounts for their inferior product quality.

This particular technique which died down some years ago, has again reappeared because of the scarcity and high cost of salt. However this process cannot really be looked upon as a reliable source of salt. The quantity of wood required for its operation is the main problem. Even if we assume that after some evaporation from the well the brine concentration increases to about 5 kilograms/litre, it will require about enough energy to evaporate 19.0 kilogram of water for every kilogram of salt produced. This represents a woodfuel requirement of about 2.8 kilogram assuming 100% conversion efficiency. (Table 5.1 gives

TABLE 5.1

Theoretical amount of wood required for the production of salt from various concentrating of brine. (N.B. The stove is assumed to be 15% efficient).

	Fresh Brine	Brine after partial evaporation	Brine from leaching of silts
Specific Gravity of solution	1.035	1.050	1.150
Approximate salt concentration in solution (gm.salt/litre)	35	50	155.00
(A) Approx. amount of salt/100kg of solution	3.4	4.7 kg	13.4 kg
(B) Amount of water per 100 kg solution B = (100-A)	96.6 kg	95.3 kg	86.6 kg
Amount of water per kg. of salt in solution = B/A	28.4 kg	20.27 kg	6.46 kg
Theoretical wood required (kg/kg of salt produced)	28.4 kg	20.3 kg	6.47 kg

Latent heat of water = 2256 KJ/kg

Cal. value of wood = 15 MJ/kg.

the summary of energy requirements). This is a large amount of wood and explains why during the survey the only problem this group of processors said they had was with the supply of fuel. This was not expressed by any of the other group of traditional processors (Type II). Later on in this chapter it will be shown whether this operations makes an economic profit if all factors including labour have a commercial value.

The operation only takes place during the dry season (December - May) when they can be sure of high concentration brine. Very little capital is required. Only a galvanised metal pot costing about Le140/00 (replasable every season) is required. Each operation had a team of 2 to 5 people (a husband and a wife and sometimes children). The average daily consumption of wood is about six 40 kilograms bundles per day.

Boiling of a solution to produce 20 kilograms of salt would normally take an average of 2½ days continous operation including night-time supervision. Thus a total of about 600 kilogram of wood is required to produce 20 kilogram of salt. The production rate of 20 kg every 2½ days per group of three can be stated as 3 kg/man-day which is extremely small when compared to the other type of traditional process.

The salt was of the same quality as the Mokambi salt given in the analysis in table 3.1. The producers have no problem in selling. It was observed however that all the producers considered this salt operation as only a minor source of income. Fishing was listed as the main occupation and the feeling was that if encouraged, they would rather do fishing all the time.

On the issue of cooperative marketing, almost all the producers using this technology in the Bonthe region were opposed to it.

This may be partly due to the fact that they consider this whole salt production as a temporary income source and would therefore not like to enter into long term arrangements.

5.1.2 <u>Traditional Technique Type II</u>: This type of method produces salt from the salt-laden silts deposited at coastal estuaries of certain rivers, notably the Ribbi river and the Rokel river. Although a few activities involving such techniques were spotted on Tasso Island north of Freetown, and the Sherbro Island, the bulk of salt produced by this technique is from an area a few miles south west of Newton (see inset on the map of Sierra Leone fig. 4.1).

The technique involves producing a highly concentrated brine from salt-laden silts which are collected from the tidal flats and creek beds. The salt is leached from the silts by a percolation process. A filter funnel is packed with silt and fresh well water (which is often saline) is poured through the bed. The filter funnel which is depicted in Appendix 1, is made with sticks and lined with wood leaves. The filter medium at the bottom, is a collection of well-placed rice straw resting on small sticks. During the peak season several of these filters will be used simultaneously. They are usually placed over a wooden trough that collects the filtrate.
After filtration, the filtrate is poured into enamel pans (sometimes locally fabricated galvanised pans) and heated over stove. The water evaporates and the salt crystallises. The wet salt is sprayed with a small quantity of water to wash away the magnesium salt impurities. The salt is then allowed to drain for a day or two and then dried in the sun.

The salt is sold by container loads (approximately 30 kg) to anybody (retailer or wholesaler), who visits the site. All salt produced is sold immediately and on site.

The operation is far more efficient in energy use than the type I traditional operation described earlier. This is due to the highly concentrated brine used in the boiling operation. The densities of samples of the brine were measured. These averaged at about 1150 gm/litre, indicating a concentration of about 150 grammes of salt in a litre of the solution. This is considerably higher than that of the fresh brine which has a density of 1035 gm/litre. Thus the woodfuel requirement will only be about 20% of that required for the production of salt from fresh sea water.

One advantage of the operation is that it can take place throughout the year, if properly planned. This is quite unlike any of the local salt manufacturing techniques we have discussed. The silt used in the process can only be collected during dry season (December - April). Large quantities of the silts are usually collected during this period and stored outside in the open where they are covered with straw and palm leaves to protect them from the rain. Some producers have now started storing in covered huts. Once there is a large stock of the silt the filtration and boiling can go on throughout the year. However nearly all the people interviewed indicated that they are only engaged in salt production for about four (4) months a year, and that whatever is stored is carried over to the next year.

This may be due to the fact that salt production is just one of several income sources. Once the farming season begins, the salt production stops. This is because the boiling of salt is far more labour intensive than farming. Sometimes boiling can go on continously for 24 hours and somebody has to be there to maintain the fire and add the brine when it is low. Most salt producers virtually sleep by their fire hence the need to have a break every four months. However it is hoped that if the drudgery and pain of the production can be reduced through improved technology, production throughout the year could be organised.

The quantity of wood used by the producer depended on the type of stove used. About three years ago a Non-governmental organisation, Foster Parents Plan International of Freetown, (see Massaquoi, 1985) initiated a project to introduce improved stoves in the salt production project. Nearly twenty such stoves were built and several more have been built since then by individuals. These stoves have been tested both in the laboratory and in the field and found to give a 60% or more savings of wood compared to the traditional three stone stoves (Kamara, 1985). The stoves which are illustrated in the Appendix 2 can heat two salt boiling pans simultaneously. Thus, in addition to the saving in the woodfuel used in the operation, the stove is also able to save time and increase the productivity of the operation.

During the survey it was discovered that the production of salt from silt using traditional stoves required an average of approximately 400 kilograms of wood for every 30 kg batch of salt produced. On the other hand the improved stoves used only 200 kg woodfuel to heat two salt pans each producing 30 kg.

Usually most operators prefer to collect all the silts they require for the season at the start of the season. This is usually a two or more weeks operation involving several man-hours. Others prefer to collect enough silt to last only a few days. Still others, collect and process simultaneously with no storage of the silt. It was estimated that silt collected in approximately 1½ man-hours was used to process 30 - 32 kgm of salt.

5.2 Economics of Salt Production by Traditional Method

In this section, attempt is made to determine the cost of fixed capital involved in starting the operation, the production cost and the profit from the operation. Some price have been put on the labour and wood used in the operation. The salt producers normally consider both labour and wood as free and hence consider any income as profit, but there is need to carry out a profit and loss calculation, if only to find out whether their income is not simply a wage for their labour in collecting the silt or wood. For if it turns out that there is no real profit, then the industry will collapse once other employment is available in the community.

5.2.1 Capital Cost: For the traditional type II the fixed capital involved is very small: representing only the cost of the boiling pan, stove (if improved stove is used), a wooden trough for collecting the filtrate the cost for housing the operation and the filtration equipment. Only the boiling pan and sometimes the wooden trough and the improved stove involve cash transfer. The filtration system, the hut and the traditional stoves are normally made by the producer. On the basis of information provided by the salt producers, it is estimated that the fixed capital involved in traditional type II production process is Le360/00 with three stone or U-shape stoves and Le600/00 with improved stoves. A breakdown of these figures is given in table 5.2. A twenty percentage contigency allowance has been added for the cost of assembling the items and clearing the production site.

For the type I traditional producers, the capital investment is even smaller with only the boiling pan involving a cash transaction. The estimated capital involved in this type of operation is Le240.00 (see table 5.2).

In both types of operations, the costs of the production huts, the filter funnel and stoves have been estimated from information on the labour involved in their construction and the local cost of labour. All capital items except the wooden trough are replaceable at the end of each production season. The improved stoves made of mud/cement bricks instead of pure mud bricks can serve two seasons.

The working capital is what most of the traditional salt producers lack. It was revealed very vividly in all responses to all the questionnaire that some amount of money to help them in the early production period is very crucial to their motivation. Effectively, a working capital in such an operation is some amount of money necessary to feed the producers and their families for the first two weeks of the production season whilst they wait for the proceeds from their first sale. Thus the typical production unit (an average of 4 persons) would require at least Le600 /00 as working capital in a realistic commercial venture. Needless to say that this amount is not available to any of the production units interviewed in this study. In general producers

Table 5.2

Capital cost of the various traditional salt processes

(a) Type 1

Item	Cost
Boiling pan	150
Stove	-
Temporary hut	50
Contingency	40
	Le 240

(b) Type II

Item	Cost if using traditional stove	Cost if using improved stove
Boiling pan	150	150
Stove	-	200
Filtration unit	20	20
Wooden trough	80	80
Temporary hut	50	50
	Le 300	Le500
Contingency	60	100
	Le 360	Le600

start with only a few basic foodstuffs in store and prepare themselves for a "hungry" period of about two (2) weeks to one month.

Thus the cash equivalent of the total initial input into the production process (i.e. the total capital) is Le840 for traditional type I and Le960 (for type II) and Le1020 for type II (with improved stove).

5.2.2 Production Cost: The cost of producing a single batch of salt was estimated. In the traditional type I process, a batch is about 20 kg and is on average produced twice a week. In the type II process a batch of 30 kg is processed six times a week. Other assumptions made in estimating the average production cost are as follows:

* cost of wood is assumed to be Le10/forty kg bundle
* labour is Le12/man-day (8 man-hours)
* over night rate for supervision of the operations is one and half times the day time equivalent
* little or no labour is involved in the filtration process
* although not much physical labour is involved in the boiling of the solution, it is assumed that supervisory labour is involved inorder to maintain the fire and prevent an overspill of the froth into the fire.

Table 5.3 presents a summary of the cost of the materials involved in the production of a batch of salt. It is observed that the production cost of a kilogram of salt is Le13.05 by the type I traditional method, Le4.15 by the type II traditional method

Table 5.3

Details of cost of production 1 kg of salt.

(a) Traditional type I

Direct production cost of a batch of 20 kg salt

Item	Quantity used	Rate	Cost of item
Wood	600	Le10/40 kg bundle	150.00
Labour for boiling	36	Le1.50/man-hr (day-time)	54.00
"	24	Le2.25/man-hr (night)	54.00
Labour for washing and drying	2	1.50	3.00
	Total cost of batch		Le261.00
Direct production cost of a kg. of salt			Le 13.05

(b) Traditional type II (with 3-stone stove)

Production cost of a batch of 30 kg salt

Item	Quantity used	Rate	Cost of item
Labour for silt collection	1½ man-hours	Le1.50/man-hour	Le2.25
Labour for preparation of filter bed	1 man-hours	Le1.50/man-hour	1.50
Labour for boiling	12 man-hours	Le1.50/man-hour	18.00
Labour for washing/drying	2 man-hours	1.50	3.00
Wood	400 kg	Le10/40 kg bundle	100.00
		Total cost of batch	Le 124.75
	Production cost of a kg.of salt		Le 4.15

(c) Traditional Type ((II)) (with improved stove)

Production cost of two batches of 60 kg salt

(note: Two pots are simultaneously boiled in this stove)

Item	Quantity used	Rate	Cost of item
Labour for silt collection	3 man-hrs	Le1.50/ man-hr	4.50
Labour for preparation of filter	2 man-hrs.	Le1.50/ man-hr	3.00
Labour for boiling	8 man-hrs	Le1.50/ man-hr	12.00
Labour for washing/drying	4 man-hrs	Le1.50/ man-hr	6.00
Wood	200 kgs.	Le10/40 kg bundles	50.00
	Total cost of batches		Le75.00
	Production cost of a kg of salt		Le 1.25

using the three stone stove and Le1.25 when using the improved stove in the type II method.

The biggest contributor to the production cost is the cost of wood which represents 60 - 80% of the entire cost of the operations. This means that if the production cost is to be reduced efforts must be concentrated on reducing the wood requirement. This is particularly obvious when one observes that by introducing improved stove into the type II process, the production cost is reduced from Le4.15/kg salt to Le1.25/kg salt. The introduction of improved stove not only reduces the total wood used, but it also drastically reduces the boiling times which improves the production capacity considerably.

The traditional type I method produces very expensive salt because of the low concentration of brine that is boiled. This leads to large wood requirement and a very big demand in time to boil the solution to dryness.

5.2.3 <u>Profitability of the Traditional Methods:</u> In order to determine the annual profit made by each production unit, we shall first estimate the total production per season. From the interview it was estimated that the average annual production of those using type I stove is 640 kg. This estimate is based on an average weekly production of two 20 kg batches for a period of four (4) months.

Similarly for the type II methods (using any stove), the average annual production based on a daily production of 30 kg batches in a six-day week for 4 months, is estimated as 2880 kg. There was no reported increase in the annual production when improved stove was used, even though the savings in time in the boiling operation could have made it possible. However it is likely that a constraint was imposed by the rate of filtration. This is something that should be noted. Any effort to improve any activity must examine its effect on succeeding activities as well as how it is affected by preceeding activities.

Other assumptions made in estimating the profit of a production unit for salt, are as follows:

* the sale price of salt is Le5.00/kg. This is the price which is paid at the production site. In the markets, these locally produced salt go for Le8.00 per kg and imported salt is sold for Le12/00 per kg. Refined table salt is sold in the supermarkets at Le20/00 per kg;

* there is no sale cost incurred by the producers. All the salt produced are sold at the site within two-weeks of production;

* the annual depreciation of the fixed capital item is equal to the total initial cost of the capital except the wooden trough which has a much longer life and hence a very low depreciation rate.

Table 5.4 shows the steps in the computation of the annual profit as well as its values. It is immediately observed that there is no economic profit in producing salt by traditional type I process. Even if we were to assume that the labour for boiling the brine as well as collecting the wood is "free," and therefore consider the total sales income as profit, the sales value of Le3200/00 per production unit of 3 or 4 persons is very small. This infact explains why this method is not popular.

Table 5.4

Annual profit from a production unit (Ave. of 3 - 4 persons)

	Type 1	Type II (a)	Type II (b)
Production cost per kg (Le)	13.05	4.15	1.25
Average annual production (kg)	640.00	2880	2880
Annual production cost (Le (A)	8352.00	11,952	3600
Annual depreciation of fixed capital (B)	240.00	220	420
Total annual sale (C)	3200.00	14,400	14,400
Gross annual profit C - (A + B) (Le)	(-5392.0)	2228	10,380
Loss/profit per kg. of salt produced (Le)	(-8.425)	0.77	3.60

In fact several of the people involved in the operation were only interested in producing enough salt for themselves, friends and relatives in other regions.

The profit from the traditional type II process involving open fire stove is estimated at Le2228/00 per annum. This figure is significant especially when one considers that all the estimated annual operating expenditure of Le11,952/00 goes back to them because they collect the wood and the silt for the process. So infact even though the profit is only Le2228 their total annual income is approximately Le14,400 (i.e. the total annual sale).

For a family unit working together this income is quite high in a rural setting.

Finally we also observe that when improved stoves are used in the type II method the profit margin is increased considerably while the sales income remains the same.

5.3 National Production Capacity of Small Scale Salt

In estimating the national production capacities, we have restricted our efforts to the determination of the total production from the type II method. This is because it was revealed from the survey that type I is still not yet a major operation and is really restricted to remote coastal areas in Bonthe and Moyamba districts (Shenge area). Amount produced in this operation is definitely no more than 10% of the total traditional small scale salt production.

5.3.1 <u>Existing (or Current) Production Capacity:</u> It was discovered early on in the study that in the area producing salt from silt, every household was engaged in the operation.

Thus, instead of conducting a census of all the producers, it was cheaper to use the extract of the information from the national household population census. Knowledge of the total number of households in the area (N.B. each household is a production unit) combined with the figures for the average annual production by each unit, will give the total quantity of salt available annually from this source. Accordingly, the major production villages were all identified and their household populations are listed in table 5.5. It is estimated that the total number of households engaged in the salt-from-silt process is approximately 1157. In this estimation technique there may be some over estimation for some regions and some under estimation in other areas so that the effects are balanced out. For instance in the case of Tasso Island using the number of households as the production units may overestimate because not all households are involved in salt processing. On the other hand in Batkong, Fogbo and Mokimba, the figures may be an underestimate because some households may have two production units instead of one. This was certainly noticed in Mokimba and could even be observed from the larger than average value for the population per household. Overall, therefore, the estimate of 1157 small scale salt production units is realistic.

If it is assumed that the average annual production of each production unit is 29 tonnes (see table 5.4), then the total annual production of salt from silt in the whole country is approximately 3,400 tonnes. If we take note of the very small quantity of salt produced from silt in some parts of the Bonthe District (Maima, York Island, Bonti Bai) and also the salt produced from fresh sea water in and around Bonthe town and Shenge the total estimated annual production of salt by small

Table 5.5

Number of households, persons and sex distribution - major salt producing villages

(Source: Provisional figures of 1985 national census)

Name of Village	Administrative region in which located	Number of house-holds	Number of persons	Male	Female
SUEN	Ribbi chiefdom Moyamba dist.	145	921	448	473
Morkase I & II	" "	20	181	85	96
Sea Port	" "	13	98	40	58
Monkoni	" "	6	40	21	19
Banga Ground	Bumpe Chiefdom Moyamba dist.	67	434	221	213
Moia	" "	73	476	222	254
Tasso Island	East III, Western Rural Area	580	3672	1952	1720
Makombi	York, " "	9	63	37	26
Moiyon	Koya, " "	34	268	131	137
Ma-koi Lunga	" " "	19	112	53	59
Batkomp	" " "	15	162	86	76
Masili Mani	" " "	28	172	78	94
Makonkobo	York Western Rural district	5	29	18	11
Banga Ground	" " "	3	13	9	4
Fogbo	Koya Western Rural District	75	547	292	255
Ma-Konte	" " "	9	67	31	36
Mashewore	" " "	7	40	20	20
Barmouth	" " "	13	85	43	45
Makimba	" " "	20	160	82	78
Rokai/Salt Pan	" " "	16	102	49	53
	Total	1157			

scale producers is 4000 tonnes. This represents about 30% of the total salt consumption in the country.

The production capacity of the Bonthe district has not figured strongly in the estimate even though the potential is great because in addition to firewood problem which every salt producer encounters, they also have a problem of marketing. Unlike Koya rural district and Tasso Island which are located just outside Freetown, the Bonthe salt producing areas are too far from any major urban market and transportation facilities can be difficult. The survey showed an average of 6 weeks delay between production and sales compared to one week reported in Koya area. Thus marketing is a major issue in any policy to assist the development of the small scale salt producers of Bonthe.

5.3.2 <u>Potential Capacity</u>: In section 5.3.1 we examined the present total annual production of salt from small scale industries. In this section we examine the potential for expanding this industry given the correct policies. (Once again we shall restrict our consideration only to type II salt production). Existing salt production from silt are concentrated mainly at the estuaries of rivers Rokel, Ribbi and Kukuli. However it is observed from the map in fig 5.1 that other coastal areas also have silt deposits and hence could serve as small scale salt production centre. These areas are located in the estuarine swamps of rivers Kagboro, Thanka, Bagru and Jong as well as the northern area of the Sherbro island. The soil type in all these estuaries are weekly developed mud and hydromorphic clays. The total area suitable for deposit of salt laden silts is

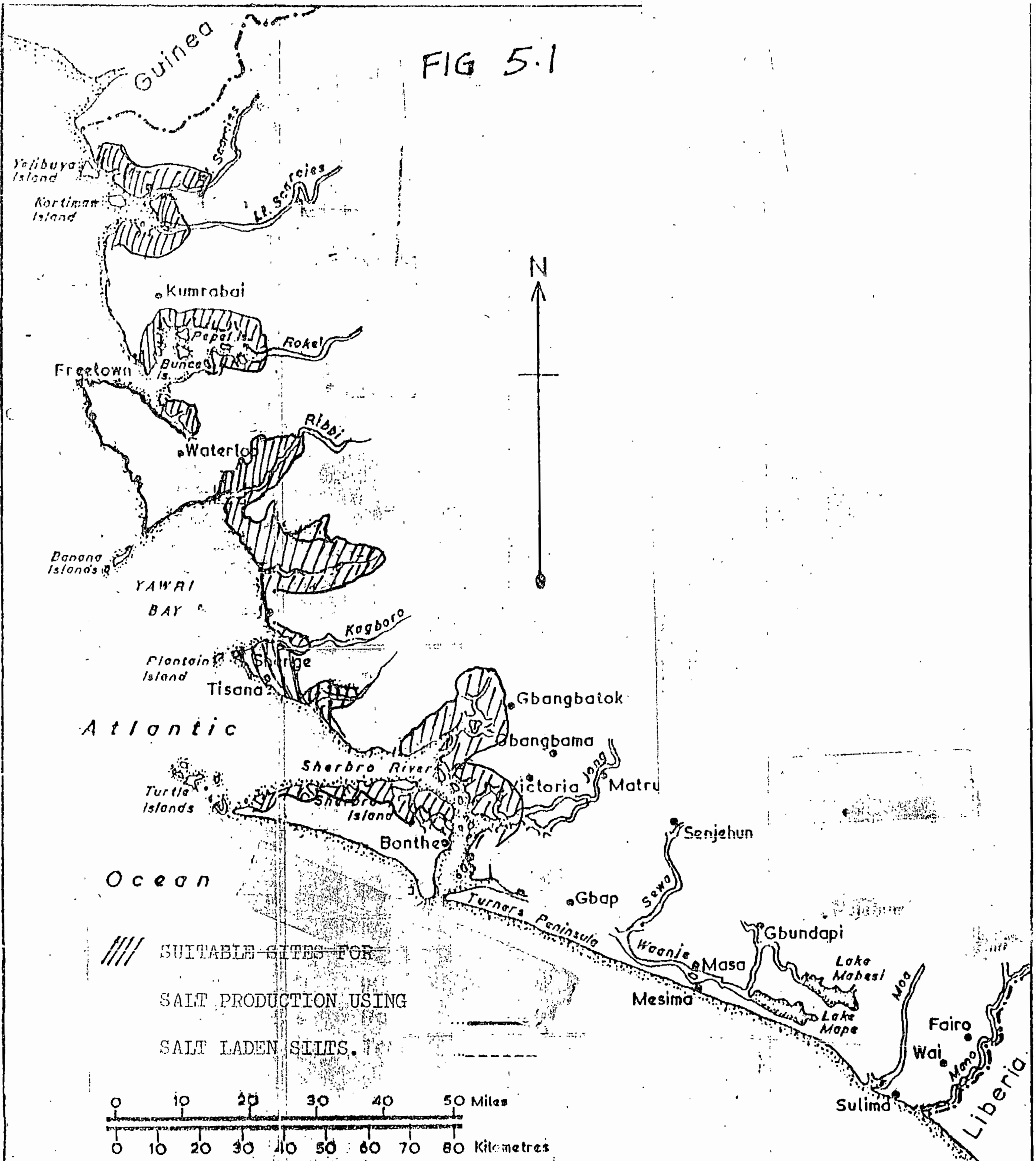


FIG 5.1

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estimated as 2347 km^2 (PEMSU 1983). Only about one fourth is presently be utilised. Thus from the point of view of the availability of the silts the salt production could easily be extended to other areas and increase its present level four (4) times. However the biggest constraint in the development of salt production in these areas is their remoteness from the markets. Unless a good communication system can be developed (e.g. feeder roads programme) it is unlikely that these areas can jointly produce more than the 4000 tonnes now produced annually. Most of their product could be channelled to provincial towns especially those in Moyamba, Bonthe and Bo district.

In the existing production sites there is plenty of silt for several more production units. However the number of production units can only be increased if population of the area increases or if the idea of seasonal inhabitants is encouraged. In the meantime the silt can be effectively exploited if the presented production technique is improved. For instance, the introduction of fuel efficient stoves coupled with more filtration units could double the production with the same effort. Or one could even look into the possibility of eliminating the stove entirely and evaporate the concentrated brine with solar energy.

The latter is ~~more~~ into the future requiring some research effort. But the fuel-efficient stoves can be introduced at once and thereby increase the annual production by some 2000 - 4000 tonnes.

Thus with the appropriate policies to extend and improve the salt production from salt-laden silt, it is possible to have annual production of 10,000 - 12,000 tonnes of salt a year. This is almost enough to satisfy the national demand.

5.4 Contribution of Small Scale Industry to the National Economy

The small scale salt industry produces 4000 tonnes of salt a year with total combined revenue of 20.0 million leones. Thus it is expected that the industry should be making contributions within the economy. Among them, are the employment they provide to the rural population, the savings in foreign exchange, the security of supply and the provision of low cost salt.

The industry provides employment for nearly 1150 households approximately 2500 adults with an average income of about Le8000/00 a year. Further employment could be provided at very marginal cost by developing policies in favour of the small scale producers. As will be shown later the capital labour ratio for this small scale industry is very low.

The industry requires no foreign raw material for its production process. Hence, on the basis of existing production rate, a foreign exchange saving of about US $300,000 (approximately Le7.5 million) can be realised. This amount is very significant representing 0.4% of the total foreign exchange available in the country. By far the biggest advantages of the local salt production process is the security of supply and the low cost of the product. Local salt is available at about 40% of the price of the salt imported by the salt manufacturing company and at almost comparable quality. Furthermore a local production process can ensure that salt is available no matter what the foreign exchange situation is like.

The main disadvantages of the small scale salt processing are the low labour productivity and the lack of contribution to the national treasury by way of payment of income tax and excise duties. The small scale salt processors are not registered and therefore do not pay excise duties or income tax. It is estimated that, based on existing rates paid by the salt manufacturing company (SMC) at Kissy, at least Le750,000 is lost by government through excise tax which could have been paid had the quantity of salt produced by small scale processors been produced in SMC Kissy. Furthermore a total of Le1.4 million is lost which could have been obtained from import duty and fees if the locally purchased salt were imported.

The problem of low labour productivity is not an important consideration since unemployment is very high in these areas, especially during the dry season when there are no farming activities.

5.5 Cooperative Marketing

There is very little trust in cooperative system after the collapse of the previous national cooperative society. However, it was revealed during the study that some processors (about 20%) will be interested in participating in a cooperative marketing scheme if it will bring them loans for use as working capital. Most, however, were not impressed by the idea. This was also due to the fact there was no expressed marketing problem in the sale of the salt.

CHAPTER SIX

REVIEW OF EXISTING GOVERNMENT POLICY ON TRADE AND MANUFACTURE OF SALT

In order to set the limits on our enquiry into existing government policies pertinent to the development of a local salt industry, it is necessary to first understand the role and nature of technology policy. Such an examination will enable us to recognise what we are looking for as well as give an insight into the basis of some of the policy decisions.

6.1 Role and Nature of Technology Policy

6.1.1 What is Technology? Technology is simply defined as the application of knowledge either directly or with the aid of some tool or machine (Dickson 1974). It is the useful combination of "man-material-tools." (Muller 1973). The definition of technology may also be presented in terms of the nature and specifications of its product and the technique used to produce it (Stewart 1977). Such product specification may include the general role the product plays within the economy (e.g. luxury, intermediate, and capital goods), the functional need it fulfils (e.g. shelter, food etc.) and the technical details. Hence one frequently hears of "food technology," and "chemical technology" both of which define the type of technology in terms of its products.

It would appear from the above definitions that technology is represented only by the visible hardward such as tools, machines and products. But a close examination of the basic definition of technology would indicate that the application of knowledge (i.e. technology) will only be possible if there is knowledge, skill (know-how), experience and education. Thus the latter group represents the softward of technology while machines, tools and products represent the hardware.

6.1.2 <u>What is Policy?</u> A policy is simply a statement of objectives. It is normally formulated to guide a course of action towards a specific goal. There are two parts to any policy: A policy statement and policy instruments. The former is a statement of objective and the latter is list of actions and considerations necessary to achieve the objectives.

6.1.3 <u>Technology Policy:</u> Technology policy tend to cover a wide range of topics involving several disciplines in the physical and social sciences. Examples of technology policy issues include, diffusion and adaptation of technological innovations, technology choice, technology management and technology transfer. The present study involves both technology choice and the development and diffusion of technological innovations in the salt industry.

It is observed from the previous definitions that in general policies on technology choice will cover choice of product, knowledge, enterprise organisation and production technique.

Once the technology has been selected the problem of diffusion will rely on the policy instruments such as tariffs or technical training, and other financial incentives. It is in the light of this last category of technology policy that we shall review existing government policy on salt trade and manufacture.

6.2 Past and Ongoing Measures for Promoting Local Salt Manufacture

In this analysis the definition of local salt manufacturers does not include the salt manufacturing company at Kissy which only process intermediate products. Thus local salt manufacturer include only the small scale processors and the solar salt at Suen.

There is at present no definite, clear-cut, coherent government policy for the promotion of a local salt industry. What few measures exist can only be isolated from the global government policy on small scale industries development and the levels of tariffs set in various budget speeches. We shall therefore review government measures relevant to the salt industry in two parts: one part will review the general policy on the promotion of small scale industry with particular reference to the salt industry; another part will examine the present tariffs on salt trade and manufacture.

6.2.1 General Policy on Promotion of Small Scale Industry (SSI)

Compared to the big industrial establishment, little has been done at government level to promote the development of small-scale industries in Sierra Leone. The 1960 industrial Development Act (Sierra Leone Government, 1960) was geared solely to the establishment and development of big industries. It was not until 1969, that the first practical effort was made in the development of SSI when the Small/Scale Industry and Handicraft Division(SSHID) was established within the Ministry of Trade and Industry. However most of its work has been concentrated in Freetown and mainly in the fields of handicraft production. Rural small scale industries such as salt production had been completely ignored until 1983 when the small scale soap industries were developed. This followed recommendations of Chuta and Wijenaike, 1982 on the promotion of rural small scale industries and handicrafts.

In 1982, a parliamentary bill was drafted with the objective of promoting rural as well as urban small scale industries and handicrafts. The draft (Sierra Leone Government, 1982) which is extensively reviewed by Mulagwe (1984), was never passed by parliament. Had it become law, it would have provided the framework for the promotion of all small scale industries and establish the SSIHD as the sole agents of the promotion efforts. As far as small scale salt production is concerned the act would have made it possible for SSIHD to:provide extension facilities such as advice on marketing, finance, management, product development, quality control etc. (ii) establish pilot projects, common facilities and training programmes; (iii) plan and implement an internal and external marketing programme for the products; (iv) undertake any other activities as would be necessary for the promotion of the industry.

Some of the policy instrument embodied in the bill included the establishment of a small industries and handicrafts development financing programme and the provision of soft loans, seed-capital, and working capital. Government were also to protect this sector through tariffs on imported competing items.

Although the draft Act of 1982 was never passed, the SSIHD if it is fairly well staffed, can carry out some of the policy objectives of the act. However its activities especially in the rural areas has not been effective because of the lack of adequate transportation facilities.

6.2.2 <u>Government Tariffs and its Effect on Local Salt Industry</u>: There are three types of tariffs which the Sierra Leone Government levies on salt trade and manufacture. They are the customs duties, the import fee and the excise duty. The current level of these tariffs are as follows: The excise duty is 10% of the selling price and the combined import fee and custom duty is 12% of the CIF value.

Although the levels of tariffs is low it is sufficiently high to keep the price of the imported salt far above that produced locally. Any increase in tariff in order to protect the local industry is really not necessary especially when one takes into account that the supply of locally-produced salt cannot meet demand and the local producers have no problem in selling their product even in the face of competition from imported salt.

CHAPTER SEVEN

CRITERIA FOR TECHNOLOGY SELECTION: POLICY OBJECTIVES AND ISSUES

In this chapter we shall discuss some of the issues which will form the bases of selection of a technique for salt production in Sierra Leone. The chapter begins by giving a quick background on some of the approaches to technology selection. It then spells out the objective of any choice of technique in the Sierra Leone context and finally presents the issues involved in such objectives and the criteria that are used for the selection.

7.1 Approaches to Technology Selection

It was argued earlier in chapter six that each technology is associated with a vector of characteristics which include the production technique itself, the knowledge, the type of organisation and the nature of the product. In the case of salt manufacture we are initially restricted to two main technologies (the solar technology and the traditional technology). This does not mean that there are only two technologies for salt manufacture. But in any selection of technique the choice is usually confined to those about which the community has complete knowledge which may not necessarily be a complete set of technologies. Within each technology various techniques have been identified in previous discussions which maximise either production and/or quality of the product. Thus we are now expected to consider three "different types" of technology. Traditional technology (Types I and II) and solar technology.

There are several approaches to technology selection depending on the objectives of the development process. In this section we give a brief outline of some of the major selection mechanisms in use, and after giving the objectives of the expected choice (Section 7.2), we shall then raise the issues to be considered (Section 7.3). In general the type of technology selected will depend on whether the motive is to maximise profits[1], (neo classical approach) maximise current output of the product, encourage more equitable distribution of income (the appropriate technology approach) or undertake a structural transformation of the output mix.

There are two broad categories of the selection process: A purely empirical choice and theoretical (or analytical) choice. The former approach selects the technology by carrying out a comparative assessment of the various parameters of the technology. This approach measures or evaluates all the parameters which fit the objective of the selection. In this study because technologies we are dealing with are few and because the scope of the variation of the parameters of these technologies are limited, we have opted for the empirical approach in selecting the technology. The second approach develops a general model of technological choice by fitting production functions to data within an industry. This approach has been subject to many criticisms for failing to fully address some of the problems of developing countries. (Enos, 1982); Morawetz (1974 ,1976); O'Herlihy (1972); Harcourt (1972)).

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1. The neo classical model of choice of technique picks out two characteristics of techniques-labour and investment requirements - and regards the question of choice of techniques of differing labour and investment intensity. The relative price of labour and investment is regarded as the determinant of this choice, with that technique being selected that maximises profits given the relative price and substitutability between labour and capital. F.Stewart. Pg.25, Technology and Underdevelopment. Macmillan Press Ltd. (1977).

7.2 Objectives of the Technology Choice

In the proceeding section it was argued that the process of technology choice in this work will involve the empirical determination of various characteristics of the technologies followed by a comparative study. In order to decide on which parameters of the technology one should look for one needs to state the objectives of the selection process. It was pointed out early on in chapter 1 that there is considerable dependence in Sierra Leone on imported salt. This has the dual disadvantage of the uncertainty of supply and a drain on the foreign exchange. Thus the primary objective of any technology selection is to maximise output. Furthermore the technology must return an economic profit so as not to be dependent on subsidies. As secondary objective, it will be useful if the industry were to provide employment for large number of people which will be in keeping with the overall government policy of emphasizing labour-intensive enterprises (S.L.Govt. 1983). However it is very likely there is some trade-off between increase in output and increase in employment (Morawetz 1974). If there is such a trade off it is usually recommended that employment should be chosen (ILO, 1976). However, given the priority accorded our objectives in the selection of the technology, where there is a trade-off between employment and output we shall choose the latter. In any case Chuta and Liedholm (1975) have shown that if a technology possesses the highest output-capital ratio and also the highest labour-capital ratios, then both employment and output can be jointly maximised and the conflict will never arise. This will therefore be one of the main issues in the selection of the technology.

7.3 The Issues

The discussions on the approaches to technology choice followed by the statement of the objectives leads one to the issues involved in the selection of technology for salt production in Sierra Leone. One can categorise the issues into two very broad classes. Issues which can be completely assessed from field data which we refer to as empirical issues and those issue which require some theoretical analysis (analytical issues).

7.3.1 Empirical Issues: From the statement of the objective one can identify three types of empirical issue: Those dealing with resource efficiency, and those dealing with the economic profitability of the technology and general issues. Under resource efficiency we have looked at labour intensity and capital intensity. The concept of labour intensity is fairly complex with several definitions depending on the objectives of the user (Bhalla). In most literature on technology choice, labour intensity is often inferred from the degree of capital intensity (i.e. in terms of capital-labour and capital-output ratio). Thus the determination of capital intensity invariably leads to the determination of the labour intensity. In this work, since our objective was the maximisation of output, we have used the definitions of labour intensity as the labour coefficient (i.e. the ratio of labour to output L/V and the labour capital ratio L/K). The inverse of the latter represents the capital intensity. In investigating the intensity of capital we had also examined the intensity of foreign exchange requirement for the different technologies.

Another major empirical issue is whether or not the various salt production techniques generate positive economic profits when all factors are valued in terms of their opportunity cost. An examination of the profits will not only reveal the underlying strength of the various technologies but also permit one to ascertain if there is any relationship between the performance of certain aspects of the technology and the economic profit. It is hoped that such analysis would lead to suggestions for improvement in the related technology.

Among the general empirical issues are the seasonality of the production process and the locational requirement.

7.3.2 Analytical Issues: The issues involve major determinants of the demand for and output of the various technologies. It is expected that an analytical approach will reveal the strength and characteristics of the demand for the salt of the different technologies and the factors that affect supply.

The considerations of the nature of demand is important inorder to determine the economic viability of the industry especially in the face of competition. The main issue in demand analysis is how it is affected by income of the consumers. If the salt is considered are "inferior" goods then the demand for it will drop as the income of the consumer increases. Specifically it is necessary to estimate the income elasticity of demand coefficients because it clearly illustrates the linkage between incomes and quantity of salt demanded. This involves fitting a functional relationship to an empirical data. Fitting a function such as the following $C = AE^{b_1}S^{b_2}$ one could get a value for b_1 which is the approximate value of the income elasticity of demand. In the above equations b_1 is the income elasticity demand coefficient, E is the value of cash expenditures (indirect indication of income) C is the value of salt purchased and S is the household size.

Another aspect of the nature of the demand is the size of the non-income demand sources. Such sources would include industry (e.g. soap making) and agriculture. If the non-income demand is strong then the income elasticity of demand coefficient may not be a controlling parameter.

The supply of salt will be affected by both the choice of technique and the relationship between interpreneural characteristics and profit. In the analytical approach to resolving the issues of technology choice it was pointed out earlier that the most common method is the use of Neo-classical production functions such as the Cobb-Douglas and the constant elasticity of substitution (CES) production functions (Liedholm and Chuta 1976). However it has been agreed in several literature (Morawetz, 1974; O'Herlihy 1972) that this may not be a good approach for developing countries because the production function fails to take note of the fact that in these countries what is sought is not so much a "production of goods as an assignment of benefits." (Enos 1982).[2] Factors such as maintenance problems

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2. As an example of how the production function fails to address problems of developing countries we quote from a paper by J.L.Enos (1982) "... the economic production function is a relation between the physical quantities of inputs and the physical quantities of output - for inputs, this means so many units of a particular raw material, so many man-hours of a particular skill, so many machine hours of a particular piece of equipment, so many bureaucratic hours of various types of administration. It is irrelevant to the production function how these raw materials are acquired, how the providers of labour are organised, how the ownership of the capital goods is distributed, whose interests the bureaucracy has at heart, and in consequence, how each factor of production is regarded. Guided by the production function how does one treat these 'hows'?"

in remote areas, cultural inhibitions to certain technologies, the nature of ownership, whether profits are repatriated abroad or returned for local use and the nationality of the labour force are usually not accounted for by production functions.

7.3.3 General: In this work only the empirical issues outlined in (7.3.1) have been investigated. The analytical issues have not been examined for the following reasons: The demand considerations are mainly about the income elasticity of demand. Since the analysis of the salt of the various local technologies concerned shows that they are all about the same, the elasticity coefficients are likely to be the same and hence effect of income on demand will be small for the products of the local salt production industries. If however we put the locally produced salt against imported salt, the situation changes considerably. The locally produced salt could become an "inferior good" and our analysis for the choice of technology should then be extended to include foreign technologies (including salt refinery etc). However our task now is only to identify the most viable local salt production technique and suggest ways of improving the technique and the product.

On the supply side, the neo-classical analytical production function approach to technology selection in developing countries has already been discredited by several authors and hence could not be adopted in this work.

CHAPTER EIGHT

SELECTION OF SALT TECHNOLOGY

A decision is to be made on which technology to promote. There are at present three known techniques for producing salt. These are the solar evaporation of sea water, the boiling of sea water over woodfuel stove and the extraction of salt from salt-laden silts. There is no point trying to promote a particular salt production technology if its performance is not the best among the lot. Hence the need arises for technology selection. Furthermore, each technology has associated with it a set of variables which affect their overall performance. It may also be necessary in the process of the technology selection, to highlight the weak and strong links in each technology. This will help in the formulation of a policy for promoting the technology.

The criteria of selection and their basis have already been outlined in chapter 7. We shall use these criteria to choose the most suitable technology for salt production in Sierra Leone. Table 8.1 gives a summary of the values of various parameters for the different salt production technologies presently employed in Sierra Leone. The computations of these parameters were carried out using values presented in chapter 4 and 5. We shall now proceed to examine the three types of salt production techniques on the basis of the three previously selected criteria: output maximisation, resource utilisation efficiency and economic profitability.

8.1 Output Maximisation

Table 8.1 gives both the current capacity and the potential production rate if all available resources are developed. At the moment the production level at the solar salt work at Suen, is nil, and it has been so far the last 3 years. Its potential is 600 tonnes/year which will be very difficult to improve on because of the low productivity of the process. At the present level of productivity one hectare of land will be required for every two tonnes of salt produced. Hence it will be difficult from the point of view of availability of suitable land and land preparation to increase production capacity.

The traditional type I method which produces salt from fresh sea water has a capacity of 600 tonnes/annum and cannot be expanded any further because of the constraint on the supply of wood. The quantity of wood required is several times that required in the type II operation and in most cases the processing takes place on beaches where wood may be very scarce.

The traditional type II process has a current capacity of 3400 tonnes which could be expanded to 11,000 tonnes/annum. Details of how these figures were obtained are given in chapter 5. The figure, 11,000 tonnes, assumes that improved stoves will be widely adopted and thereby reducing the demand for fuelwood by 60%. This reduction will make the existing woodlots adequate for the expanded production level. Thus the only constraint will be the availability of labour. However if the demand for salt is high and the infrastructure for marketing is developed, people will move into the salt producing areas and there will be no shortage of labour.

Table 8.1

Production Technology	Present output (tonnes /annum)	Potential output (tonnes /annum)	Labour intensity $L/_V$ (*)	Labour intensity $L/_Q$ (**)	Capital inten-sity $Q/_L$	Profit per unit product
Traditional method Type I	600	600	$9/_{20}$*	$9/_{240}$	$\frac{240}{9}$	(-8.425)
Traditional method Type II	3400	11,000	$3/_{30}$*	$3/_{600}$	$\frac{600}{3}$	3.6
Solar salt field	Nil	600	$3/_{600}$	2.5×10^{-4}	4×10^{3}	Heavy losses

* Man-days/kg. of salt

** Man-days/Le.

Thus from the point of view of maximising output the type II traditional process should be selected.

8.2 Resource Utilisation Efficiency

There are two types of resources been considered: labour and capital. We shall examine both the capital intensity and labour intensity as measures of resource utilisation efficiencies. The definition of labour intensity is not always clear cut. However, in this work we have used the ratio of labour to output (L/V) and the ratio of labour to capital ($L/_Q$). The inverse of the latter is a measure of capital intensity.

It is observed from Table 8.1 that whichever method of assessment of labour intensity is used, the intensity is highest for type I traditional process and lowest for the solar salt works at Suen. The capital intensity obviously follows a reverse path.

On the basis of resource utilisation efficiency, the type I traditional process should be selected.

8.3 Profitability

The profit per kilogram of salt produced and the rate of return on investment are given in Table 8.1. From these figures, it is observed that when all factors are priced at their opportunity cost, the only technology that returns an economic profit is the traditional type II salt process. The level of losses in the solar salt works is not given in Table 8.1 but it was low enough for the operation to be discontinued.
It has been mentioned earlier that this negative performance

of solar salt operation is primarily due to the low rate of evaporation. Another secondary factor is the poor management and lack of skilled manpower and equipment to monitor the operation. As for the traditional type I operation the cost of the large quantity of wood used was responsible for the negative performance.

Thus on the basis of economic profitability of the technologies, the traditional type II salt production technique should be adopted.

8.4 General Remarks

It appears from the proceeding analysis that the traditional type II salt production technology is the only operation that will maximise output and thereby save foreign exchange, and also satisfy some of the social and political issues such as employment.

The decision to adopt and promote a traditional technology for salt production may appear to be going against the general trend of modernisation. But the wholesale transfer of highly mechanised, capital-intensive and unworkable technologies purely for the sake of modernisation is economically unwise. Throughout chapter 4, it was made very clear that the Sierra Leone climate is not very suitable for solar salt works. And in the absence of any salt deposit, the only real alternative is the traditional salt production from salt-laden silts. Furthermore, in the modernisation of rural industries the challenge is to produce technologies which will improve the productivity and the quality of home-based, and traditional-skill-based production rather than one that will dislocate people.

Thus it is hoped that policy recommendations emanating from this study will, if implemented, lead to the transformation or modernisation of the traditional salt processing technology.

CHAPTER NINE

POLICY RECOMMENDATIONS

The empirical results presented in this report is of great value in formulating policies with respect to the local production of salt. In this chapter we shall consider the overall policy implications of the study and discuss the policy instruments for achieving the desired objectives.

9.1 Policy Implications

The main objective of any policy on salt industry is to increase the local production so as to reduce the dependence on foreign supply and thereby minimise the problem of foreign exchange availability and the lack of security of supply. The key policy implication stemming from the study is the evidence that the traditional technique of producing salt from silt can contribute towards meeting the output objectives of Sierra Leone. It has been revealed that this technique generates not only output but more employment per capital when compared to the large scale solar salt works. Moreover because of its high labour intensity, the traditional type II technology generates more output per capital. The economic strength of this particular salt production technique is further illustrated by the fact that the process generates an economic profit when factors are valued at their appropriate opportunity cost.

In view of the strong economic justification for the type II traditional salt processing technique, it is important to institute policies that will promote it as well as improve on its performance. Furthermore, a clear policy is essential inorder to facilitate the transformation of the traditional production techniques into a modern, more efficient and better organised process. We have examined policies that directly affect the production (e.g. credit) and those that indirectly affect it (e.g. infrastructure and institutional framework).

The examination has considered the three main characteristics of any good policy. Those include: (a) The benefits of the policy; in particular, whether the policy instrument would achieve the policy objective. (b) The cost of the policy: This includes the costs both to regulator and regulatee. (c) Administration aspects of the policy: This involves the questions of how fast the policy can be implemented, the ability to understand and implement the policy and the jurisdictional domain of the policy.

9.2 <u>Policy Instruments</u>

9.2.1 <u>Institutional framework:</u> In order to reduce the cost of administering any policy, it is recommended that the promotion of the local salt industry be carried out within the framework of existing structures in the Ministry of Trade and Industry. The SSIH Division of the Ministry has undergone considerable reorganisation since the joint ILO/UNIDO report (Chuta and Wijenaike 1982). The SSIH Division advises government in policy support of small scale industries and handicraft. And, among its numerous functions, it identifies and evaluates projects, should provide technical services through a network of extension services, undertakes research and development into appropriate technologies including the operation of plants for demonstration purposes and trains enterpreneurs and other skilled personnel. Thus the SSIH Division has the authority to carry out all the policies for the promotion of small scale industry. However the activities of the division has been adversely affected by the lack of personnel and vehicles to move around. For instance, the joint ILO/UNIDO report had recommended that three (3) extension agents be attached to each rural industry. However at the moment, extension agents are only available for the small scale soap industry and even these are all located in Freetown. If three extension agents are similarly deployed in the small scale salt industry, they will be able to effectively implement the policies suggested in this study.

9.2.2 Organisation of the Industry: The small scale salt processing is in the informal industrial sector. Very little is known about the operation. Inorder to promote the industry it is very necessary to organise it and have accurate record of the various operators. A registration of all the small scale processors, should be the first step in this direction. The registrar should have several categories of the processors: full-time and part-time, all-the-year-round and seasonal, resident operators or migrant operators, type of ownership (single household processing units or joint household processing unit). This classification will make it possible to identify production unit which could be given credit, technical assistance and the benefits of other policy investments. To be registered, a processor must show the facilities from which he produces the salt.

9.2.3 Credit Policies: One of the most frequently used method of promoting any small scale industry is the provision of capital. Indeed even the salt processors generally argued that working capital was the biggest constraint in their operation. In all cases, the entire operation was financed through family savings and substitution of labour. While it may be argued that capital may not be a very crucial constraint in view of the magnitude of the amount involved, it must however be added that there was very strong need for a small amount of capital to cover the operating expenses and cost of food during the early stages of the operation.

In an earlier study on small scale industry (Chuta and Wijenaike, 1974) the suggestion was made that a special small scale industry trust fund be established to enable entrepreneurs to borrow Le50 - 500 to buy equipment. A separate trust fund of about Le200,000 within the National Development Bank (NDB) or within the structure of the rural banking system was also recommended.

These recommendations were never carried out. This study endorses these recommendation and further suggests that in view of the importance of salt within the economy that priority of award of credit be given to this sector. Furthermore the level of loan should be increased to Le1000/00 and to cover fixed and/or working capital.

As far as administration of the loans are concerned, some of the rural banks and the NDB already have experience with a similar arrangement for promoting the agricultural sector. However it is recommended that the small scale industries division (SSID) within the Ministry of Trade and Industry Act as referral agent for assessing the credit needs.
In order to facilitate payment, credit will only be provided to registered processors. It is generally felt that a large

fraction of credit defaulters in the small scale industry sector are those who take loans to start the operation. However if an operator is already registered, it means he/she is already in business and has risked some of his own capital. Thus he is likely to put the loan to a better use. Priority for credit will be given to full-time resident operators. The level of income from the operation is substantial for a rural community in Sierra Leone. And once the production starts, the income is very regular . It is therefore expected that small loans could be quickly repaid over a short time. Infact, during this study it was revealed that an informal loan system already exists. Salt retailers usually visit the area at the start of the season and give credit in the form of rice. This rice loan is usually repaid in the form of salt. The scheme is usually more beneficial to the salt retailers than the processors. A similar scheme administered in a more formal way will be very difficult because it will involve the purchase of rice and the marketing of salt by the finance company. It should however be added that the barter credit scheme usually has no loan defaulters.

9.2.4 Technical Assistance: The level of sophistication of the technology for production of salt from silt is fairly low. Most salt processors have acquired their skill through a system of apprenticeship. And, although, they produce salt of good quality with present know-how, there could be a lot of improvement if some of the basic principles of the operation is explained to them and if they are made to realise the significance of each activity with respect to salt quality and productivity. During the study it was observed that some salt processors attributed high productivity or quality to "luck." This obviously suggested tha t there is a lot of guess work involved. Areas in which technical training or information are required include: (i) the desirable level of concentration of the solution from the leaching of the silt. This means providing a guide on the water/silt ratio. (ii) The extent to which the boiling operation should go in order to avoid crystallisation of the bitter magnesium salts. (iii) The use of the improved stoves. (iv) Other technical modifications that will be useful in improving the quality and output. (v) Assistance in the gradual modernisation and organisation of the operation. The overall effect of the above programme of activities would be the improvement and standardisation of the quality of the product. This will help stabilise the price at a higher level.

The program of technical assistance could be part of the extension mechanism for promoting the industry. Two extension workers who have completed a secondary school should be trained to perform this responsibility. They will be attached to the Ministry of Trade and Industry within the small scale industry division with the sole responsibility for the salt industry.

9.2.5 Fiscal Policies: Fiscal policies such as the import duty structures often have negative effects on small scale industries. These negative effects are not necessarily the result of conscious design but rather arises out of the indirect effect of policies designed to achieve other objections such as increase in revenue. However it was discussed earlier that the existing fiscal policies in Sierra Leone do not have a negative effect on the local salt industry. If anything, the strict foreign exchange control tend to favour the local industry. This study does not therefore recommend any change in the existing structure.

9.2.6 Infrastructure Program: The results of the study provide some indication that the lack of infrastructure may not be a critical constraint for the traditional salt production. No electricity is required. Only wood and water is required. A good road to the main production sites could also facilitate the marketing operation. The availability of drinking water in most of the production areas affect the productivity of the processors. Most boleholes in the area have saline water which is not fit for drinking. Water is usually obtained in exchange for salt. Provision of regular supply of drinking water will encourage more people to move into the salt processing areas. The problem of wood supply can best be handled through the introduction of improved stoves.

9.2.7 Research and Development Policies: The decision to adopt the traditional type II salt processing technology instead of the solar salt operation, may at first glance seem a step backwards. However, the idea is to start from a technology with which people are familiar and whose economic parameters are all favourable, and then gradually modernise it through several research and development efforts. Thus the objective of any research and development policy would be to transform the existing technology so as to increase output, product quality and the income of the processors.

The small scale industry division, in collaboration with the

University should develop a research and development programme for improving and modernising the traditional salt processing technology. Such programme should consist of laboratory testing and field trials of prototypes and the demonstration of the improved technology by extension agents. From the studies, it was found out that one of the activities requiring special research attention is the boiling operation. There are two possible research policies in this particular area. One deals with improved stove development, demonstration and dissemination and another involves the use of solar energy.

In this study, it has been shown that the use of solar energy to produce salt from fresh sea water in Sierra Leone is uneconomic because of the slow rate of evaporation. However, the solution obtained from the leaching of the silt, is several times stronger than fresh sea water. Thus even the slow evaporation rate could still produce satisfactory yield. The use of solar energy to crystallise the salt will release a lot of time that will otherwise be used to collect wood and supervise the boiling. This additional time could be used to collect more silt and increase salt production.

The research activity should also look into developing technology for large scale operation. Thus materials design for large percolation tanks should be investigated.

In order to fund the research activities, research proposals should be jointly submitted by the Ministry of Trade and Industry and the Faculty of Engineering of the University, to various funding agency. The main local funding agency for this type of activity is the National Aid Coordinating Committee (NACC). The NACC programme of activities puts great emphasis on rural development. Originally, only agricultural projects were sponsored. However the committee has recently started emphasizing small scale industries.

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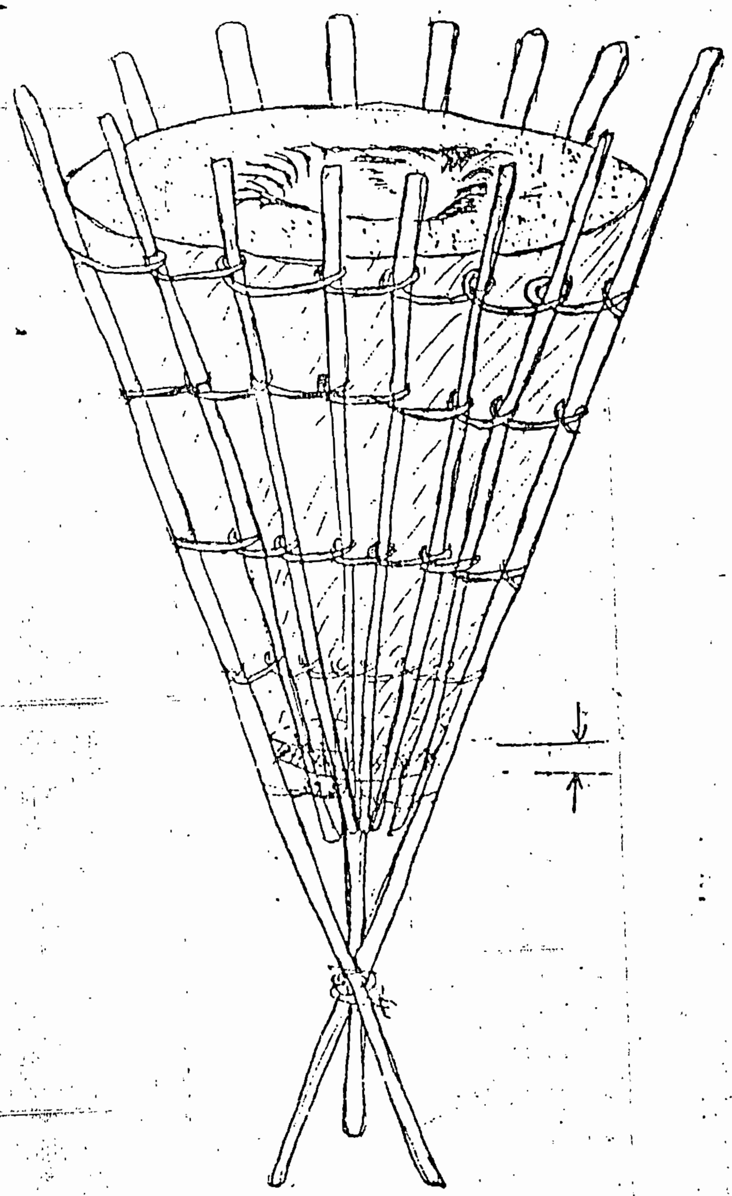
APPENDIX 1a

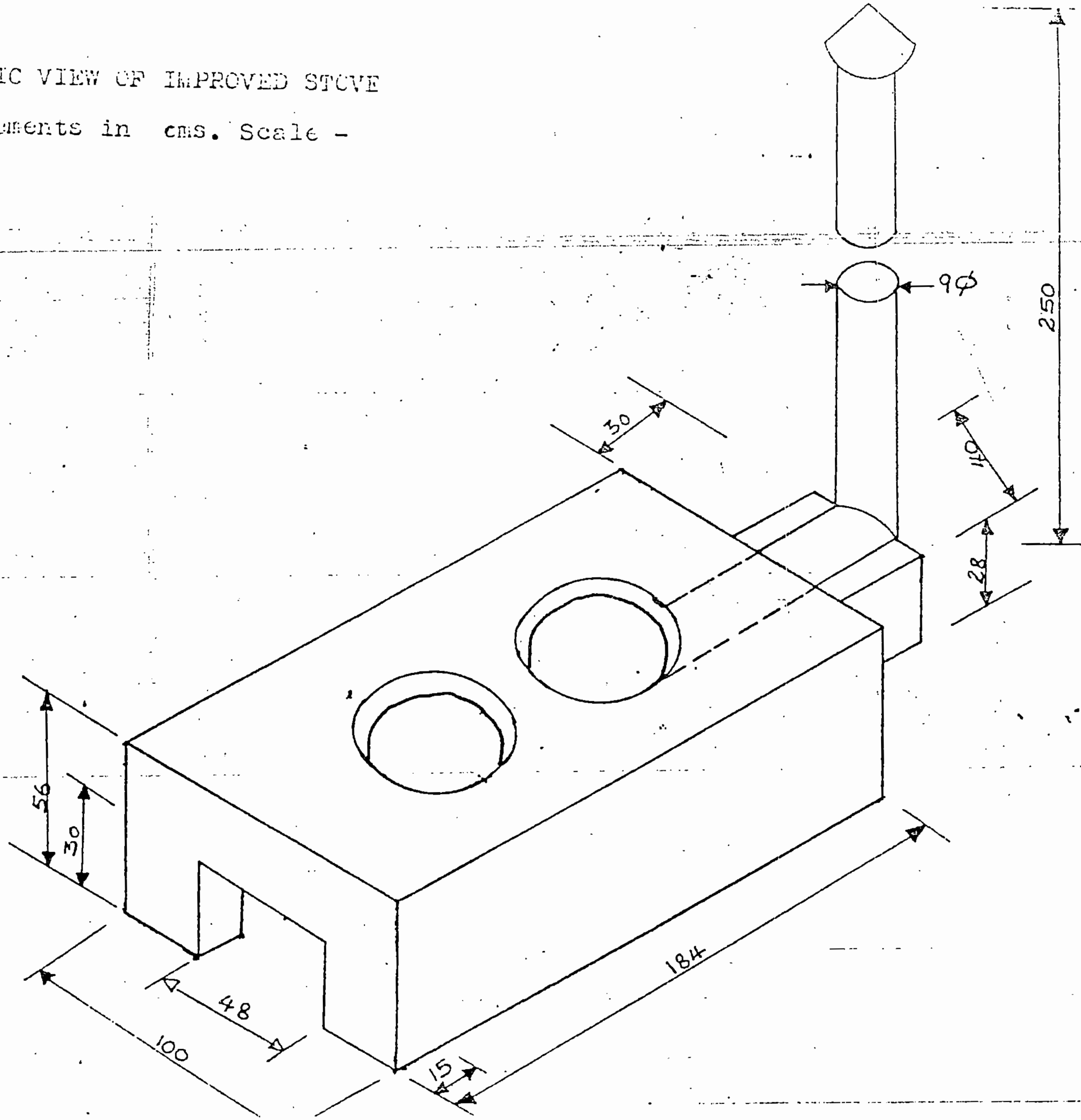


Traditional Filtration Unit used by salt processors.

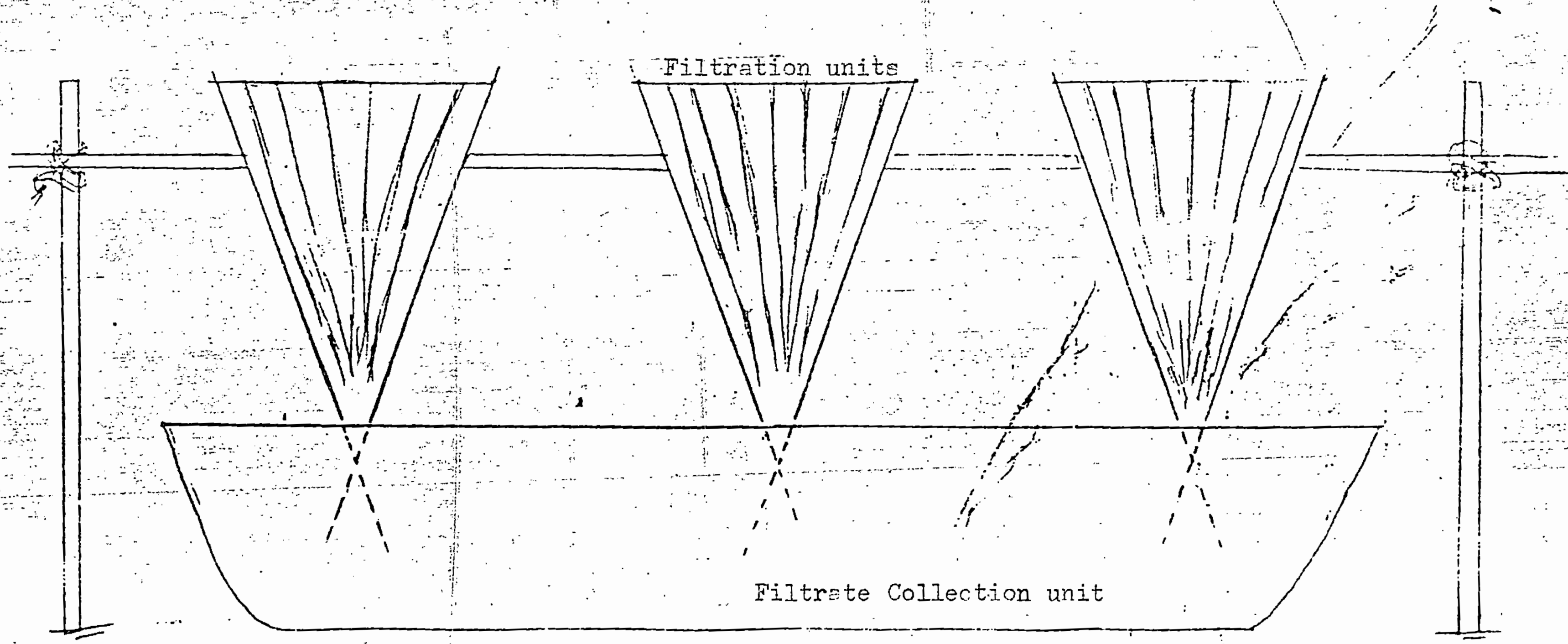
APPENDIX 2

ISOMETRIC VIEW OF IMPROVED STOVE

(Measurements in cms. Scale - 1:20)



APPENDIX 1b



Arrangement for collection of filtrate.