STRATEGY FOR GHANA’S SALT SECTOR

Final Report
July 2009

Prepared for the GEPC with support from the Commonwealth Secretariat
**Project:**
Strategy for Ghana’s salt sector

| Technical Experts               | Sidhi Professional s Consortium  
|                                 | 12 DDA SFS Gulmohar Enclave  
|                                 | New Delhi 110 049  
|                                 | India  
|                                 | sidhicon@bol.net.in |

| Project Manager                | Trade Section  
|--------------------------------| Special Advisory Services Division  
| Estella Aryada                 | Commonwealth Secretariat  
|                                | Marlborough House  
|                                | SW1Y 5HX, London  
|                                | www.thecommonwealth.org |
Preface

This final report is the result of technical support to the Government of Ghana. Assistance was provided by the Commonwealth Fund for Technical Co-operation of the Commonwealth Secretariat’s Special Advisory Services Division (SASD) under the auspices of the Trade Section.

The Project counterpart in Ghana was the Ghana Export Promotion Council (GEPC). The Project was carried out in close collaboration with the President’s Special Initiative (Salt) and the Private Enterprise Foundation (PEF). Technical expertise was provided by Sidhi Professionals Consortium represented by Rajendra Tandon, M M Sand (India) and John Edgar (UK).

The project commenced in October 2008. This report is the outcome of background research and analysis, and consultations with salt producers, Government ministries, agencies and support organisations. The findings were presented and discussed at a stakeholder workshop held in February 2009.

The report summarises the prevailing situation in the salt industry in Ghana, presents a snapshot of the potential and outlines key actions that need to be taken for the future growth and development of Ghana’s salt sector.

The team wishes to acknowledge all stakeholders who participated in this project.

Estella Aryada
Trade Advisor
Special Advisory Services Division
# Table of Contents

**Executive Summary** 5

**Section 1: Introduction** 12
1.1: Background 12
1.2: Global trends 14
1.3: Salt in Ghana 18

**Section 2: Assessment of competitiveness** 28
2.1: Industry structure 28
2.2: Positioning and competitiveness 33

**Section 3: Production and Marketing strategy** 35
3.1: Increase Production 36
3.2: Product Diversification 44
3.3: Cross cutting issues 44

**Section 4: Implementation** 48
4.1: Institutional framework 48
4.2: Government support 51
4.3: Other 52
4.4: Strategy and Implementation Plan 53

**Annexes**

Annex 1: Estimated production capacity 56
Annex 2: Composition of sea water 57
Annex 3: Recovery of dissolved substances 58
EXECUTIVE SUMMARY

The GEPC requested the Commonwealth Secretariat for technical assistance to develop a sector strategy to help define a framework to guide the development of the salt sector and enhance exports. This is in the context of Ghana’s Poverty Reduction Strategy whose goal is to attain middle income status by the year 2015.

The world market for salt is growing and production estimated in 2007 is 256m/mt. Demand is inextricably linked to both population and industrial growth. The output of China alone has accelerated to an estimated 50M/Mt largely to support the rapidly growing Chlor –alkali market. Senegal and Ghana are the major producers of salt in West Africa, where a large proportion of salt produced is for human consumption.

This report seeks to address 2 fundamental and related questions: Firstly, does Ghana have the capacity to develop its salt reserves and increase exports? Secondly, what needs to be done if Ghana is to realise its potential? Working with the main stakeholders in Ghana, the Commonwealth Secretariat visited salt producers and interacted with policy makers, community leaders, support agencies and finance institutions. The findings are summarised below:

A. Diagnosis

Ghana has the potential to rapidly increase salt production as demand is extremely good in the regional market. However, this can only be achieved if the industry is supported to become capable of consistently supplying a range of good quality products at competitive rates in the region. It is estimated that Ghana has about 500km coastal front with a total production potential of 2.2 million metric tonnes per year. Actual production is estimated 250,000 metric tonnes per year, of which about 62,000Mt is exported annually, yielding US$ 3.043m in 2007. It is believed that actual exports are higher. Available records indicate that generally, exports have shown no real growth over the last eight years. The main export markets are Niger, Burkina Faso and Cote D’ Ivoire, which together account for about 90% of Ghana's total salt exports.

Salt production in Ghana is a pyramid structure with a very large number of artisanal salt winners; some micro and small scale producers, and a few medium to large scale producers. We believed that the key to transformation of the sector lies with the
latter 2 categories. An examination of the industry shows that this potential arises from a relatively secure base: existing market opportunity, low entry barriers and lack of substitutes. In the short term, buyers consist of individual retailers and traders with corporate clients making up only a small proportion. As industry continues to grow-and especially the new oil and gas finds - the character of buyers is likely to change significantly, and the sector must be in position to adapt accordingly.

The major issues to be addressed are:

- **Generally low quality of salt**: This appears to be a direct result of demand outstripping supply. A high percentage of the salt produced by the units surveyed does not adhere to any given standards. Nevertheless, it is all sold on-site.
- **Lack of access to appropriate finance**: A number of schemes have been introduced in the past. However, the financial support appears to have been misjudged as funds have been misdirected, resulting in late or non payment of loans. This has in turn led to reluctance by financial institutions to lend to the sector, although there are a few exceptions.
- **Access to land**: Land ownership is an issue due to the stool system of control of land in most salt producing areas. Productivity depends on the attitude and approach to administration of land owners.
- **Low levels of technology**: Unscientific methods of production are used. Lack of development has not encouraged the appreciation of technology either in chemical or in production methodology. Management, technological know how and marketing expertise would be crucial in raising capital from any commercial institution.

**B. Strategy**

Based on site visits, consultations and analysis carried out, the strategy for Ghana’s salt sector comprises three mutually re-enforcing strands. These are:

1. **Increase the volume of production**. This can be achieved by:

   1.1 **Making production more efficient**: Although a few units visited were continuously working to make production more efficient, the majority were not. The specific measures will vary from unit to unit. There is need to adopt the principles of continuous improvement and other production management techniques such as quality circles to make the effort sustainable.
1.2 Increasing the scale of production: As salt is a low value commodity, economies of scale are very important for long term profitability. It will require significant capital outlay to achieve this. The non-performance of the majority of loans provided to the salt sector, coupled with the shrinkage of available funds brought about by the global financial crisis implies that it will be extremely difficult for producers to acquire the necessary capital from the banking/financial sector. The alternative is to attract joint venture partnerships with foreign investors. There is need to profile the existing Ghanaian companies to establish those for whom this is a viable strategy and to clearly define the parameters for partnership in order to ensure mutual benefit.

1.3 Fostering linkages with producer groups: Salt producer associations in Ghana are quite well organised. They currently provide a service for local markets and individuals. Where larger orders need to be satisfied members will arrange to sell to each other to make up the difference. There is a level of co-operation between the associations and production units and this needs to be strengthened if producers are to achieve the economies of scale necessary for long term profitability and value addition. The major issue is to create the incentive for this relationship to develop.

1.4 Resolve the issues in the Songhor area: This area is the most productive as far as salt production is concerned and crucial to the development of the salt industry in Ghana. A major obstacle has been the acquisition of land for investment and development projects. Two inter-related problems need to be addressed urgently, namely: a) Songhor salt industries b) The wider Songhor lagoon.

Our recommendation is for Government urgently take action and consider returning Songhor salt industries to the private sector.

As far as the Songhor lagoon is concerned, we note the efforts of the Private Enterprise Foundation (PEF) in facilitating a process between the clans and the Government; the result has been the formation of a company limited by guarantee The Tekperbiawe Clan Foundation (TCF). This type of foundation is paramount to the success of any significant land development not only for the Songhor Lagoon. The crucial factor is the ability to have the clans work together through one organisation-TCF- and have their commercial interests represented by a Salt Development Company. Protecting the rights and control of the TCF, and establishing the Salt Development Company as the representative organisation that has direct access to investors enabling it to establish lease agreements and the distribution of funds are
key priorities. If implemented, this model would go a long way in dealing with the obstacles in the way of developing the Songhor lagoon. However there are still major problems to be overcome, most of them revolving around feasibility. It is essential to build trust and secure the commitment of the clan heads. In addition, it will be necessary to clearly articulate the potential benefit to the community.

2. **Promote product diversification:**
A wide range of substances are dissolved in sea water. These include calcium sulphate, sodium chloride, magnesium chloride, among others. In view of the low percentage of other marine chemicals in sea water it is not economically possible to recover most of them. Because of its size, Songhor Lagoon if fully developed can be a source of recovery of not only salt but such marine chemicals which will substantially improve the profitability and economies of scale.

Existing production units should be encouraged to add value of their product. For instance, refining salt produces different grades of salt, each targeted to a different market.

3. **Address key cross-cutting issues:**
3.1 **Legal and regulatory review:** There were a range of views on how best the regulatory regime can support the future development of the salt sector. The following modifications are proposed:

  **Royalties:** The law provides for royalties of 3-12%. Given the various land ownership structures in the different regions of Ghana, and the low value of salt relative to other minerals such as gold, the applicable range of royalties should be revised accordingly.

  **Community involvement:** Where feasible, there is need to provide some guidelines for commercial relationships between a local community and an investor to ensure mutual benefit and predictability. For instance, investors in some areas highlighted the prevailing situation where royalties are paid to up to 3 different parties.

  **Consultation and enforcement:** Stakeholders raised the issue of non-enforcement of some regulations, such as the requirement for license holders to develop land within two years, or have the licenses revoked. In addition, there are regulations that protect the livelihoods of communities surrounding salt works that are not well understood. There is need for wider discussion with a view to build consensus on priorities for review.
3.2 Quality: There is need to inculcate the importance of developing and adhering to quality standards. This extends to basics such as not bagging salt while the moisture content is still high, and labeling the right quantities.

3.3 Marketing: At the moment there is no substantial marketing effort for Ghana’s salt, mainly because demand outstrips supply. As the industry develops with more companies investing in salt production, and more by-products being available, there will be need to embark on a concerted marketing effort. In order to defray the costs, it is proposed that the efforts at the level of production units be complemented with support from an association or agency such as GEPC.

C: Implementation arrangements

It is important to reiterate that most of the companies involved in the production and marketing of salt have the capacity to implement specific recommendations in this strategy, given the appropriate tools. Government agencies must play the role of facilitating the sector. The implementation of this strategy cuts across a considerable range of ministries, agencies and departments in the public sector. The key, lead agencies are GEPC, PEF, PSI and GIPC. It is proposed that they should play the following roles:

GEPC
As the national focal point institution for export development and promotion under the aegis of the Ministry of Trade and Industry, GEPC already engages in an extensive scope of activities encompassed within its mandate. There is need to have a focus on the salt sector. GEPC should be facilitated to increase its capacity to:

- Spearhead market research
- Facilitate promotion
- Policy advocacy
- Training and capacity building for successful export marketing
- Sourcing opportunities for financial and technical support.
- Develop and maintain a database of exporters
PEF:

PEF has already done commendable work in facilitating the resolution of land disputes between the Traditional Council and the land owning clans of the Songhor Lagoon and Ada, to create a level playing field for development of the salt within the land. The result has been to establish the Tekperbiawe Clan Foundation (TCF) which is essential for the future development of the land owned by the clans.

It is recommended that PEF take a leadership role in:

- *Land ownership arrangements for commercial use.* PEF should spearhead efforts to streamline land acquisition and licensing procedure to enhance easy accessibility and enhance land tenure security. Specifically, PEF should be facilitated to address the issues highlighted with respect to the wider Songhor lagoon. This should be with a view to pilot the TCF, adapt and replicate it in other salt rich areas where similar constraints exist.

- *Research and policy advocacy* on resource management, legal and regulatory issues concerning the wider community aspects of salt production.

Presidents Special Initiative on Salt (PSI):

The role of PSI or a successor organ should be focussed on technical support to the producers and associations. This includes:

- Providing technical advisory services for companies to enhance production efficiency, including facilitating linkages between producers and manufacturers
- Human resource development to improve both managerial and technical skills;
- Co-ordinating feasibility studies for product diversification and value addition.

Ghana Investment Promotion Centre (GIPC)

The successful export of salt or any by-product will depend on the ability to attract investment. GIPC is well placed to lead this aspect of the strategy. Specific activities include:
• *Profiling the salt companies* to establish those for whom joint venture partnerships are viable and performing some due diligence on interested investors.

• * Providing technical assistance* in structuring companies to take advantage of opportunities in the salt sector, such as advice on seeking and managing partnerships or sale of companies.

• *Targetted investment promotion and after care.* This could extend to advice on acquisition of land, relationships with relevant Government agencies, incentive regimes, among others.

**Government support**

The Government needs with some urgency to provide policy direction for the industry to serve as the basis for future support to the agencies that facilitate the industry. It is recommended that a high level official in the Ministry of Trade be designated to establish an implementation committee and ensure that the respective agencies are well facilitated to perform their roles in developing the salt sector in Ghana.
SECTION1: INTRODUCTION

1.1 Background

Ghana is implementing Phase 2 of its Poverty Reduction Strategy with the goal of attaining middle income status by the year 2015. To achieve this, the strategy lays emphasis on developing the private sector, diversifying the export base and increasing agricultural productivity and rural incomes. Ghana's exports are still dominated by gold and cocoa. Government has long recognised the importance of diversifying the economy and has embarked on a number of measures to realise this objective. The Ghana Export Promotion Council (GEPC) was given the mandate to oversee the development, promotion and growth of Non-Traditional Exports (NTE), among which is salt.

The GEPC therefore requested the Commonwealth Secretariat for technical assistance to develop a sector strategy to help define a framework to guide the development of the salt sector and enhance exports.

The overall purpose of the Project is to enhance the competitiveness of Ghana’s salt sector by carrying out the following specific tasks:

a) Establishing the supply capacity of Ghana
b) Analysing the structure of the salt industry, and recommending an optimal organisation structure
c) Assessing the capacity and relative influence of the key players along the supply chain
d) Reviewing the private and public institutions involved in the production and marketing of salt
e) Analysing the demand for salt, with specific emphasis on the regional market
f) Assessing the policy environment for the production and export of salt
g) Determining the level of competitiveness of Ghana's salt sector
h) Identifying constraints and making recommendations on how they are to be addressed
i) Developing a production and marketing strategy based on (a) to (h) above.

Sidhi consultants were selected to provide technical assistance to this Project. The team did field work, interviews and desk research to prepare the strategy. They met a
cross section of salt producers, both large and small, as well as producer and industry associations. Meetings were held with Government ministries and agencies as well as the International Finance Corporation. In addition, a workshop was held to present the findings and recommendations to stakeholders in the industry. A number of reports on the salt sector in Ghana were also reviewed. Particular attention was given to the Songhor Lagoon as the area with the greatest potential to supply salt. The team also reviewed the proposed Tekperbiawe Clan Foundation (TCF), an initiative aimed at ensuring that the community and land owners maximize the benefits of salt production in the Songhor lagoon.

This document is the final report of this study and is in 4 main sections. Section 1 begins with a snapshot of global salt production, continuing with an overview of the salt sector in Ghana. Section 2 is a competitiveness assessment of Ghana's salt industry. Section 3 is the strategic plan which sets out the main thrust to develop the distinct segments in the salt sector in Ghana. A summary of the framework for implementation is presented in Section 4.
1.2: Global trends
Common salt is a necessity of life. It imparts improvement in flavour and taste of food. Salt is no less essential for livestock. Salt is also very valuable for agriculture and as a preservative. The use of salt in modern industry is equally important. The chemical industry is the largest user consuming about 60%; the food industry consumes about 30% and the rest 10%. The following industries are major users of salt.

a. Water softening
b. Textile Dyeing
c. Dyes manufacturing
d. Soap, detergent and glycerine
e. Chlor-Alkali
f. Tanning

Almost every country in the world has salt and deposits the resources for salt are unlimited. There are no economic substitutes or alternatives for salt. Calcium chloride and calcium magnesium acetate, hydrochloric acid, and potassium chloride can be substituted for salt in deicing, certain chemical processes, and food flavoring, but at a higher cost. The major requirement for the existing chemical and allied industries is the intermediate product - caustic soda. The largest consumers of caustic soda are soaps and detergents factories, plastics, paints and pharmaceutical industries. Large quantities of caustic soda are used in the textiles, paper and metallurgical industries and in the production of synthetic fibres.

Fig. 1 below summarises the main uses of salt.
Fig1: Uses of salt
The world market for salt is growing and production estimated in 2007 is 256m/mt. The output of China alone has accelerated to an estimated 50M/Mt largely to support the rapidly growing Chlor –alkali market. Increases in the market for salt have also arisen due to the demand for salt in food from Asia and South America\(^1\).

These figures include solar, rock salt and brines of which solar salt provides over a third. The main producers of salt are North America, Europe and Asia producing approximately 84% between them. In Europe the major producing countries are France, UK, Germany, Netherlands and Spain producing about 43.270 m mt/y. The main producers in Asia are China and India producing between them 63 M mt/y equivalent to about 87% of Asia’s production.

Rapid industrialisation in China has resulted in a period of growth in the salt industry that has not been seen for many years, with world production reaching 256Mt in 2006. There was a worldwide slump in 2003-2004, but production recovered quickly and since 2003, global output has risen at an average rate of nearly 5.2% per year, while Asian output has risen by over 12.3% annually. However, the rise in Asian output has not been sufficient to satisfy all the regional demand and the shortfall has largely been satisfied by Australian production, which grew by about 5.5% per year from 2000 to 2006. The principal driver behind increased production has been growing demand from the Chinese chemical industry and, to a lesser extent, from population growth.\(^2\)

\(^1\) Salt institute
\(^2\) Roskill Report
Statistics of salt production in Africa are not readily available. Reports suggest that undeveloped salt reserves do exist, particularly in the horn of Africa. Emerging Capital Partners announced recently that they were making an initial investment of US$ 30M in Salt Investment SA, a Djibouti based salt production and export company that will produce salt from Lake Assal which could yield about four million tons of salt per annum. Much of the production will be aimed at the Middle East and Asia for chemical manufacture.

Most of the salt produced in West Africa is by solar evaporation from both sea and lake water. Senegal and Ghana are the major producers in West Africa. A large proportion (90-94%) of the production is allocated to human consumption. This is in stark contrast with the consumption pattern in other salt producing regions in the world, where almost 90% is used in the food and chemical industry. The implication

---

3 “Salt situation analysis in Central and West Africa” - UNICEF
of this is twofold. Firstly, where industrial growth is not a key market for the salt sector, product diversification is likely to be limited. Although the picture is set to change with the developments in the oil and gas sector, this is the prevailing situation in West Africa and Ghana in particular. The second implication is that since local supply cannot adequately meet the demands of the industry, countries in the region will continue to import salt in the short to medium term.

Ghana has the potential to rapidly increase salt production as demand is extremely good in the regional market. However, this can only be achieved if the industry is supported to become capable of consistently supplying a range of good quality products at competitive rates in the region.

1.3: Salt in Ghana

1.3.1 Supply and Production

The recent history of the local salt industry producers is difficult to establish as much of the information is hearsay and not recorded. A number of studies on Ghana’s salt sector have been completed in recent years with support from Government and international agencies, including the World Bank, UNICEF and UNIDO.

Supply capacity is particularly difficult to ascertain due in part to the nature of salt production in Ghana and the absence of reliable data. Nonetheless, it is estimated that Ghana has about 500km coastal front with a total production potential of 2.2 Mil/Mt/y. The Songhor basin is particularly productive, potentially accounting for approximately 64% of this total output. Most of the salt producers are located in the central region or in Greater Accra. These areas are listed as follows:

- Ada / Songhor
- Elmina
- Keta and Ketu
- Mankessim
- Prampram to Weija
- Shama Ahanta
- Winnebato Apam

Salt production in Ghana is largely artisanal and can be roughly divided into 3 distinct categories of producers:
Salt winners: These are ‘chance entrepreneurs’- people living around lagoons that collect and sell it as the water evaporates.

Micro and Small Scale Producers: These will typically have right or access to 5-40 acres of land under salt production and are often represented through Associations.

Medium to Large Scale producers: These are established producers who may have some plant and machinery, including refineries. They range in size from about 40 acres to 3,706 acres. Of these, the following have washing and refinery capacity:

- Ningo
- Eldin salt
- Pambros
- U2

Excluding salt winners, the salt industry in Ghana therefore has a simple two sector structure. The first sector consists of the associations and sole traders or family businesses, who we estimate are responsible for the employment of over 1000 workers a figure which increases substantially during harvest. Their operation is simple and well proven. The Associations represent their members in questions of politics, legality and welfare. All salt is produced in 50kg sacks imprinted with the association name, which establishes a sort of local brand. Sacks are bought from the association who use a percentage of the proceeds to satisfy the clan chief and for the internal revenue. Rules are not formalised and disputes are settled at local meetings. The associations are not looking for commercial quality although some claim to have better quality than others, all speculative.

The associations and sole traders provide a service for local markets and individuals. Where larger orders need to be satisfied members will arrange to sell to each other to make up the difference. Some salt is sold through agents although no figures are available. The producers that make up the associations are family businesses that have been handed down from father to son sometimes over generations.

The second sector provides the main producers of which we estimate there are about 30. These vary in size and range of activities, from those that harvest and sell the salt to merchants, to those that own refineries and pack branded salt for corporate buyers and some international organisations. However this market is not well developed.
The team visited several production units in Ghana. Below is a summary of the conditions for salt production in Ghana based on observation made and discussions held with the owners or managers of the units.

a. **Climate**: Dry weather and high temperatures are preferred for salt manufacturing. In Ghana, climatological data shows that humidity is higher during two rainy seasons in a year. Because of these conditions, salt production generally takes place for 6-7 months in the year and seasonal variations greatly affect production. However, as temperature remains within a small range, overall evaporation is attractive for salt manufacturing. During most part of the year, wind velocity is high which contributes to the productivity of salt.

b. **Topography**: Units visited had generally good flat land suitable for salt production.
c. **Soil condition**: Generally, units have suitable soil and percolation losses of brine were reported below 5 %.

d. **Availability of Sub Soil Brine**: A systematic survey of subsoil brine has not been done. This survey is important because if subsoil brine of higher concentration is found in good volume, it can be an additional resource for harvest of salt as the requirements for concentrating area is reduced. In other words, producers will be able to get saturated solution in large volumes to feed crystallizers which will mean higher salt production with minimum effort. Thus in any salt works, underground brine sources should be fully exploited as a means of increasing production.

e. **Sea Brine**: Most of the units visited depend on sea brine which is 3.5 – 5.0 Be. Supply of such brine is not sufficient in some cases due to silting. At other places outsiders were diverting sea brine from the main channel.

f. **General design (Layout) of Salt works**: Salt manufacturing is based on fractional precipitation of various chemicals present in the sea water by solar evaporation. The layout of salt units should be designed in a manner which will ensure precipitation of various salts in different ponds gradually. For the common salt pond (Crystallizer) precipitation should be between 25.5 to 30.0 Be in order to minimise the presence of chemical impurities associated with this method. This layout design principle was not adhered to in many salt works visited.

g. **Technical Support to Salt works**: Production staff was reasonably conversant with the basic operations of salt production. Only the larger producers had salt technologists on-site.

h. **Operation Practice**: Salt production is mostly manual, right from harvesting to bagging. Generally, salt is harvested directly from the crystallizer to go-downs or storage sheds. Only basic equipment is used. Transportation is mainly by head load and, in a few instances, hand pushed carts.

i. **Raw Salt quality analysis system and laboratory set up**: There is little quality control in the industry and only a few larger units have laboratories. Quality control is limited to reducing insoluble substances.
j. Upgradation of raw Salt: There are only a few refineries which are generally producing edible salt only.

k. Iodization Technique: Iodization was carried out on-site at most of the sites visited, using the wet spray method. In some units, the freshly harvested salt is directly iodised and packed. Although mobile iodising units are available a large percentage of small producers still do not use this facility.

l. Labour: Producers rely heavily on casual labour, which is readily available. Remuneration varies from $2 to $10 per day.

m. Infrastructure: Most units visited were connected to the national electricity grid, with some supplementing this with diesel generators. Similarly, piped, billed water was also widely available. Salt units are connected with generally good roads for transportation within the country and vehicles from private companies are adequate in both numbers and capacity. Growth of the salt industry and the anticipated distribution to the oil industry could seriously alter this position especially in the area of the Songhor Lagoon. The main port of Accra is just adequate, but there is poor connectivity of containerised traffic to regional ports from Ghana. To relieve road congestion and to service the future oil industry there should be a plan for the provision of sea jetties and barges.

n. Machinery: Generally units have pumps of standard make for operation of salt units. With the exception of a few producers, movement of salt within the production cycle is manual.

1.3.2 Marketing

Of the estimated 250,000Mt/annum that Ghana produces, only 62,000Mt is exported annually. The above total does not include the Keta Lagoon which could bring production within the 3m.Mt region.

Exports are erratic and have shown no real growth over the last eight years. The price per kilo also varies considerably, reflecting demand and supply conditions in the country and region as well as the different quantities of salt packed in 50kg bags. Another important factor is that much of the salt is exported through agents who do
not necessarily represent specific producers. A significant proportion of the salt is sold on-site, without the requirement for prior orders or proforma invoices. Available figures from GEPC indicate that in 2007 exports totalled 62000 Mt earning US$ 3.043m. The main export markets are Niger, Burkina Faso and Cote D’Ivoire, which together account for about 90% of Ghana’s total salt exports. This figure (both volume and revenue) is almost certainly understated.

**Fig4: Destination of exports (2007)**

![Destination of Salt Exports in 2007](image)

**Source: GEPC statistics**

The main exporters at present are the medium scale producers with capacities in the range of 5000 – 70,000 MT. However in common with most producers, production is basic and the market is driven by ample demand. The process is subjective i.e. there is little or no marketing and the companies respond to enquiries. There is no quality control. The same product has been produced repeatedly and historically and pricing is based on what they can get. The comfort zone that has developed has meant that they get better than normal prices.
Based on the average price for 2007\(^4\) if only the salt from the Songhor Lagoon were to be exported it would represent US$ 70,505,120. This figure is arbitrary but interesting given that the price in different markets will vary; niche markets are likely to attract a higher price.

1.3.3 Major issues:
Generally low quality of salt: This appears to be a direct result of demand outstripping supply. A high percentage of the salt produced by the units surveyed is sold on-site. Because of this, the sector seems to be in a comfort zone.

Lack of access to appropriate finance: A number of schemes have been introduced in the past. However, the financial support appears to have been misjudged as funds have been misdirected, resulting in late or non payment of loans. This has in turn led to reluctance by financial institutions to lend to the sector, although there are a few exceptions. Representatives interviewed made the case for tailor-made instruments which will take into account the seasonal nature of salt production in establishing the repayment periods, but this should be an integral part of the business plan. Lack of access to finance has meant that there has been little or no development on most units over the years.

Access to land: Land ownership is an issue due to the stool system of control of land in most salt producing areas. Productivity depends on the attitude and approach to administration of land owners. Where land is under Government control, there is acute encroachment and diversion of brine by outsiders (winners). A number of salt producers have access to extra land but in terms of a global market the total production would not be sufficient to justify capital investment for many of these producers to achieve sustainable export performance.

Low levels of technology: Unscientific methods of production are used. Lack of development has not encouraged the appreciation of technology either in chemical or in production methodology. Even with the desire and available resource to enter new markets, lack of technological expertise would be a serious factor. Management, technological know how and marketing expertise would be crucial in raising capital from any commercial institution.

\(^4\) GEPC statistics
1.3.4 Government support

The leading support institutions for the salt sector are the Ministry of Trade and PSI; Ghana Export Promotion Council and the Private Enterprise Foundation.

*President’s Special Initiatives under the Ministry of Trade and PSI:* The vision of the President’s Special Initiative on Salt is to develop an internationally competitive salt based industry that shall be a lead export earner and a pillar of socio-economic growth in Ghana. The PSI (salt) was specifically set up with the objective “to systematically address the constraints, identify and transform the industry into an internationally competitive one, with enhanced capacity for the production of salt particularly for the export market.”

The PSI salt was the first attempt to re-develop the salt industry to achieve international competitiveness and international performance and to play a significant role in Ghana’s poverty reduction strategy with emphasis on job creation. The target it set for production in 2004 was 200,000 Mt to 2,500,000mt within five years and the employment of 50,000 people as part of a developing chlor-alkali industry. This claim was based on an assessment of the industry at that time. Unfortunately the industry has shown little advancement since 2004.

The PSI has lacked resource in terms of finance and personnel, but the concept had merit.

*Ghana Export Promotion Council (GEPC):* This is the national focal point institution for export development and promotion of NTE’s. GEPC aims to ensure that the national export diversification and promotion drive succeeds. In pursuance of this goal, the Council engages in an extensive scope of activities, including provision of market information, collection of statistics, training and capacity building for exporters.

*Private Enterprise Foundation (PEF):* The Private Enterprise Foundation (PEF) is a national center for advocacy and promotion of the private sector. It is a non-political organization founded in 1994 by a number of private sector associations, including the Association of Ghana Industries (AGI), Ghana National Chamber of Commerce and Industry (GNCCI), the Ghana Employers Association (GEA), the Federation of Association of Ghanaian Exporters (FAGE), The Association of Bankers (GAB) and the Ghana Chamber of Mines (GCM).
The Mission is to service the development needs of the private sector by influencing government policies and regulations in order to create an enabling environment for a private sector-led economic growth strategy and national development.

PEF services include:

- Providing communication channels and consultation mechanisms for the policy dialogue between the private sector and government;
- Initiating economic and business policy recommendations for government’s consideration;
- Reviewing economic policies with a focus on their impact on the private sector;
- Coordinating activities of common interest to member associations and their direct impact on workplace operational efficiency.

Such services have strengthened the private sector by improving and sustaining the enabling environment, and hence, they have contributed in accelerating the country’s socio-economic development.

As part of its mandate, the PEF facilitated the resolution of land disputes between the Traditional Council and the land owning clans of the Songhor Lagoon and Ada, to create a level playing field for development of the salt within the area. The result has been to establish the Tekperbiawe Clan Foundation which is essential for the future development of the land owned by the clans, with the objective of poverty reduction not only in the Dangme East District but throughout the country. The PEF is now assisting to establish a trading company, to trade directly with inward investment companies capable of developing the salt for export. The creation of this company is a turning point as that company should take on the role as the driver and integrator of the development with all key players in their role of representing the foundation.

**Other initiatives:** In June 2008, UNICEF published “Sustainable elimination of iodine deficiency”, a new report on progress since 1990 when the world’s governments set the target to eliminate iodine-deficiency disorders worldwide. UNICEF estimates that iodine-deficiency disorders (IDD) is responsible for about 5.7 million cases of cretinism, 43 million cases of people with some degree of intellectual handicap, and 655 million cases of goitre. West Africa is endemic for IDD.
A Multiple Indicator Cluster Survey was therefore conducted in Ghana in 2006 by the Statistical Service of Ghana and the Ghana Health Service with the support of some international bodies. On salt iodization, the survey indicated that although 85% of consumers are aware of the importance of using iodised salt, 50.8% of households actually use it and that out of the households that use iodized salt, only 32.4 of their salt was found adequately iodized. Ghana aims at achieving 90% of households consuming iodized salt by the end of 2010 and sustaining the level thereafter. Ghana’s challenges are mainly on the supply side as consumer awareness on iodised salt is already 85%. In partnership with the President’s Special Initiative, The Micronutrient Initiative, Technoserve and UNICEF, WFP is providing technical assistance in the form of eight mobile salt iodization units. Although Ghana is recognised as the second largest salt producer in West Africa, only 32% of the population consumes adequately iodised salt, compared with 98% in Nigeria. The report recommends that Ghana should encompass salt iodisation in law.
SECTION 2: ASSESSMENT OF COMPETITIVENESS

2.1: Industry structure

In determining the competiveness of Ghana’s salt industry, it is necessary to first understand the structure of the industry. Porter’s 5 forces model illustrated below was used for this purpose.

![Porter's 5 forces model](image)

**Fig 5**: Porter’s 5 forces model
Bargaining power of suppliers: The most important supply for Ghana’s salt is the sea and subsoil brine. Although access to sea brine is free, there are regulations governing the ownership of salt units where production is done.

Ghana’s complex land tenure systems have been an obstacle to socio-economic growth for many years. In many parts of the country private land is communally owned and held in trust on behalf of the community by stool chiefs or skins, which they hold allodial, that is to say absolute ownership, as a symbol of traditional authority. This approach to land ownership is characteristic of a pre-market economy where the limited exchange that took place was still restricted to specific clans or ethnic groups. Consultations and reforms to bring the land tenure system in line with economic and commercial realities have been on-going since pre-colonial times. However, a satisfactory solution is yet to be reached.

The land surrounding the Songhor Lagoon within the Dangme East district differs from most areas in that the district has no stool lands. Land is owned by clans through families and the clan heads have jurisdiction over the land owned by their clans. The administration of the lands is undertaken by the head or chief in consultation with the land owning families and elders. Of the 10 clans within this area only six are land owning and of these only three own the lands of the Ada Songhor Lagoon. These clans are the Tekperbiawe, Adibiawe and the Lomobiawe.

In order to encourage private investment in mining, Government enacted the Minerals and Mining Law, 1986 (PNDCL 153) and the Small-Scale Mining Law (PNDCL 218) in 1989. Salt is considered to be a mineral, and therefore subject to these legal provisions. Under the Ghana Investment Promotion Centre(GIPC) Act, 1994 (Act 478), foreign investment in all sectors of the economy, other than mining, petroleum, free zones and portfolio investments, can be established without prior approval by GIPC. However mining and petroleum sector projects have to be approved or licensed by the Minerals Commission and the Ministry of Mines and Energy, respectively.

In spite of this, the regulatory framework for investment in salt remains complicated due to land tenure issues. The list below indicates that there are close to 20 agencies involved in land for salt production:

---

5 Derived from ISSER Technical paper No. 71- “The politics of land tenure reform in Ghana: from the Crown Lands Bill to The Land Administration Project”
Formal agencies
i. Ministry of Lands and Forestry
ii. Ministry of Mines and Energy
iii. Lands Commission
iv. Survey Department
v. Land Title Registry
vi. Department of Town and Country Planning
vii. Stool Lands Administrator
viii. Land Valuation Board
ix. Land Administration Project Unit
x. Regional Coordinating Councils
xi. District Assemblies
xii. Regional Lands Commission
xiii. Stool Lands Boundary Settlement Commission
xiv. Joint Border Commissions and Minerals Commission
xv. Ghana Investment Promotion Centre

Informal agencies
xvi. National House of Chiefs/Regional House of Chiefs/Traditional Councils/Individual Chiefs
xvii. Ghana Institute of Surveyors
xviii. Environmental Protection Agency

Problems of dispute over jurisdiction of territory between different clans and independent groups of investors who had leased land in the early seventies became so serious that the government was forced to acquire the Songhor Lagoon and adjoining lands. Whilst this allowed the continuation of business for the investors it denied the clans the right to their own land. The leases were terminated by the government in 1992 and the land was vested to the government under PNDC Law 287 in trust for the owners.

In fact, land based conflicts arise out of a number of issues. A paper published by the Institute of Statistical, Social and Economic Research summarises the sources of conflict as follows:

- Conflicting claims to territorial lands arising from disputed histories and/or boundaries between ethnic groups as well as towns and villages occupying contiguous lands.

---

6 ibid
• General ‘indiscipline’, especially in the urban land market where there is rampant land encroachment and misappropriation, multiple land sales as well as unapproved and unreliable cadastral maps.
• Compulsory acquisition by government of large tracts of land which are under-utilised or misapplied,
• Tenure insecurity due to conflicting interests between landlords and tenants.

This scenario makes the process of investing in salt cumbersome, time consuming and costly and especially so for the foreign investors that the country is trying to attract. It also frustrates efforts to create employment, generate wealth at the grassroots and improve the living standards of communities in salt-rich areas such as Songhor.

Generally, the bargaining power of suppliers- taken to include access to land and the legal and regulatory environment- is high.

**Threat of new entrants:** Once a licence has been secured, establishing a salt unit requires very little capital. However, the barriers grow in proportion with the scale and complexity of the operation.

An entrepreneur, irrespective of nationality, can set up a business enterprise in Ghana in accordance with the provisions of any of the following legal instruments:

• The Companies Code, 1963 (Act 179)
• The Partnership Act, 1962 (Act 152)
• The Business Name Act, 1962 (Act 151).

Under the GIPC Act 478 the registration will be concluded only when the legal minimum equity contribution has been met. The amounts involved are:

• Joint Venture - US$10,000.00
• 100% Foreign-Owned - US$50,000.00
• All Trading Enterprises - US$300,000.00

Providing an investor meets the minimum equity requirement of US $ 50,000 or trading US$ 300,000 then 100% foreign ownership is allowed.
For a joint venture with a Ghana company there is no country equity requirement, but there is a minimum requirement US$ 10,000 or equivalent in capital goods. Depending on location there are tax incentives for industrial/manufacturing companies. Ghana is committed to entering into double taxation agreements (DTAs) with interested countries with the ultimate objective of freeing investment capital and thereby securing the investment capital from being eroded by the effects of taxation. There are DTAs with France, the UK, Belgium, Italy, Germany and S. Africa.\textsuperscript{7}

The threat of new entrants is high.

\textbf{Threat of substitutes:} As most of Ghana’s salt is used for animal and human consumption, the threat of substitutes is not significant.

\textbf{Inter-industry rivalry:} Salt is a naturally occurring product that is seasonal. The barriers to entry are low, and demand is high. The situation in Ghana is that virtually all the salt produced is sold, regardless of its quality. The result is that most producers have reached a comfort zone and inter-industry relations were observed to be healthy. An informal price signalling mechanism has evolved and this is generally observed since demand outstrips supply. However, this may change when large scale players enter the market. Too many of the major producers of salt in Ghana have not developed over a long period. The result of this is a low level of technology and as essential, a lack of management skills, and difficulty in accessing affordable capital due to their limited track record. Inter-industry rivalry is low.

\textbf{Bargaining power of buyers:} With the exception of a few producers who supply Development agencies and manufacturing concerns, the customers are almost entirely individual retailers and traders. Because this is a disparate group dealing in a product whose demand is inelastic, and which has few substitutes, their power is limited.

\textsuperscript{7} Details of requirements for investment and applicable incentives can be obtained from the GIPC- \url{www.gipc.org.gh}
2.2: Positioning and competitiveness
The emerging picture of the salt industry in Ghana is one that has great potential arising out of the market opportunity, low entry barriers and lack of substitutes. The legal and regulatory environment needs to be streamlined as a matter of urgency if the industry is to become more competitive. In the short term, buyers consist of individual retailers and traders with corporate clients making up only a small proportion. As industry continues to grow- and especially the new oil and gas finds- the character of buyers is likely to change significantly.

Much has been said about state of the art production i.e. a high degree of mechanisation. However, care should be taken not to introduce expensive machinery. An approach where there is a gradual move to simple mechanical processes would be less costly and the yield per acre not significantly different for most of the present producers.

The oil industry will require prompt deliveries at the right quality and price, even on a just in time basis (JIT). Inward investors will be able to produce salt at the right quality depending on the market demand and will have international experience. They will have little hesitation in providing for the oil industry or indeed to local industry. This will have the effect of making the internal market more competitive.

It is therefore crucial that the industry (i.e. producers) begin to prepare for this transformation.

The implications of such an industry are broadly twofold:

1. Any strategy to transform the industry must include a component to streamline the land ownership and regulatory structure
2. The producers in the industry are in a strong strategic position. However, there appears to be very little growth in terms of scale (output) and complexity (moving into more value added products). Here again the access to land becomes a key factor. The strategy should therefore be underpinned by the need to incentivize producers and move them out of the current comfort zone.

Ghana will not be a world player but has enough salt to make a mark on the regional market. It is essential that Ghana establishes suitable markets ahead of any efforts to
encourage new production methods and technology. Establishing suitable value
added markets will allow an analysis of the competition, confirmation of affordability
and generate business for salt producers in Ghana.
SECTION 3: PRODUCTION AND MARKETING STRATEGY

Ghana produces about 250,000Mt/annum of which 62,000Mt/annum is exported. (Estimated production capacity is presented in Annex 2.) We estimate the salt available for production is as follows:

<table>
<thead>
<tr>
<th></th>
<th>Estimated production capacity existing units</th>
<th>683600</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Estimated production after adopting basic technology</td>
<td>786140</td>
</tr>
<tr>
<td>C</td>
<td>Production potential of Songhor Lagoon</td>
<td>1,438,880</td>
</tr>
<tr>
<td></td>
<td>Total approximate salt production potential B+C</td>
<td>2,224,940 Mt /annum</td>
</tr>
</tbody>
</table>

The above total does not include the Keta Lagoon which could bring production within the 3m.Mt region.

Salt in Ghana is an unlimited resource whose production is, nonetheless, seasonal. We have established that virtually all the salt currently produced is sold, and that there are no significant substitutes to the product. The population in the region is growing, therefore it can be inferred that demand will almost certainly increase. At the same time, we have established that the chemical and food industry consumes more salt than human and animal use. Long term growth is inextricably linked to industrial development. Between 2003 and 2006 the average rate of industrial growth in Ghana was 4.6%. It is not possible to disaggregate the figures to determine the growth rate of industries that use salt as an input. It is clear that human and animal use consumption will remain an important market segment for Ghana’s salt producers in the short to medium term. The challenge therefore is to change the culture and attitude of the industry to get them to produce more and better quality salt.

Our concern is with the producers in the 5000 – 70,000 Mt range. With very few exceptions there has been little growth for these producers, who lack the economies of scale for export, have low investment, a lack of credit and inadequate production know how and technology. In many respects much of this stems from a lack of commitment to growth.

Based on site visits, consultations and analysis carried out, the production and marketing strategy comprises three mutually re-enforcing strands:
1. Increase the volume of production
2. Product diversification

3.1 INCREASE PRODUCTION

3.1.1: Making production more efficient: Although a few units visited were continuously working to make production more efficient, the majority were not. The specific measures will vary from unit to unit. For some it will require regular de-silting of channels to increase the bome of sea brine; or modifying the layout of salt ponds in such a way as to ensure the gradual precipitation of the different salts (e.g. adopting a series layout rather than in parallel), for others it will simply be investing in light carts so as to improve the method of collection of the salt harvested. A report prepared for the PSI in 2004 highlights some of the pertinent unit-specific issues that need to be addressed. A few units (e.g Pambros, Ningo) have implemented some of the recommendations. There is need to adopt the principles of continuous improvement and other production management techniques such as quality circles to make the effort sustainable.

3.1.2: Increase the scale of production: As salt is a low value commodity, economies of scale are very important for long term profitability. It will require significant capital outlay to achieve this. The non-performance of the majority of loans provided to the salt sector, coupled with the shrinkage of available funds brought about by the global financial crisis implies that it will be extremely difficult for producers to acquire the necessary capital from the banking/financial sector. The alternative is to attract joint venture partnerships with foreign investors. During this study, the team was made aware of several foreign investors that are interested in the salt sector in Ghana. There is need to profile the existing Ghanaian companies to establish those for whom this is a viable strategy and to clearly define the parameters for partnership in order to ensure mutual benefit.

3.1.3: Foster linkages with producer groups: Salt producer associations in Ghana are quite well organised. They currently provide a service for local markets and individuals. Where larger orders need to be satisfied members will arrange to sell to each other to make up the difference. There is a level of co-operation between the associations and production units and this needs to be strengthened if producers are
to achieve the economies of scale necessary for long term profitability and value addition. The major issue is to create the incentive for this relationship to develop.

Strategic Alliances and Clusters have become an innovative and proven business practice which develops cooperation between small and medium sized businesses enabling them to gain substantial competitive advantage. Companies are motivated to join forces in achieving business goals which they could not achieve in isolation. Strategic alliances have a proven record in Europe, US, New Zealand, Australia, Canada and Malta, where companies have taken advantage of new strategic opportunities, entered new markets and developed new production methods.

Clusters can be informal among local companies, a geographically bounded concentration of similar or related businesses with active channels for business transactions, communications and dialogue that share specialised infrastructure, labour markets and services and are faced with common opportunities and threats. Clusters are geographical and work well where companies are in reasonable close proximity. Given the right conditions, they can form the basis for innovative ideas and commercial partnership. Where an idea or practice becomes commercial i.e. is marketable, formalisation needs to take place; we are then looking at creating a strategic alliance. A strategic alliance comprises a complementary group of small and medium sized companies established to achieve shared objectives and draws upon the skills and competencies of all participants. Typically an alliance will have three to eight firms. Strategic alliances are not mergers, they are cooperation initiatives built on interdependence and the ability to capitalise on each others’ strengths and facilities to mutual advantage.

To our knowledge, this approach has not been tried in Ghana’s salt sector and will require a pilot led by a support organisation such as PSI or GEPC.

**3.1.4 Resolve the issues in the Songhor area:** As previously stated, this area is the most productive as far as salt production is concerned. The Songhor Lagoon area is crucial to the development of the salt industry in Ghana having a potential production of 1,438,880 Mt /annum. This figure is calculated on the basis of modern state of the art production methodology. Development at this scale requires capital investment together with a high degree of technology and management skills. Above all, it requires an operation at a large scale. Inward investment will have a substantial effect on poverty reduction and also on the nature of employment. Whilst
modern production methods require less people they are better paid, provide good facilities and the opportunity to learn new skills. If by-products are manufactured then the number of job opportunities will increase. It is important therefore to attract and encourage the right investors.

Revenue from the lease of the land would be the major factor in poverty reduction for the area and close attention needs to be taken in setting value, time scale and need. Farming, fishing and environmental considerations are also important factors which must be developed alongside manufacturing. This subject is well covered in the “Land Use Plan for the Ada Songhor Lagoon Area”. The plan which is now before Government but not yet adopted should form the backdrop for future proposals.

A major obstacle has been the acquisition of land for investment and development projects. Two inter-related problems need to be addressed urgently, namely: a) Songhor salt industries b) The wider Songhor lagoon.

**a) Songhor salt industries**: This company was operated successfully as a private entity until 1992 when Government cancelled the lease. Since then Government has held the concession in trust for the community. Songhor salt industries company is managed by an interim committee appointed by the Ministry of Lands, Forestry and Mines. So far there have been 3 interim committees. Although an agency under Government, the company does not receive any subvention.

Songhor salt company faces a number of pressing challenges. Production, which peaked at 100,000 tonnes whilst the company was in private hands, has fallen to 45,000 tonnes and is likely to decline even further. This is due to a confluence of factors, including massive encroachment and diversion of channels by the surrounding community, high labour costs and contamination. It is recommended that Government urgently take action and consider returning it to the private sector.

**b) Songhor lagoon**: The Ada Songhor Lagoon area in 2006 had a population of approximately 80,000 which is estimated to grow at 2% per annum. The land is owned by clans. Clan heads have jurisdiction, but administration of the land is undertaken by the clan chief in consultation with the elders of the land-owning clan families. The three clans in the Songhor lagoon are the Tekperbiawe, Adibiawe and the Lomobiawe. Each of the clans currently controls salt production at the micro
level. This provides a degree of income and employment for the communities, but a lot more would be achieved if the clans developed the land together. The Private Enterprise Foundation (PEF) has been in the process of facilitating a sustainable process between the clans and the Government; the result has been the formation of a company limited by guarantee The Tekperbiawe Clan Foundation (TCF), which is detailed below.

**The Tekperbiawe Clan Foundation (TCF)**

The TCF is a company limited by guarantee which represents the clan as a whole, who will abide by the aims objectives and rules as specified within the memorandum and articles of association. The directors and subscribers (Guarantors) are the Traditional rulers and selected specific persons able to give technical, legal and administrative advice and who are known to the traditional rulers. Disputes are settled at this level and there is a structure and agreed procedure. This type of foundation is paramount to the success of any significant land development not only for the Songhor Lagoon. While not all clans are on board at this stage, negotiations are at an advanced stage. The land owned by the Tekperbiawe Foundation however is sufficient to proceed without the other clans. It is still important to involve all the clans as this removes any doubts from investors and ensures that they only contract with one organisation.

It is estimated that up to five production companies could produce effectively from this area. However attracting this type of investment requires ease of entry—that is to say most obstacles to leasing and developing land have been removed to a degree that encourages international companies to invest.

The PEF has developed a model to govern investment and revenue sharing with the objective of improving the livelihoods of the community through higher incomes and provision of social services. A simplified illustration of the model is presented in Figure 6 below:
Figure 6: TCF model

The crucial factor is the ability to have the clans work together through one organisation-TCF- and have their commercial interests represented by the Salt Development Company. If implemented, this model would go a long way in dealing with the obstacles in the way of developing the Songhor lagoon. However there are still major problems to be overcome, most of them revolving around feasibility. It is essential to build trust and secure the commitment of the clan heads. In addition, it will be necessary to clearly articulate the potential benefit to the community.

Some issues to consider include the following:
1. **Expectations:** It is anticipated that by following the TCF model, the community will benefit through higher employment. However, it is likely that new investors will apply modern production methods which typically require less unskilled labour. The upside is that the jobs available will be of higher value, although there is no guarantee that they will go to the community. Further, there is need for careful consideration in attracting investors who are not only looking for growth but are prepared to be closely involved in the locality.

2. **Revenue from the lease of the land:** Substantial revenue could be earned, but for what? There needs to be a firm understanding of what is needed. This may be schools, medical services, investment in other job creation, education etc. this should to be estimated beforehand, and otherwise the foundation will get what is left not what is needed.

3. **Infrastructure:** A firm understanding on infrastructure development is crucial. The foundation should already be meeting with the government as the subject also impacts on the oil industry.

4. **Management:** So far there is no constitution confirmed for resolving disputes within the foundation. Any investor will require seeing this, as it should encompass the mechanisms for guarantee. If there is a dispute which stops production then the investor will require compensation. Settling this subject at an early stage provides the type of credibility that investors will be looking for.

**RECOMMENDATIONS**

*i.Structure*
Protecting the rights and control of the TCF, and establishing the Salt Development Company as the representative organisation that has direct access to investors enabling it to establish lease agreements and the distribution of funds are key priorities.

In negotiating with future investors a further company is about to be formed, that is the Ada Salt Development Company Ltd (ASDC). This company is limited by liability and therefore has shareholders who are the Clan heads and a number of other key personnel. The structure of the company is important and must have careful consideration as it should be the lead company that represents the clans. Ultimately,
the success of any production programme depends on the efficacy of this organization.

The disposition of shares in the salt development company should not be eroded i.e. remain at the suggested 80% for the TCF and this situation of control fully understood by TCF guarantors.

Ownership (shareholders) dictates control. Control is not the same as management. Control enables the owners to set policy, either positively or quiescently, or to appoint those who set policy (directors). Management should follow the policy set by/or on behalf of the owners. Ownership and management may be in the same hands but they are distinct functions. To illustrate using British law:

75% + 1 share - almost total control. Can pass:

*Extraordinary Resolution* (14 days notice and three-quarters majority of those present and voting unless a ballot is called for). Needed to voluntarily wind up the company or can be put in the Articles to make it more difficult than by an Ordinary Resolution to pass some matters, e.g. to approve dividends, appoint a Chairman, etc.

*Special Resolution* (as an Extraordinary Resolution but with 21 days notice, specifying it as a special resolution with printed copy to Registrar of Companies). Needed to alter shareholders’ rights (reduce capital, redeem shares, change voting rights, etc.), change Memorandum and Articles Association except if Memorandum does not allow variation, change of name, no auditor for a dormant company, etc.

Share holding in the ASDC is likely to be a sensitive and controversial subject. The process and distribution of shares must be fully understood and agreed by the clan members, represented by the Tekperbiawe Clan Foundation. Share holding should be as a reward for future sustainable, specialist and necessary advice, or to ongoing senior management and by sustained results. The question of the company being limited by guarantee and even set up as a charity should be fully investigated and the basis of the final decision explained to the stakeholders.
It is extremely important that the Ada Salt Development Company (ASDC) appoints directors that are experienced and competent to run and develop the company. A number of key shareholders should be board members, but these should be limited. Investors will be looking for competence. It is crucial that all disputes and development plans are agreed at the Tekperbiawe Board.

Consideration must be given to the cost of setting up and running ASDC until such a time when inward investors are contracted and there is a cash flow. Like for any other going concern there will be need to consider the running costs, including recruitment, salaries, premises and administration costs.

**ii) Representation**
The contact point for negotiation and management with potential licensees should be the ASDC or similar organisation, supported by the relevant public and private institutions. Inward investors will not want to interface with a fragmented and badly planned approach from too many organisations. Rules of engagement should be confirmed beforehand.

This is a turning point for the PEF where the Board of ASDC begins to take some of the responsibility whilst the PEF continues to advise and support the foundation. Now is the time to provide a feasibility study which will explore the boundaries of what is needed and what is possible. This exercise needs the support of an experience facilitator working with those members of the PEF that will carry the feasibility forward into a final business plan, supported by the Government, local authorities and key stakeholders.

**iii) Feasibility**
The fundamental purpose of the Feasibility Study is to validate that the ASDC is not only commercially viable but provides the necessary resource to implement and sustain a poverty reduction programme. An effective study will clearly demonstrate to the foundation, the government and key players that the proposed idea is consistent, achievable and acceptable.

**iv) Consistency**
The three elements of consistency are that the project proposition:
• Meets the criteria defined by foundation and necessary to encourage investment
• Solves the identified common problems and/or exploits a real opportunity
• Fits the participants’ shared vision of collaborating with each other to gain incremental competitive advantage

v) Achievability

The proposition should deliver the cost and/or revenue aims of the participants, create a genuine sustainable competitive advantage, actually solve the defined problems and/or effectively exploit the identified opportunity. The key players who constitute the support of the ASDC jointly have (or can acquire) the skills required to implement the project proposition. In addition, the foundation or supporting organisation jointly have (or can acquire the resources required to establish the ASDC and support it until trading begins.

vi) Acceptability

The six elements of the foundation proposition which must be acceptable to participants are:

• Forecasted financial performance
• The benefits which the foundation gains from participation in the projects
• The degree of risk to which the foundation is exposed.
• The resources which will be required to commit to any future proposition
• The time frame each player will have to commit to the project
3.2 PRODUCT DIVERSIFICATION

The substances dissolved in sea water and brines which constitute the total dissolved solids are:

- Calcium
- Calcium sulphate
- Sodium chloride
- Potassium chloride
- Magnesium sulphate
- Sodium sulphate
- Magnesium chloride
- Magnesium bromide

Annex 3 outlines the composition of brine.

Besides these salts there are a large number of others occurring in very small quantities in sea water e.g., Iodides, Fluorides, Phosphates and Nitrates, Iron, Silver, Gold, Copper, Lead, Arsenic, Zinc, Nickel, Lithium, Rubidium and Caesium; but as these substances occur in infinitely minute quantities, they are of no technical importance in the recovery of substances from sea water. In view of the low percentage of other marine chemicals in sea water it is not economically possible to recover most of these marine chemicals. Thus in large salt fields recovery is only possible of Potassium Salts, Calcium Salts, Magnesium Salts, & Bromine Compounds.

Because of its size, Songhor Lagoon if fully developed can be a source of recovery of not only salt but such marine chemicals which will substantially improve the profitability and economies of scale. Annex 4 provides a technical explanation of recovery of dissolved substances.

Existing production units should be encouraged to add value of their product. For instance, refining salt produces different grades of salt, each targeted to a different market.
3.3 CROSS-CUTTING ISSUES:

3.3.1 Laws and regulations: Like in many countries, salt is considered to be a mineral and governed as such. In carrying out this study, the team undertook consultations\(^8\) with different stakeholders. There were a range of views on how best the regulatory regime can support the future development of the salt sector. The following modifications are proposed:

**Royalties:** The law provides for royalties of 3-12%. Given the various land ownership structures in the different regions of Ghana, and the low value of salt relative to other minerals such as gold, the applicable range of royalties should be revised accordingly.

**Community involvement:** Where feasible, there is need to provide some guidelines for commercial relationships between a local community and an investor to ensure mutual benefit and predictability. For instance, investors in some areas highlighted the prevailing situation where royalties are paid to up to 3 different parties.

**Consultation and enforcement:** Stakeholders raised the issue of non-enforcement of some regulations, such as the requirement for license holders to develop land within two years, or have the licenses revoked. In addition, there are regulations that protect the livelihoods of communities surrounding salt works that are not well understood. There is need for wider discussion with a view to build consensus on priorities for review.

3.3.2 Quality: There is need to inculcate the importance of developing and adhering to quality standards. This extends to basics such as not bagging salt while the moisture content is still high, and labeling the right quantities.

3.3.3 Marketing: At the moment there is no substantial marketing effort for Ghana’s salt, mainly because demand outstrips supply. As the industry develops with more companies investing in salt production, and more by-products being available, there will be need to embark on a concerted marketing effort. In order to defray the costs, it is proposed that the efforts at the level of production units be complemented with support from an association or agency such as GEPC. The process to be undertaken is outlined in Figure 7 below. The agency would perform the first 3 tasks (market

---

\(^8\) Efforts to meet with the Minerals Commission were not fruitful.
information, product evaluation and market entry strategy) on the basis of which the companies would develop business plans and service the markets.

**MARKET INFORMATION**
Market size, country, market segments, competition

**PRODUCT EVALUATION**
Products, standards, quality, price

**MARKET ENTRY STRATEGY**
agents, distributors, joint venture, license

**BUSINESS PLAN**
what period, finance, cash flow, payback

**IMPLEMENTATION**
Sales, customer service, monitoring

Fig 7: Marketing plan

An approach to consider in the medium to long term is the establishment of a marketing company which would be owned by different salt producing companies as shown in Figure 8 below. This approach allows the companies to achieve the benefits of scale and concentrate on production.

Fig 8: Salt marketing company
SECTION 4: IMPLEMENTATION

Successful implementation of any sector-wide strategy requires the following:

- Broad endorsement and ownership by the key players, in this case salt producers, companies and respective member-based associations, if any
- Government commitment to provide policy direction, funding and capacity building for the ministries, departments and agencies involved
- Clear roles and responsibilities of the implementation agencies
- A mechanism to steer and monitor implementation, and make any necessary changes
- Strong leadership

It is essential that these ingredients are in place in Ghana.

4.1: Institutional framework

During the consultations, there was a recommendation to create a specific body to oversee the growth and development of the salt sector in Ghana, similar, for instance to the Cocoa board. While there is merit in this approach, our view is that the requirements for its establishment (e.g., enacting and passing legislation and obtaining the necessary funding) are quite considerable in time and funding. In addition, a vast majority of the roles this body would play are already within the mandates of existing institutions. It is therefore our recommendation that these institutions be strengthened and empowered to carry out the required functions.

There is no doubt that the private sector is willing and has the capacity to deliver Ghana’s aspirations with respect to the role that salt can play in the country’s development. However, the importance of obtaining support from other Government and Non-governmental agencies cannot be over-stated.

The main agencies are:

- Ghana Export Promotion Council
- Private Enterprise Foundation
- President’s Special Initiative (Salt)
Among these, the first three (GEPC, PEF and PSI) have specific and direct roles to play in implementing the strategy. PSI, GEPC and PEF are among the agencies supporting the salt sector. With their limited resources, each has played a part in getting the sector to the stage it is today. However, in moving forward, it is recommended that the roles be more clearly delineated in order to maximize synergies, avoid duplication, thereby making the most effective use of the limited resources.

4.1.1 The Ghana Export Promotion Council (GEPC)

As the national focal point institution for export development and promotion under the aegis of the Ministry of Trade and Industry, GEPC already engages in an extensive scope of activities encompassed within its mandate. There is need to have a focus on the salt sector. Specifically, GEPC should:

- **Spearhead market research**: This entails collecting regular information on market information (specific countries, segments, competition); products (standards, quality, price); and provide advice on appropriate market entry strategies.

- **Facilitate promotion**: Organise and mobilize for buyer missions, preparation and assistance for effective participation in buyer missions, fairs and exhibitions.

- **Policy advocacy**: Recommending to Government the necessary assistance and incentives needed by the exporters

- **Training and capacity building** for successful export marketing

- **Sourcing opportunities for financial and technical support**.

- **Develop and maintain a database of exporters.** In addition to tracking the performance of companies, this helps to match exporters to markets and supplier chains.
4.1.2. The Private Enterprise Foundation (PEF)

The mission of the PEF is to service the development needs of the private sector by influencing government policies and regulations in order to create an enabling environment for a private sector-led economic growth strategy and national development. Government of Ghana, supported by a World Bank programmatic Development Policy operation, arrived at Agreements under a 2008 Natural Resource and Environmental Governance (NREG) programme supporting institutional reforms including further decentralization of services and greater engagement of civil society and local communities in natural resource and environmental governance. PEF’s work would be complementary to this programme.

PEF has already done commendable work in facilitating the resolution of land disputes between the Traditional Council and the land owning clans of the Songhor Lagoon and Ada, to create a level playing field for development of the salt within the land. The result has been to establish the Tekperbiawe Clan Foundation which is essential for the future development of the land owned by the clans.

It is recommended that PEF take a leadership role in:

a. **Land ownership arrangements for commercial use.** PEF should spearhead efforts to streamline land acquisition and licensing procedure to enhance easy accessibility and enhance land tenure security. Specifically, PEF should be facilitated to address the issues highlighted with respect to the wider Songhor lagoon. This should be with a view to pilot the TCF, adapt and replicate it in other salt rich areas where similar constraints exist.

b. **Research and policy advocacy** on resource management, legal and regulatory issues concerning salt production.

4.1.3. Presidents Special Initiative on Salt (PSI)

The vision of the President’s Special Initiative on Salt is to develop an internationally competitive salt based industry that shall be a lead export earner and a pillar of socio-economic growth in Ghana. The PSI salt made the first attempt to re-develop the salt industry to achieve international competitiveness and international performance and to play a significant role in Ghana’s poverty reduction strategy with
emphasis on job creation. Key implementation priorities include certain tasks that are considered critical for the effective execution of the program, such as:
Implementation of an industry audit report to improve production methods;

- **Technical advisory services** for companies to enhance production efficiency, including facilitating linkages between producers and manufacturers
- **Human resource development** to improve both managerial and technical skills;
- **Co-ordinating feasibility studies** for product diversification and value addition.

### 4.1.4 Ghana Investment Promotion Centre (GIPC)

The successful export of salt or any by-product will depend on the ability to attract investment. GIPC is well placed to lead this aspect of the strategy. Specific activities include:

a. **Profiling the salt companies** to establish those for whom joint venture partnerships are viable and performing some due diligence on interested investors.

b. **Providing technical assistance** in structuring companies to take advantage of opportunities in the salt sector, such as advice on seeking and managing partnerships or sale of companies.

c. **Targetted investment promotion and after care.** This could extend to advice on acquisition of land, relationships with relevant Government agencies, incentive regimes, among others.

### 4.2 Government support

The Government needs with some urgency to provide policy direction for the industry to serve as the basis for future support to the agencies that facilitate the industry. It is recommended that a high level official in the Ministry of Trade be designated to establish an implementation committee and ensure that the respective agencies are well facilitated to perform their roles in developing the salt sector in Ghana.
4.3 Other

There will be need for targeted technical expertise. As much as possible, this should be designed in such a way as to transfer real practical skill and expertise to the companies, producer groups or agencies. In some cases, this expertise is already available in Ghana and what would then be required is for limited additional funding, or prioritising the activity in the organisation’s work plan. It goes without saying that nothing can be achieved without the goodwill and commitment of the main actors—that is the companies, producer groups and community representatives.
### 4.4 Strategy and Implementation Plan

<table>
<thead>
<tr>
<th>Activities</th>
<th>Responsible agencies</th>
<th>Requirements</th>
<th>Time frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INCREASE PRODUCTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Make production more efficient</td>
<td>PEF</td>
<td>Technical expertise</td>
<td>Year 1-3</td>
</tr>
<tr>
<td>a. Update and implement 2004 production audit</td>
<td>Production companies</td>
<td>Funds Training</td>
<td></td>
</tr>
<tr>
<td>b. Develop and implement procedures and practices for continuous improvement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Increase scale of production</td>
<td>GIPC</td>
<td>Technical expertise</td>
<td>Year 1</td>
</tr>
<tr>
<td>a. Profile companies to assess viable investment measures for expansion</td>
<td>Production companies</td>
<td>Funds</td>
<td></td>
</tr>
<tr>
<td>1.3 Foster linkages with producer groups</td>
<td>PSI</td>
<td>Technical expertise</td>
<td>Year 1</td>
</tr>
<tr>
<td>a. Raise awareness and establish obstacles to co-operation arrangements</td>
<td>Producer companies Producer associations</td>
<td>Funds</td>
<td></td>
</tr>
<tr>
<td>b. Assess feasibility of cluster formation</td>
<td>PSI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Resolve the issues in the Songhor area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Take action on the Songhor salt industries (e.g. privatisation)</td>
<td>MoT Ministry of Lands, Forestry &amp; Mines</td>
<td>Government policy Technical expertise</td>
<td>Year 1-2</td>
</tr>
<tr>
<td>b. Carry out wider consultations and secure buy-in on the TCF</td>
<td>PEF PSI Minerals Commission</td>
<td></td>
<td>Year 1</td>
</tr>
<tr>
<td>c. Streamline the organisation and structure to establish the ASDC</td>
<td>PEF</td>
<td></td>
<td>Year 1</td>
</tr>
<tr>
<td>d. Secure commitment to develop a pilot project for the Songhor lagoon</td>
<td>PEF</td>
<td>Funds</td>
<td>Year 2-3</td>
</tr>
</tbody>
</table>

<p>| 2. PRODUCT DIVERSIFICATION                      |                      |                                       |              |</p>
<table>
<thead>
<tr>
<th>Activities</th>
<th>Responsible agencies</th>
<th>Requirements</th>
<th>Time frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Carry out feasibility study on viable products</td>
<td>PSI</td>
<td>Technical expertise</td>
<td>Year 2-3</td>
</tr>
<tr>
<td></td>
<td>GEPC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Production companies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. CROSS-CUTTING ISSUES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Review legal provisions and propose amendments with respect to salt</td>
<td>PEF, PSI, GEPC, GIPC, Minerals Commission</td>
<td></td>
<td>Year 1-2</td>
</tr>
<tr>
<td>b. Promote adherence to quality standards</td>
<td>PEF, Production companies Associates Ghana standards Board</td>
<td></td>
<td>Year 2-3</td>
</tr>
<tr>
<td>c. Carry out market and product research and analysis</td>
<td>GEPC</td>
<td></td>
<td>Year 2-3</td>
</tr>
<tr>
<td></td>
<td>Production companies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Annexes
Annex 1. Estimated production capacity

Salt production achieved during last 5 years in Ghana – Approx. 250000 MT/annum.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name of Salt Producing Units</th>
<th>Area / Location</th>
<th>Est. Capacity (MT/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adjua Salt Mining Company</td>
<td>Adjua</td>
<td>2,000</td>
</tr>
<tr>
<td>2</td>
<td>Adom Salt Industries</td>
<td>Apam</td>
<td>2,000</td>
</tr>
<tr>
<td>3</td>
<td>Bobana Salt Co. Ltd.</td>
<td>Mankessim</td>
<td>2,000</td>
</tr>
<tr>
<td>4</td>
<td>Dangme Salt Co. Ltd.</td>
<td>Sege, Ada</td>
<td>50,000*</td>
</tr>
<tr>
<td>5</td>
<td>Edinaman Salt Ind. Ltd.</td>
<td>Elimina</td>
<td>10,000</td>
</tr>
<tr>
<td>6</td>
<td>Eldin Salt Mill Ltd.</td>
<td>Prampram</td>
<td>20,000</td>
</tr>
<tr>
<td>7</td>
<td>John Harris Salt Ltd.</td>
<td>Prampram</td>
<td>5,000</td>
</tr>
<tr>
<td>8</td>
<td>Modern Salt Ltd.</td>
<td>Ningo</td>
<td>1,000</td>
</tr>
<tr>
<td>9</td>
<td>Narrey Salt Ind. Ltd.</td>
<td>Prampram</td>
<td>1,000</td>
</tr>
<tr>
<td>10</td>
<td>Ningo Salt Refinery Ltd.</td>
<td>Ningo</td>
<td>250,000</td>
</tr>
<tr>
<td>11</td>
<td>Pakat Salt Ltd.</td>
<td>Mankessim</td>
<td>2,000</td>
</tr>
<tr>
<td>12</td>
<td>Panbros Salt Refinery Ltd.</td>
<td>Accra</td>
<td>70,000</td>
</tr>
<tr>
<td>13</td>
<td>Petua Salt Ltd.</td>
<td>Mankessim</td>
<td>500</td>
</tr>
<tr>
<td>14</td>
<td>Sastin Salt Ltd.</td>
<td>Apam</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>Savannah Salt Ltd.</td>
<td>Prampram</td>
<td>50</td>
</tr>
<tr>
<td>16</td>
<td>Sege Salt Ltd.</td>
<td>Ada</td>
<td>60,000*</td>
</tr>
<tr>
<td>17</td>
<td>Shenying Salt Ind. Gh. Co. Ltd.</td>
<td>Narkwa</td>
<td>15,000</td>
</tr>
<tr>
<td>18</td>
<td>Songhor Salt Project</td>
<td>Ada</td>
<td>50,000</td>
</tr>
<tr>
<td>19</td>
<td>Tradervo Salt &amp; Trading Co.</td>
<td>Mankessim</td>
<td>5,000</td>
</tr>
<tr>
<td>20</td>
<td>Transvolta Salt Complex Ltd.</td>
<td>Keta</td>
<td>1,000</td>
</tr>
<tr>
<td>21</td>
<td>U 2 Co. Ltd.</td>
<td>Winneba</td>
<td>30,000</td>
</tr>
<tr>
<td>22</td>
<td>Manna Invests</td>
<td>Mankessim</td>
<td>5,000</td>
</tr>
<tr>
<td>23</td>
<td>Anlo-Afiadenyigba Coop. Salt Prod.</td>
<td>Keta</td>
<td>40,000</td>
</tr>
<tr>
<td>24</td>
<td>Adina Salt winners Coop.</td>
<td>adina, Denu</td>
<td>4,000</td>
</tr>
<tr>
<td>25</td>
<td>Dangme East Salt Prod. Assoc.</td>
<td>Ada</td>
<td>6,000</td>
</tr>
<tr>
<td>26</td>
<td>Apam Salt Prod. Assoc.</td>
<td>Apam</td>
<td>3,000</td>
</tr>
<tr>
<td>27</td>
<td>Nyanyano Salt Prod., Assoc.</td>
<td>Nyanyano</td>
<td>4,000</td>
</tr>
<tr>
<td>28</td>
<td>Elmina Salt Producers Assoc.</td>
<td>Elamina</td>
<td>5,000</td>
</tr>
<tr>
<td>29</td>
<td>Salt winners around</td>
<td>Keta &amp; Songor lagoons</td>
<td>40,000</td>
</tr>
</tbody>
</table>

Estimated Production capacity of existing units (Total i )

\[
\text{Estimated production salt after adopting basic technology in existing units.} = 633600 \times 1.15 = 728640
\]

Production potential of Songhor basin

\[
\text{Estimated Production potential of Ghana} = 2,167,440
\]
Annex 2. Composition of Sea Water

<table>
<thead>
<tr>
<th>Substance</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Carbonate</td>
<td>0.1266</td>
</tr>
<tr>
<td>Calcium Sulphate</td>
<td>0.9976</td>
</tr>
<tr>
<td>Magnesium Sulphate</td>
<td>2.7267</td>
</tr>
<tr>
<td>Potassium chloride</td>
<td>1.0906</td>
</tr>
<tr>
<td>Magnesium chloride</td>
<td>2.6220</td>
</tr>
<tr>
<td>Magnesium Bromide</td>
<td>0.5934</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>26.8588</td>
</tr>
<tr>
<td></td>
<td>35.0157</td>
</tr>
</tbody>
</table>

**Percentages**

<table>
<thead>
<tr>
<th>Substance</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaCO3</td>
<td>0.3615</td>
</tr>
<tr>
<td>CaSO4</td>
<td>2.8490</td>
</tr>
<tr>
<td>MgSO4</td>
<td>7.7880</td>
</tr>
<tr>
<td>KCl</td>
<td>3.1145</td>
</tr>
<tr>
<td>MgCL2</td>
<td>7.4880</td>
</tr>
<tr>
<td>MgBr2</td>
<td>1.6940</td>
</tr>
<tr>
<td>NaCl</td>
<td>76.7050</td>
</tr>
<tr>
<td></td>
<td>100.0000</td>
</tr>
</tbody>
</table>
Annex 3. Recovery of Dissolved Substances

The dissolved substances give to the sea water their characteristic saline taste. There is a limit to the solubility of each of these substances. This limit depends upon the temperature of the liquid and the presence of other dissolved salts. In each individual case, water at a given temperature will dissolve only a certain quantity of the substance. When this quantity is dissolved, it will dissolve no more of that particular substance. The solution in that case gets saturated. In order to recover the dissolved substance, water which is not chemically changed, by the dissolved substance must be removed by evaporation either spontaneously in the open air, or by the application of heat. Most of the solids are dissolved in larger proportions by increase of temperature, but in the case of Sodium Chloride, its solubility remains practicably constant at higher temperatures.

If the saturated solution is lowered in temperature or its volume reduced by evaporation the equilibrium is disturbed, and the solution in that case holds more salt than it is able to retain in its normal solubility conditions. The solution is at this point super saturated, and the salt in excess will be thrown out of the solution as a solid until again a stable solution is formed under the altered conditions. This process becomes complicated if the solution contains more than one dissolved salt.

The separation of dissolved solids as the evaporation proceeds is in fixed order. The least soluble salt separates first and it is followed by the other salt in the order of its solubility. By regulating the rate of evaporation it is thus possible to separate out each salt as it reaches its point of saturation. This process known as fractional crystallization is applied in the separation of the various salts dissolved in sea water. In certain cases two salts separate out simultaneously. In such cases the mixture of salts is re-dissolved in fresh water, and the solution again concentrated and the salts re-crystallised.

By this process of re-crystallisation, pure salts are isolated. If, when the solution is super saturated a minute crystal of the salt is introduced into the solution by way of seeding or inoculation, the process of crystallization starts spontaneously in the solution. In many cases if the super-saturation is carried far enough, the crystallization will grow without the necessity of inoculation. When inoculation is necessary, the solution is in the metastable state, and when no inoculation is required and where the crystallization is spontaneous, the solution is in the liable state. In the concentration of sea water we have these three states occurring between the following densities:-

From 3.5 – 17°B the solution is unsaturated
From 17-25°B it is saturated as far as Calcium Sulphate is concerned.

---

9 Extract from: “SALT” Technology and Manufacturer of By-Products by Kapilram H. Vakil
From 24-25° the sea water or brine is in the metastable state. Between 25-29.5°B it is in the labile state as far as Sodium Chloride is concerned.

Evaporation – the change in water from its liquid to the gaseous state is brought about in increasing the molecular activity by the application of heat. The molecules of water are in a state of perpetual motion. The energy of this motion depends on the temperature and pressure. It is continuous, but increases if heat is applied to the liquid. When the molecules in motion are in liquid they are attracted by other surrounding molecules, but when these molecules reach the surface, some of them are moving with sufficient velocity to escape from the surface of the liquid into the surrounding space and mingle with the air over the liquid. Some of the molecules that have thus escaped have not sufficient energy to remain in the space and are thrown back in the liquid. Over the liquid there is a certain layer of molecules in gaseous form in constant struggle to go out of and come inside the liquid, the process of coming out of the liquid is known as evaporation. In short, water appears in gaseous state in the form of vapour at its surface. As the molecules are projected from the surface into the air, they have to encounter a certain resistance in their passage exerted by the pressure of the atmosphere and by the pressure of other molecules of water already existing there. If the pressure is great, a number of molecules strike back on the surface and return to the water till for a given temperature a maximum vapour pressure is obtained. The air above the liquid in that case is saturated.

As the molecules come out of the liquid they are rapidly carried away by a current of air, they do not get a chance of getting back so the liquid state and their place is taken by fresh molecules coming out of the water. The causes therefore which influences the rapidity of evaporation of water in open surfaces are:

[1] The temperature which increases the molecular activity;
[2] The quantity of the same vapour in the surrounding atmosphere;
[3] Renewal of this atmosphere, and
[4] Extent of the surface of the evaporation inducing a large number of molecules to strike out of the water as vapour at the same.

If evaporation is to be accelerated, it is necessary that:

(1) The molecular activity or temperature should be high. Temperature of the brine would depend on the temperature of air.
(2) The surface exposed should be as large as possible, if the brine is stationary the evaporation will be slow as the area exposed would be constant. It instead of this static condition, the brine is kept moving in thin layers, a very large surface would be exposed to the air and the evaporation in the latter case would be very rapid. The principle of a thin moving film is now widely applied in chemical engineering for concentration of liquids. The exposed surface of a liquid may be
considerably increased by a slow trickling over a pile of pebbles or faggots or by spraying from a great height. Both these methods are used in the rapid concentration of brine.

(3) There should be wind. Wind is the greatest factor in the removal of saturated vapours from evaporating surfaces. Wind also increases area exposed by creating waves and ripples. In French salterns, wind is considered of greater importance than the Sun. By increasing the current of air and by increasing the surface a maximum rate of evaporation may be obtained. This principle is employed in concentrating brines in high towers about 80 feet high by a 8 feet in diameter in which a strong current of air is maintained by blowers.