

NUST INSTITUTE OF MANAGEMENT SCIENCES

**MBA 2001
RESEARCH THESIS**

“POTENTIAL OF ROCK SALT IN THE ECONOMY OF PAKISTAN”

**ADVISOR:
WASIQUE WAHEED CH.**

**SUBMITTED BY:
FATIMA K. JAFFERI**

2001 – NUST – MBA – 132

NUST Institute of Management Sciences, Tamiz ud din Road, Rawalpindi Cantt.
Phone #: 051-9271580, Fax #: 051- 9271596, Email: wasique@hotmail.com

ACKNOWLEDGEMENTS

I am indebted to many people for having been able to write this research report, and I would like to express my gratitude to all of them. In particular I wish to thank:

My supervisor, Mr. Wasique Waheed Chaudhry, for his constant support, able guidance and the outstandingly good working conditions at NUST Institute of Management Sciences.

I must acknowledge as well my other thesis committee members:

- Mr. Naukhez Sarwar
- Ms. Zeenat Jabbar
- Mr. Irtaza Malik Awan (external advisor)

who assisted, advised, and supported my research and writing efforts. Especially, I need to express my gratitude and deep appreciation to Mr. Irtaza Malik Awan for his hospitality, knowledge that supported, enlightened, and provided me with the necessary information. He consistently helped me and generously gave time and expertise to better my work. I thank him for his contribution and support.

Table of contents

Chapter	Page No.
Executive Summary	i
Chapter 1: Introduction	1
1.1 background	1
1.2 research question	1
1.3 objective	1
1.4 Methodology	3
Chapter 2: Literature Review	7
2.1 economic order	7
2.1.1 world economic order	7
2.1.2 Pakistan's economic order	7
2.2 Exports – an important economic indicator	7
2.2.1 History of Pakistani exports	8
2.2.2 Opportunities & Challenges for Pakistan	8
2.3 Salt – An Important Mineral	11
2.3.1 Rock Salt in Pakistan	14
2.4 History of Salt	14
2.5 Salt production methods	16
2.5.1 Evaporated salt	16
2.5.2 Rock Salt	17
2.5.3 Solar Salt	18
2.6 Uses of Salt	19
2.6.1 Salt: Leading Chemical Feedstock	19
2.6.2 Human Nutrition	21
2.6.3 Animal Nutrition and Agriculture	25
2.6.4 Highway Deicing	26
2.6.5 Water Conditioning	28

2.6.6 Other Uses	29
Chapter 3: Findings	31
3.1 Major Salt Players	31
3.1.1 Cargill Salt Inc.	31
3.1.1.1 Cargill Salt Asia Pacific	35
3.1.2 Morton Salt	36
3.1.3 Salt Union Ltd	38
3.1.4 Dampier Salt	39
3.2 Rock salt in Pakistan	40
3.2.1 Location & Geology	41
3.2.2 History of Salt Mining	42
3.2.3 Salt Deposits	44
3.2.4 Types of Salt Produced	45
3.2.4.1 Rock Salt	45
3.2.4.2 Evaporated And Refined Salt	48
3.2.5 Production	49
3.2.6 Markets	50
3.2.7 Economics	52
3.2.8 Exports	56
3.3 Reasons for Inefficient Salt Production	59
Chapter 4: Analysis	62
4.1 Case Study of A Pakistani Salt Mining Company	62
4.1.1 Introduction	62
4.1.1.1 Some Historical Perspective	62
4.1.1.2 Company Overview	63
4.1.1.3 Mining Area	63
4.1.1.4 Area and Hand over Condition	63
4.1.2 Main Founding Objectives	64
4.1.3 Business Philosophy	64

4.1.4	Mining Lease Allotment and Renewal	64
4.1.5	Rock Salt Reserves Estimation	65
4.1.6	Developments	65
4.1.6.1	Salt Mines	65
4.1.6.2	Link Road	66
4.1.6.3	Civil Works	66
4.1.6.4	WAPDA Electricity and Electrification of Mines	67
4.1.6.5	Drainage and Disposal of Brackish Water	67
4.1.6.6	Water Supply System and Reservoirs	67
4.1.6.7	Communication Network	68
4.1.6.8	Mining Machinery and Transport Vehicles	68
4.1.7	Production	70
4.1.8	Organizational Chart	71
4.1.9	Future Plans of the Company	71
4.2	Analysis of the Company	72
4.2.1	Production	73
4.2.1.1	Investment in Technology – Key to Production	74
4.2.2	Lack of Interest from Investors and banks	86
4.2.3	Geographical Location with relation to nearest seaport	88
4.3	Case Study Analysis – Salt Tender from Finnish NHA	89
Chapter 5: Conclusion & Recommendations		91
5.1	Afghanistan Scenario	91
5.2	EPB Pakistan	92
5.3	Recommendations	93
5.3.1	Export Strategy	97

Appendices

EXECUTIVE SUMMARY

Rock salt is crystalline sodium chloride, called halite by mineralogists. It occurs in the form of rock masses and beds and is abundant in rocks from all geological periods. Nature has given Pakistan an inexhaustible wealth of high-grade rock salt deposits in the Punjab and NWFP. These abundant deposits of rock salt may have a very favorable impact on the economy of the country provided they can be utilized and exploited properly and efficiently. The prospects of export of rock salt and subsequent salt-based products from Pakistan are very high if we can effectively tap into this natural source of abundant rock salt deposits.

This research study validates the importance of rock salt in the economy of Pakistan. The study contains a comparative study of Pakistani salt producing companies and international salt producers and exporters. Further the study gives reasons for the inefficient salt production and exports of rock salt from Pakistan.

The last part of the study includes the methodology of overcoming the obstacles to exports of rock salt, so that the economy of Pakistan could realize the true potential and benefits of rock salt.

CHAPTER 1: INTRODUCTION

1.1 Back ground

For a country to properly and effectively utilize all its available resources, be it human or natural, is of utmost importance to sustain economic progression. The geological disturbances of millions of years ago have left Pakistan with abundant natural resources especially minerals like gypsum, granite, dolomite and many more. However the least talked about and fancied of all such natural resources is ironically the one with the most potential for export and growth – Rock Salt. Nature has bestowed upon Pakistan an inexhaustible wealth of high-grade rock salt deposits. This important raw material with a massive significance in the world can alone have a favorable impact on the economy provided we accept the dictates of nature and exploit these deposits to the optimum extent.

1.2 Research Question

How much potential does rock salt hold and what reasons obstruct the export of this mining asset from Pakistan?

1.3 Objectives

The main objective of this research study is to prove that not only Pakistan has abundant deposits of rock salt but also that there exist a major scope for export of this commodity to all over the world. However this study will first establish that indeed salt, as an important and vital raw material, has widespread uses all over the world. Most people probably are unaware of the true scale and importance of salt in every day life apart from its common use as a food preservative and taste enhancer.

However there is more to salt that meets the eye. It is an essential element in the diet of not only humans but of animals, and even of many plants. It is one of the most effective

and most widely used of all food preservatives. Its industrial uses are numerous almost without number. From the chemical industry to production of microchips to nuclear reactors to oil & gas wells, salt plays a vital role in almost all industry. In fact, salt is involved in almost all aspects of human activity. Every day, each of the earth's six billion inhabitants uses and relies on salt in one way or the other. The annual salt production of 204 million tons per day is mostly derived from massive multi-stage salt refineries spread in the industrialized world. It is the hope that this thesis will firstly establish the importance of salt in world and leave the reader more informed about its vast potential.

Secondly this study will discuss the largest natural deposits of rock salt any where in the world which exist in Pakistan. As a matter of fact according to Encyclopedia Britannica, Pakistan's rock salt deposits, mostly concentrated in "Salt Range" region of Punjab, are the richest and purest deposits of this important mineral in the world. Incongruously though not even 5% of these deposits are being exploited today. This research will attempt to point out the deficiencies and ill planning that has hampered attempts to fully exploit these rich deposits. The biggest salt mines in Pakistan that are being run by the government will be shown suffering from chronic mismanagement and lack of vision and sight thus rendering them useless to large scale possible export of this commodity. Pakistan's private rock salt sector would be looked at and discussed in detail. While a few such private enterprises have shown the vision and courage to realize the potential of rock salt, however due to many circumstances their efforts are coming short of what is needed to improve the situation.

The study will also look at major salt producers like Morton Salt and Cargill Salt of USA, Salt Union of UK and Dampier Salt of Australia that have a strangled hold on worldwide salt production and trading on a massive scale. These powerhouse companies with revenues in millions and in some cases billions of dollars a year from salt have realized the importance of this innocuous looking white granular substance we know today commonly as "Salt." This thesis will establish how these companies have been able to convert salt into billions of dollars of yearly revenues for them. While Pakistan which has this substance in abundance in nature, cannot even tap 10% of these revenues

It is also important to take a look at our salt competitor companies in India. In spite of virtually zero rock salt deposits, Indian companies have invested heavily in solar-salt production facilities i.e. salt produced from seawater evaporation. This foresight has resulted in them today holding a major chunk of yearly salt exports to Middle East resulting in millions of dollars of revenues. Though being located geographically closer to the Middle East, Pakistani salt companies still cannot compete with Indian salt manufacturers for this lucrative market. This document will outline in detail the reasons behind this fact.

The main reason behind this lack of competency of the Pakistani rock salt companies is that these companies are incapable of producing the adequate amount to reach economies of scale to bid for competitive prices. The most important portion of thesis will include a feasibility thesis of enhancing production of this natural resource as according to the hypothesis of this thesis the underlying problem of this industry is the inadequate production

1.4 Methodology:

The information, data and knowledge collected to formulate this research study were divided into three parts.

PART-1 dealt with establishing the importance of salt. It also included a brief history, description and importance of salt to humans over the ages. The most valuable source of information for PART-1 was the World Salt Institute based in Alexandria, Virginia, USA. This institute of worldwide repute is the foremost authority on salt, its uses and importance. World Salt Institute Website was regularly consulted for information about history, importance and uses of salt. a brief email communication was also maintained with the same to gather and compile all necessary information vital to establishing salt's importance and widespread usage in daily life on this Planet. Salt Institute was also helpful in providing information about worldwide salt production and capacity per country and geographical region. Further 1997 edition of Encyclopedia Britannica was

another invaluable source of compiling all knowledge about history and uses of salt, which appears in this research study.

PART-2 of information, data and knowledge collected in formulation of this research study is associated with worldwide salt production and major international companies involved in this area of business. For that four of the largest salt companies in the world were selected which include Cargill Salt, Morton Salt, Salt Union and Dampier Salt. A uniform and generic questionnaire was generated and sent to each one of these companies. This questionnaire dealt not only with their respective companies, their performance, markets and future plans but also with the importance of salt as they view it. A copy of this questionnaire appears in APPENDIX-B of this research study. From Cargill Salt, Mr. Skip Niman was the first to respond to this questionnaire. Mr. Skip Niman is a foremost authority on salt worldwide and has been involved in this business for over thirty years working with world's largest salt producer, Cargill Salt. His feedback was very helpful in not only determining the role and position of Cargill Salt in world but also the general direction of salt business as it stands today. Mr. Skip Niman was however not too forthcoming in detailing his company market share, markets by country and production costs.

From Morton Salt, Mrs. Rose Magdziarz replied to the questionnaire. However she refused to get into too many details about Morton Salt citing corporate confidentiality. However she was helpful in detailing Morton Salt's vast number of products and markets related to salt.

Mr. Allen Sheen from Salt Union not only replied to the questionnaire in much detail but also spoke about his company and its position in British salt business during a pre-arranged Internet telephonic conference. His feedback was also necessary to formulate the author's view of worldwide salt business and its economic impact on world economy.

Dampier Salt of Australia did not reply to the questionnaire. Information about this company was collected from the Internet website as was for some of the other companies as well.

PART-3 was the information gathering stage for all things related to Pakistani rock salt mining business. Unfortunately it was very difficult to get hold of concrete hard data about Pakistani rock salt business due to the fact that firstly private companies are not too forthcoming to discuss their business with others and government regulatory agencies who are supposed to file and keep all figures related to it, are buried under bureaucracy and lethargy. Hence all requests for official data from Pakistan Mineral Development Corporation (PMDC), Punjab Mineral Mining Company (PUNJMIN) were not received with much enthusiasm by these largest of two state owned rock salt mining companies of Pakistan. However the Inspectorate of Mines, Government of Punjab, Lahore and office of Director, Industries and Mineral Development, Government of Pakistan were able to supply some good data on production and capacity of Pakistani rock salt operations.

However the most useful Pakistani rock salt business data was received from a private sector Pakistani rock salt mining company, Wanhar Salt Corporation Limited. This is Pakistan's largest, most successful and efficient rock salt mining company, head office in Lahore with a local area office in Rawalpindi. Mr. Aftab Ahmad, General Manager, Sales of this company provided me with a commercial analysis of Pakistan rock salt business both for local and international sales. An interview was arranged with Mr. Aftab Ahmad at his Rawalpindi office to get first hand information about how private sector views rock salt business and what challenges and opportunities await in future. Mr. Irtaza Malik Awan, Director of the same company gave an overall picture of salt mining operations in Pakistan and was helpful in drawing out comparisons with international mining operations with which he is familiar. Data, information and perspective gathered from both these gentlemen about commercial aspects of rock salt business in Pakistan as well technical details about over all mining operations and its comparison with international norms, was most helpful in formulating and compiling data for part-3 of this research

study. However the company was hesitant to discuss the financial figures, performance of their company.

Apart from this any available sources of information about salt were consulted. Pakistan Institute of Development Economics (PIDE) in Islamabad was helpful in providing some financial and economic figures about Pakistani rock salt business. Although it is mentioned that these figures were limited due to the fact that very detailed, comprehensive and accurate data about Pakistani rock salt business is simply not available.

CHAPTER 1: INTRODUCTION

1.5 Back ground

For a country to properly and effectively utilize all its available resources, be it human or natural, is of utmost importance to sustain economic progression. The geological disturbances of millions of years ago have left Pakistan with abundant natural resources especially minerals like gypsum, granite, dolomite and many more. However the least talked about and fancied of all such natural resources is ironically the one with the most potential for export and growth – Rock Salt. Nature has bestowed upon Pakistan an inexhaustible wealth of high-grade rock salt deposits. This important raw material with a massive significance in the world can alone have a favorable impact on the economy provided we accept the dictates of nature and exploit these deposits to the optimum extent.

1.6 Research Question

How much potential does rock salt hold and what reasons obstruct the export of this mining asset from Pakistan?

1.7 Objectives

The main objective of this research study is to prove that not only Pakistan has abundant deposits of rock salt but also that there exist a major scope for export of this commodity to all over the world. However this study will first establish that indeed salt, as an important and vital raw material, has widespread uses all over the world. Most people probably are unaware of the true scale and importance of salt in every day life apart from its common use as a food preservative and taste enhancer.

However there is more to salt that meets the eye. It is an essential element in the diet of not only humans but of animals, and even of many plants. It is one of the most effective and most widely used of all food preservatives. Its industrial uses are numerous almost

without number. From the chemical industry to production of microchips to nuclear reactors to oil & gas wells, salt plays a vital role in almost all industry. In fact, salt is involved in almost all aspects of human activity. Every day, each of the earth's six billion inhabitants uses and relies on salt in one way or the other. The annual salt production of 204 million tons per day is mostly derived from massive multi-stage salt refineries spread in the industrialized world. It is the hope that this thesis will firstly establish the importance of salt in world and leave the reader more informed about its vast potential.

Secondly this study will discuss the largest natural deposits of rock salt any where in the world which exist in Pakistan. As a matter of fact according to Encyclopedia Britannica, Pakistan's rock salt deposits, mostly concentrated in "Salt Range" region of Punjab, are the richest and purest deposits of this important mineral in the world. Incongruously though not even 5% of these deposits are being exploited today. This research will attempt to point out the deficiencies and ill planning that has hampered attempts to fully exploit these rich deposits. The biggest salt mines in Pakistan that are being run by the government will be shown suffering from chronic mismanagement and lack of vision and sight thus rendering them useless to large scale possible export of this commodity. Pakistan's private rock salt sector would be looked at and discussed in detail. While a few such private enterprises have shown the vision and courage to realize the potential of rock salt, however due to many circumstances their efforts are coming short of what is needed to improve the situation.

The study will also look at major salt producers like Morton Salt and Cargill Salt of USA, Salt Union of UK and Dampier Salt of Australia that have a strangled hold on worldwide salt production and trading on a massive scale. These powerhouse companies with revenues in millions and in some cases billions of dollars a year from salt have realized the importance of this innocuous looking white granular substance we know today commonly as "Salt." This thesis will establish how these companies have been able to convert salt into billions of dollars of yearly revenues for them. While Pakistan which has this substance in abundance in nature, cannot even tap 10% of these revenues

It is also important to take a look at our salt competitor companies in India. In spite of virtually zero rock salt deposits, Indian companies have invested heavily in solar-salt production facilities i.e. salt produced from seawater evaporation. This foresight has resulted in them today holding a major chunk of yearly salt exports to Middle East resulting in millions of dollars of revenues. Though being located geographically closer to the Middle East, Pakistani salt companies still cannot compete with Indian salt manufacturers for this lucrative market. This document will outline in detail the reasons behind this fact.

The main reason behind this lack of competency of the Pakistani rock salt companies is that these companies are incapable of producing the adequate amount to reach economies of scale to bid for competitive prices. The most important portion of thesis will include a feasibility thesis of enhancing production of this natural resource as according to the hypothesis of this thesis the underlying problem of this industry is the inadequate production

1.8 Methodology:

The information, data and knowledge collected to formulate this research study were divided into three parts.

PART-1 dealt with establishing the importance of salt. It also included a brief history, description and importance of salt to humans over the ages. The most valuable source of information for PART-1 was the World Salt Institute based in Alexandria, Virginia, USA. This institute of worldwide repute is the foremost authority on salt, its uses and importance. World Salt Institute Website was regularly consulted for information about history, importance and uses of salt. a brief email communication was also maintained with the same to gather and compile all necessary information vital to establishing salt's importance and widespread usage in daily life on this Planet. Salt Institute was also helpful in providing information about worldwide salt production and capacity per country and geographical region. Further 1997 edition of Encyclopedia Britannica was

another invaluable source of compiling all knowledge about history and uses of salt, which appears in this research study.

PART-2 of information, data and knowledge collected in formulation of this research study is associated with worldwide salt production and major international companies involved in this area of business. For that four of the largest salt companies in the world were selected which include Cargill Salt, Morton Salt, Salt Union and Dampier Salt. A uniform and generic questionnaire was generated and sent to each one of these companies. This questionnaire dealt not only with their respective companies, their performance, markets and future plans but also with the importance of salt as they view it. A copy of this questionnaire appears in APPENDIX-B of this research study. From Cargill Salt, Mr. Skip Niman was the first to respond to this questionnaire. Mr. Skip Niman is a foremost authority on salt worldwide and has been involved in this business for over thirty years working with world's largest salt producer, Cargill Salt. His feedback was very helpful in not only determining the role and position of Cargill Salt in world but also the general direction of salt business as it stands today. Mr. Skip Niman was however not too forthcoming in detailing his company market share, markets by country and production costs.

From Morton Salt, Mrs. Rose Magdziarz replied to the questionnaire. However she refused to get into too many details about Morton Salt citing corporate confidentiality. However she was helpful in detailing Morton Salt's vast number of products and markets related to salt.

Mr. Allen Sheen from Salt Union not only replied to the questionnaire in much detail but also spoke about his company and its position in British salt business during a pre-arranged Internet telephonic conference. His feedback was also necessary to formulate the author's view of worldwide salt business and its economic impact on world economy.

Dampier Salt of Australia did not reply to the questionnaire. Information about this company was collected from the Internet website as was for some of the other companies as well.

PART-3 was the information gathering stage for all things related to Pakistani rock salt mining business. Unfortunately it was very difficult to get hold of concrete hard data about Pakistani rock salt business due to the fact that firstly private companies are not too forthcoming to discuss their business with others and government regulatory agencies who are supposed to file and keep all figures related to it, are buried under bureaucracy and lethargy. Hence all requests for official data from Pakistan Mineral Development Corporation (PMDC), Punjab Mineral Mining Company (PUNJMIN) were not received with much enthusiasm by these largest of two state owned rock salt mining companies of Pakistan. However the Inspectorate of Mines, Government of Punjab, Lahore and office of Director, Industries and Mineral Development, Government of Pakistan were able to supply some good data on production and capacity of Pakistani rock salt operations.

However the most useful Pakistani rock salt business data was received from a private sector Pakistani rock salt mining company, Wanhar Salt Corporation Limited. This is Pakistan's largest, most successful and efficient rock salt mining company, head office in Lahore with a local area office in Rawalpindi. Mr. Aftab Ahmad, General Manager, Sales of this company provided me with a commercial analysis of Pakistan rock salt business both for local and international sales. An interview was arranged with Mr. Aftab Ahmad at his Rawalpindi office to get first hand information about how private sector views rock salt business and what challenges and opportunities await in future. Mr. Irtaza Malik Awan, Director of the same company gave an overall picture of salt mining operations in Pakistan and was helpful in drawing out comparisons with international mining operations with which he is familiar. Data, information and perspective gathered from both these gentlemen about commercial aspects of rock salt business in Pakistan as well technical details about over all mining operations and its comparison with international norms, was most helpful in formulating and compiling data for part-3 of this research

study. However the company was hesitant to discuss the financial figures, performance of their company.

Apart from this any available sources of information about salt were consulted. Pakistan Institute of Development Economics (PIDE) in Islamabad was helpful in providing some financial and economic figures about Pakistani rock salt business. Although it is mentioned that these figures were limited due to the fact that very detailed, comprehensive and accurate data about Pakistani rock salt business is simply not available.

CHAPTER 2: LITERATURE REVIEW

2.1 Economic Order

2.1.1 World Economic Order

The present world economic order, according to a well-known American author - Alvin Toffler, is in the form of a 3-layered pyramid, with each layer representing a different wave in human history. At the pyramid's bottom are agrarian countries, still in the first wave period, which provide basic resources to the world and appear destined to remain at a non-survival level. The pyramid's second layer consists of industrial countries, which have entered the second wave or the manufacturing age; while only a few countries in the top layer have succeeded in entering the information age or the third wave.

2.1.2 Pakistan's Economic Order

Unfortunately, Pakistan is trapped in the bottom layer in the current world economic order where transition from one layer to another seems almost impossible.

Pakistan faces a real disadvantageous economic situation, especially when the income gap between the developing countries and developed countries has doubled over the last 10 years and WTO-led economic globalization is not working in the favor of countries. Further, concessions to the developing countries are time bound and not development stage bound, and expires even if the development stage of a country has further deteriorated, as has happened in Pakistan's case.

2.2 Exports – An Important Economic Indicator

Export figures depict the state of the economy. If exports go up from a country that relies on trade, it shows the economy is competitive, that workers are productive and that company management knows what it is doing. If exports go down you want to look for

• Pakistan Development Forum, Islamabad, 12 – 14 May – 2003, ADB's Response to the Development Challenges Facing Pakistan

the causes and try to do something about it. So it is one of the measures used to gauge the health of the economy.

2.2.1 History of Pakistani Exports

According to the World Bank, Pakistan had the highest growth rate in South Asia for two decades continuously, after its independence in 1947. In 1965, Pakistan exported more manufactures than Indonesia, Malaysia, Philippines, Thailand and Turkey combined compared to the situation today of our exports being one-half of those of the Philippines, one-seventh of Thailand and one-ninth of Malaysia.

On the basis of the statistics, Pakistan would have made anyone's list of the Asian countries most likely to enjoy miraculous growth rates over the ensuing decades. That did not happen. While the growth rate in the 1980s was still over six per cent per year, after early 1990s, it fell to around four per cent a year, making Pakistan the slowest growing country in South Asia, an exact reversal of its previous role, the World Bank notes. The growth of Pakistan's economy slackened at a time when the country was about to face the challenges of economic globalization. The situation calls for concerted efforts by all stakeholders, by creating awareness among the citizens, the government regulatory agencies, industrialists and traders.

2.2.2 Opportunities and Challenges for Pakistan

Pakistan is a signatory to GATT since 1997 and it has also signed WTO agreements. After 2004, non-members of WTO will not be allowed to enter the international market without ISO certification. But most of the stakeholders in the country are not fully aware of these and need proper guidance, education and counseling.

Pakistan is primarily an agricultural country. Some 70 per cent of the country's population is dependent upon agriculture, while 50 per cent of its labor force is engaged in agriculture. The country derives 80 per cent of its foreign trade earnings from the export of its three main crops. Cotton alone contributes over 60

per cent to Pakistan's foreign trade. While Pakistan produces 10 per cent of the total global production of cotton, it has only two per cent share in the global trade, as per international textile quotas. Post 2004 trade liberalization, under WTO regime, therefore, offers us opportunities as well as challenges.

Economic globalization involves integration of finance, markets, nation states and technologies, within free market capitalism, on a scale never witnessed before. It has its own pattern of economic rules that revolve around liberalizing, deregulating and privatizing the economy. While it has given increased power to capital investors, multinational firms, markets and global financial institutions, it has also brought perilous instability and inequality in its wake, confronting developing countries with special risks as market reforms are bound to exacerbate their inequality and raise the political cost of inequality and social tension.

Erosion of quota and preference margins, as a result of WTO agreements, pose serious challenges for developing countries like Pakistan because free trade and liberalization demand reduction of tariffs to imports which, in our case, are currently about 21 per cent of the total revenue collections. Tariff reduction can accentuate fiscal imbalance further, increasing dependence on external resource, more so when imports surpass exports in volume.

Are we prepared to meet post 2004 economic challenges? The economists maintain that for facing these challenges, the country has to speed up efforts for developing necessary infrastructure, amending its policies and enacting legislation. In addition, it has to produce more competitively and cost effectively for staying in the world market and to compete internationally.

In addition to sustaining higher growth rates and pursuing population reduction strategy, we have to focus on SMEs and other industries for e.g. mining industry, other than the agriculture sector for value addition, employment generation and low technology exports. This may require raising the investment level and

creating efficient business environment in the country. At the same time, we need to increase exports by providing proper guidance to the private sector about tariffs, rules and regulations of our major trade partners and also the ways to conduct trade abroad.

This explains the rationale of the government's efforts to bridge the yawning gap in IT technology on the one hand and on the other to reduce the cost of industrial production, making a beginning by aggressively cutting bank interest rates.

Even though agriculture in the short run will remain the main plank of our economy, we should do well to opt for innovative techniques for making other industries along with agriculture sector more efficient by opting for mechanization and engaging in research, while lowering the cost of inputs, wherever feasible.

So far, the state-owned agricultural and other development banks and the private commercial banks have been providing loans to big landlords and the industrialists. The politically influential feudal lords have often managed to obtain big chunks of money from banks on bogus applications, using the names and NIC photo state copies of their tillers, who remain in the dark about these loans till the banks start recoveries. The feudal lords and land lords usually spend agricultural loans on pleasure trips abroad or other non-productive pursuits, while the industrialists use these borrowings for giving a boost to their business.

It is, therefore, the need of the hour to shift the emphasis of bank advances from industrialists and the feudal lords to the poor for agriculture, other industry (Mining & Quarrying) business so that economic activity picks-up and depositors' hard earned money is not devoured by big defaulters.

Small industry and business especially mining is not a small thing; it is a big phenomenon, which could create millions of new jobs and also activate the

economy. It should, however, be ensured that credits are given scrupulously rather than doling these to ruling party supporters

2.3 Salt – An Important Mineral

Being an essential item, salt has widespread market all over the world. With thousands of known uses salt is an indispensable part of our daily lives.

One of the largest consumption of salt is as human intake in our daily diets. There is a market for salt in each and every country of the world. However in some areas the market has more potential as an export market because of the lack of or absence of local salt producing ability.

Western and Southern portions of African continent are a prime example of such naturally “salt deficient” areas. Here due to total lack of or very limited ability to produce natural or processed salts, means that these areas rely almost entirely on salt imports to meet local demand. This local demand is mostly for human consumption purposes.

In 1989 The Embassy of Pakistan in Nigeria conducted a survey of Nigerian market for salt imports. Being a relatively wealthy country in terms of being a large oil producer, Nigerian market is very conjunctive to salt export from Pakistan. A tremendous demand exists in Nigeria for salt consumption by the population. This is due to the inherent taste of salt in local cuisine and centuries old customs of treating salt as an almost a “divine” part of daily diet.

The 1989 study conducted by Embassy of Pakistan in Nigeria revealed that in 1987 alone Nigeria imported about half a million tons of salt for human consumption only. List of countries exporting such salt to Nigeria turned out to be diverse and comprised countries from every corner of the globe. However when it came to Pakistan with its abundant mineral deposits in terms of natural rock salt, there was no mention of it in countries exporting salt for human consumption to Nigeria.

• Chin S. Kuo. The Mineral Industry of Pakistan. IMF Research, 1998

Although no further concrete data is available after this study as to prevailing trend of salt imports into Nigeria, it is safe to presume that with the increase in population and per capita income, the market for salt for human consumption in Nigeria would have only increased from 1987 till to date 2004 – a total of 17 years!

Table 1 represents below the results of 1989 study conducted by Embassy of Pakistan in Nigeria, to analyze the salt imports into Nigeria.

COUNTRY	IMPORT TONNAGE IN METRIC TONS	VALUE IN NIGERIAN NAIRA
EGYPT	20,499	3,933,894
OMAN	380	110,708
SENEGAL	1,013	506,593
U.S.A.	104	67,373
BRAZIL	24,716	10,913,710
CHILE	14,000	2,914,250
COLOMBIA	14,000	2,875,400
BELGIUM	133	97,914
FRANCE	56	16,869
WEST GERMANY	43,363	23,729,220
ITALY	70,121	11,283,363
NETHERLANDS	14,664	5,791,543
PORTUGAL	23,753	16,322,460
SPAIN	23,593	6,616,451
SWITZERLAND	729	481,070
U.K.	90,324	70,889,850
WESTERN EUROPE	834	519,742
POLAND	71,791	34,362,654
EASTERN EUROPE	366	248,045
ISRAEL	23,830	5,519,487
INDIA	3,509	1,372,098
SINGAPORE	252	413,763
CHINA	11,919	7,862,728
JAPAN	10	355,186
TOTAL	453,959	206,454,371*

* Figure in Nigerian Naira.

* In 1987, Nigerian Naira 4.01 = US\$ 1

* Total Nigerian Import of Salt for human consumption in 1987 stands at US\$ 51,485,000 in 1987 dollars

Being an essential item, salt has widespread market all over the world. With thousands of known uses salt is an indispensable part of our daily lives.

2.3.1 Rock salt in Pakistan

Nature has given Pakistan an inexhaustible wealth of high-grade rock salt deposits in the Punjab and NWFP. These abundant deposits of rock salt alone may have a very favorable impact on the economy of the country provided they can be utilized and exploited properly and efficiently. The prospects of export of rock salt and subsequent salt-based products from Pakistan are very high if we can effectively tap into this natural source of abundant rock salt deposits. Whereas in majority of the salt producing nations artificial ways and means are being employed to produce salt-based products, in Pakistan we have a natural raw material or “feedstock” for the production of such products saving production costs. However it is sadly noted that this potential as yet has been untapped. However the fact that extensive rock salt deposits are found in Pakistan cannot be ignored and this research study will look into this subject in detail.

2.4 History of Salt:

Most people probably think of salt as simply that white granular food seasoning found in a saltshaker on virtually every dining table.

It is that, surely, but it is far more. The fact is that throughout history, salt-called sodium chloride by chemists-has been such an important element of life that it has been the subject of much folklore. It served, as money at various times and places, and it has been the cause of bitter warfare.

Salt was in general use long before history, as we know it, began to be recorded. Some 2,700 years B.C.-about 4,700 year’s ago-there was published in China the PENG-TZAO-KAN-MU, probably the earliest known treatise on pharmacology. A major portion of this writing was devoted to a discussion of more than 40 kinds of salt, including descriptions

of two methods of extracting salt and putting it in usable form that are amazingly similar to processes used today.

A far-flung trade in ancient Greece involving exchange of salt for slaves gave rise to the expression, "not worth his salt." Special salt rations given to early Roman soldiers were known as "salarium argentum," the forerunner of the English word "salary." There are many references to salt in almost all major religions including Islam, Christianity and Judaism.

Salt is intertwined in European history. Likewise, British salt making encompasses much of the history of the United Kingdom. Salt has played a prominent role in American history as well. The first patent issued by the British crown to an American settler gave Samuel Winslow of the Massachusetts Bay Colony the exclusive right for ten years to make salt by his particular method. The famed Erie Canal, opened in 1825, was known as "the ditch that salt built" because salt, a bulky product presenting major transportation difficulties, originally was its principal cargo. Syracuse, NY, is to this day proud of its nickname: "Salt City." Salt played an important role on the U.S. frontier. It has been called "Illinois' first industry".

Salt also had military significance. During the American Civil War, in December, 1864, Union forces made a forced march and fought a 36-hour battle to capture Saltville, Virginia, the site of an important salt processing plant thought essential to sustaining the South's beleaguered armies.

It is recorded that thousands of Napoleon's troops died during his retreat from Moscow because their wounds would not heal as a result of a lack of salt. In 1777, the British Lord Howe was jubilant when he succeeded in capturing General Washington's salt supply.

Similarly, throughout history the essentiality of salt has subjected it to governmental monopoly and special taxes. Salt taxes long supported British monarchs and thousands of British were imprisoned for smuggling salt. French kings developed a salt monopoly by

selling exclusive rights to produce it to a favored few that exploited that right to the point where the scarcity of salt was a major contributing cause of the French Revolution. In modern times, Mahatma Gandhi defied British laws as a means of mobilizing popular support for self-rule in India.

In short, the innocuous looking, white granular substance we know today as "salt" historically has been so essential to all life as to be of the utmost value.

2.5 Salt Production Methods:

All natural, underground salt (also known as the mineral halite) deposits, came from ancient oceans. These deposits are the resources for the production of dry salt and salt in brine. Dry salt is produced by the mechanical evaporation of solution mined brine from halite deposits, solar evaporation of seawater or natural brine, and by underground mining of the mineral halite (rock salt). Salt is categorized as three types, based on the method of production. They are:

2.5.1 Evaporated Salt:

Evaporated salt is produced through solution mining. Solution mining of salt or halite deposits is just like it sounds. Fresh and recycled water is injected through a well (or wells) drilled into an underground salt bed, usually between 150 and 1,500 meters (500 to 5000 feet) deep. Dissolution of the salt forms a void or cavern in the salt deposit. Salt brine which is a chemical name of concentrated solution of Salt in water is withdrawn from the cavern and transported by pipeline to an onsite evaporating plant to make dry evaporated salt.

In simpler terms Evaporated salt is made by boiling saturated brine, under a partial vacuum with steam heat, in enclosed vessels called vacuum pans. The brine is solution mined from underground rock salt (halite) deposits or dissolving rock salt or solar salt in water can make it. The brine is purified and fed to large

evaporators where salt crystallizes in to granulated salt. Table salt is a typical evaporated salt product.

In Pakistan certain salt refineries including one very large one are located in and around Karachi that produce the evaporated salts as described above.

2.5.2 Rock Salt:

Underground rock salt deposits, are conventionally mined by drilling and blasting to produce rock salt. Such deposits of rock salt are widespread in Pakistan especially in “Salt Range” area of Punjab province. Shafts are sunk into the salt deposit, which may be at depths of 500 to more than 2,000 feet below the earth's surface. The thickness of bedded salt deposits vary but typically is between 15 and 45 ft. Geologists are uncertain of the thickness of salt domes, because no one has drilled to the bottom of one yet. These salt structures are vertically elongated salt masses and geologists believe they may be 15,000 to 20,000 feet thick. Excavations in salt domes can reach more than 100 feet in height.

In Pakistan this method of rock salt production is not very popular as large modern undercutting machines are worth millions of dollars to buy today and almost all Pakistani rock salt operations do not have the scope to afford such mechanization at the moment. In Pakistan rock salt is typically mined from underground by forming an elaborate network of tunnels. These on average 18 feet high and 30 feet wide tunnels allow trucks and other heavy vehicles to drive inside them for transportation of mined rock salt. Rock salt in such Pakistani mines is extracted from working face to form of series of caverns by leaving behind part of the total area in form of giant square pillars to support the roof, a method known as “room and pillar.” Holes are drilled in selected areas of the face of rock. These are later filled with explosives to bring the whole section down. A 10-ton truck then carries the fallen load outside the mine to a consolidated storage

area or to the customer direct. This method is not as effective as the ones being employed by more modern rock salt mines elsewhere in the world using modern undercutting machines. Hence our Pakistani rock salt mines have a meager production capability as compared to their counterparts using such modern machines. A modern undercutting machine can bring down about 1500 tons of rock salt in one go while conventional Pakistani methods can only bring down up to 30 tons per try – a vast parity that later on reflects in the annual production capability comparison of Pakistani rock salt mines and the ones elsewhere. A detailed comparison of Pakistan rock salt mining methods with more advanced and mechanized international mining methods will appear later in the research study.

2.5.3 Solar Salt:

Solar salt is produced by the action of sun and wind on seawater or natural brine in lakes. The water evaporates in successive ponds until the brine is fully concentrated and salt crystallizes on the floor of the crystallizing ponds. Solar salt plants must be located in areas of low rainfall and high evaporation rates, and where suitable low-cost is available.

Seawater contains about 3.5% (by weight) dissolved minerals. Sodium chloride is 77% of that amount, or about 2.7% of seawater. The other 0.8% consists chiefly of calcium, magnesium and sulfate ions. As seawater evaporates, its volume decreases and the concentration of sodium chloride in the resulting brine increases. Often, the concentrating ponds will have distinct coloration, a pink or red, depending on the salt concentration and what species of plants and animals find it habitable. Salt crystals begin to form when the brine concentration reaches 25.8 % sodium chloride (NaCl). As evaporation proceeds, a layer of salt builds up on the earthen crystallized floors to a thickness of 10 to 25 cm (4-10 in). Sometimes, a layer of salt remains in the crystallizers as "salt floors" to provide support for "harvesting" equipment and to lessen the chance of clay or soil

contamination of the salt. A modern, properly operated solar salt plant can produce salt that is more than 99.7 % NaCl (dry basis).

In Pakistan such solar salt plants are quite crude in their working and small. Located mostly in the hot Sindh coastline, these primitive solar salt production facilities have very low production capability as well as quality assurance.

2.6 Uses of Salt:

Every day, each of the earth's 6 billion inhabitants uses salt. Annual salt production has increased over the past century from 10 million tons to about 204 million tons today. Nearly 100 nations have salt producing facilities ranging from primitive solar evaporation to advanced, multi-stage evaporation in salt refineries. Humans need salt to live. Prehistoric man obtained salt from the meat of hunted animals. When man developed agriculture, salt was added to supplement the vegetable and cereal diet and the quest for salt became a primary motivation in history. In the mid-1800s, salt's value as an important raw material for the chemical industry was established when the Solvay process in Belgium converted salt to synthetic soda ash. Salt is, today, the largest mineral feedstock consumed by the world chemical industry.

For many it's surprising that salt has more than 14,000 known uses! A mineral so diverse in its applications and usefulness as salt is, has a major economic value to it. Many industries and of course all humans require salt to function properly. Below are some of the major applications of salt in the world:

2.6.1 Salt: Leading Chemical Feedstock:

The greatest single use for salt is as a feedstock for the Production of chemicals. The chlor-alkali industry uses Salt, primarily as salt in brine from captive brine wells, to produce chlorine and caustic soda. Demand for salt in to produce chemicals fell from 25 million metric tons in 1974 to a low of 16.7 million metric tons in 1992.

However, chemical use rebounded in 1994 to 18.4 million metric tons. Today 55% of worldwide salt production (about 112.50 million metric tons) is consumed by chemical industry. A variety of chemicals, each of which has a significant economic value, are produced by different treatments, or processing, of rock salt or salt brine. Following are a few of the most important:

- **LIQUID SODIUM** – in more recent years, used as the coolant, or heat exchanger, an essential element in the nuclear process.
- **METALLIC SODIUM** – used in making brass and bronze; sodium cyanide, in turn, used in making case-hardened steel and fumigating materials, in indigo and other synthetic dyes.
- **CHLORINE** – used primarily in producing polymers that are used in manufacture of plastics, synthetic fibers and synthetic rubber; also used in crude oil refining, for making pesticides; in household bleach, water treatment and sewage treatment. Anesthetics, bleaches, ceramic colors, cleansers, disinfectants, dyes, explosives, fertilizers, fire-extinguishers, fungicides, leather, paint removers, paper, refrigerants, solvents, textiles, water treatment, weed-killers.
- **CAUSTIC SODA** – an element used in making glass, rayon, polyester and other synthetic fibers, plastics, soaps and detergents. Adhesives, batteries, building materials, ceramics, cosmetics, dyes, explosives, fruit peeling, inks, ion-exchange, laundering, leather, lubricants, ore-refining, pharmaceuticals, pigments, plastics, refractors, rubber, water-treatment, wood processing
- **SODIUM SULFATE** – used extensively in the manufacture of pulp and paper, dyes and ceramic glazes. Detergents, explosives, fertilizers, metal fluxes, pharmaceuticals, photography, pigments, plating salts, rubber, soap, textiles

- SODIUM CARBONATE – used in manufacture of glass, pulp and paper, and rayon. Also for abrasives, adhesives, batteries, dyes, explosives, fats & oils, fertilizers, fire extinguishers, inhibitors, insecticides, leather, metal fluxes, ore refining, paint removers, petroleum, pigments, soap, textiles, water softeners.
- HYDROCHLORIC ACID – used in making synthetic rubber and in cleaning gas and oil wells. Adhesives, ceramics, dyes, engraving, inks, leather, metal cleaners, ore-refining, perfumes, pigments, printing, soldering flux, textiles
- SODIUM BICARBONATE – used in textile manufacturing, processing leather, making glass and neutralizing acids.
- SODIUM NITRATE – an ingredient in fertilizers and explosives.
- HYDROGEN – Alcohol, ammonia, cooking fats, high-energy fuels, hydrochloric acid, metallurgy, meteorology, organic synthesis, petroleum products, pharmaceuticals, synthetic fibers, synthetic gems, welding.
- OTHER CHEMICALS: Calcium hypochlorite, chlorine dioxide, sodium chlorate, sodium fluosilicate, sodium hypochlorite, sodium perchlorate

2.6.2 Human Nutrition:

Humans require both sodium and chloride for life and health. Since the body cannot manufacture either; they are "essential" nutrients. Thus salt is required for provision of these essential nutrients to human body. While developed countries dedicate most of their salt to chemical production, developing countries like Pakistan often use most of their salt for human and animal nutrition.

Salt serves many purposes. Humans and other animals have an inherent taste for this essential nutrient. Salt is the world's oldest known food additive. Salt brings

out natural flavors and makes foods acceptable, protects food safety by retarding the growth of spoilage microorganisms, gives proper texture to processed foods, serves as a control agent to regulate the rate of fermentation in food processing, provides the color consumers expect and is used to create the gel necessary to process meats and sausages. As a result, more heavily processed foods usually contain more sodium and salt. The world's great chefs appreciate salt's many culinary benefits.

Sometimes the two terms, "salt" and "sodium" are used interchangeably, but technically this is not correct. "Salt" is sodium chloride. By weight, it is 40% sodium and 60% chloride. Sodium is an essential nutrient, a mineral that the body cannot manufacture itself. Because of sodium's importance to your body, several interacting mechanisms guard against under-consumption of salt and its threat to your body's nerves and muscles. If your salt intake varies widely, these mechanisms activate to assure that your body remains healthy, maintaining a relatively constant blood pressure. Chloride, too, is essential to good health. It preserves acid-base balance in the body, aids potassium absorption, supplies the essence of digestive stomach acid, and enhances the ability of the blood to carry carbon dioxide from respiring tissues to the lungs.

Sodium chloride or salt performs several necessary functions in food processing and cooking, including:

- **PRESERVATIVE:** Salt preserves foods by creating a hostile environment for certain microorganisms. Within foods, salt brine dehydrates bacterial cells, alters osmotic pressure and inhibits bacterial growth and subsequent spoilage. Cheese making, cucumber salting, fish bait, curing, fish curing, hay preserving, hide curing, meat curing, sausage casings.

- **TEXTURE AID:** Salt strengthens gluten in bread dough, providing uniform grain, and texture and dough strength. With salt present, gluten holds more water and carbon dioxide, allowing the dough to expand without tearing. Salt improves the tenderness in cured meats such as ham by promoting the binding of water by protein. It also gives a smooth, firm texture to processed meats. Salt develops the characteristic rind hardness in cheese and helps produce the desirable, even consistency in cheese and other foods such as sauerkraut.
- **BINDER:** Salt helps extract the proteins in processed and formed meats, providing binding strength between adjacent pieces of meat. Water binding properties are increased and, as a result, cooking losses are reduced. Salt increases the solubility of muscle proteins in water. In sausage making, stable emulsions are formed when the salt-soluble protein solutions coat the finely formed globules of fat, providing a binding gel consisting of meat, fat and moisture.
- **FERMENTATION CONTROL:** In baked products, salt controls fermentation by retarding and controlling the rate of fermentation, important in making a uniform product. During pickle making, salt brine is gradually increased in concentration, reducing the fermentation rate as the process proceeds to completion. Salt is also used to control fermentation in making cheese, sauerkraut and summer sausage.
- **COLOR DEVELOPER:** Salt promotes the development of color in ham, bacon, hotdogs and sauerkraut. Used with sugar and nitrate or nitrite, salt produces a color in processed meats which consumers find appealing. Salt enhances the golden color in bread crust by reducing sugar destruction in the dough and increasing carmelization.
- **NUTRIENT OR FLAVOR:** Baking, breakfast cereals, butter and cheese, canning, cattle blocks, flour mixes, heat tablets, isotonic solutions, livestock

feeds, olemargarine, pickles, potash substitute, salted nuts, table salt, spices and flavoring.

- **FOOD PROCESSING MATERIAL:** blanching seafood & vegetables, chicken de-boning, crab-meat pickling, egg preservative, fish striking agent, gravity separation, oyster shucking, wine stabilization, yeast processing.

Salt is critical to good formulation and is perhaps one of the most common ingredients used in food processing. Yet, there are qualities about salt that can enhance or ruin a formulation. As Skip Niman, director of quality administration and technical services at Cargill Salt Division, one of the largest salt producers in the world, says, "Salt is not just salt." Different sizes of salt crystals can affect formulations in different ways, says Niman. For instance, salts that are thinner crystals have a larger surface area, and may be tasted more strongly on the tongue than other varieties. Salts with larger surface areas are also used for plating seasonings and oleoresins.

Classifications of salts used for human intake all over the world are:

- **Table salt** -- A fine-grained refined salt with additives to make it free flowing, is mainly used in cooking and as a table condiment.
- **Iodized salt** -- is table salt with added iodine (sodium iodide) — particularly important in areas that lack natural iodine, an important preventative for hypothyroidism.
- **Kosher salt** -- is an additive-free coarse-grained salt. It's used by some Jews in the preparation of meat, as well as by gourmet cooks who prefer its texture and flavor.

- **Sea salt** -- is the type used down through the ages and is the result of the evaporation of seawater — the more costly of the two processes. It comes in fine-grained or larger crystals.
- **Rock salt** -- has a grayish cast because it's not as refined as other salts, which means it retains more minerals and harmless impurities. It comes in chunky crystals and in certain areas of the world such as even Midwest USA is used as such for human intake.
- **Pickling salt** -- is a fine-grained salt used to make brines for pickles, sauerkraut, etc. It contains no additives, which would cloud the brine.
- **Sour salt** -- also called citric salt, is extracted from acidic fruits, such as lemons and limes. It's used to add tartness to traditional dishes like BORSCHT.
- **Seasoned salt** -- is regular salt combined with other flavoring ingredients, examples being onion salt, garlic salt and celery salt.

2.6.3 Animal Nutrition and Agriculture:

Livestock, poultry and other animals do not always receive adequate amounts of sodium and chloride from forages and other feeds. They need supplemental salt as part of a nutritionally balanced diet to remain healthy, disease free, and to achieve optimum growth and reproduction rates. Because animals have a natural, definitive appetite for salt - they will eat only a certain amount - it is used to ensure adequate intake of less palatable nutrients and as a means of limiting feed intake. Salt can be mixed with feed or fed free-choice, and is an excellent carrier for trace minerals, It is produced plain or as trace mineralized salt, in 50 lb blocks, smaller spools, and as loose salt, commonly known as mixing salt.

For thousands of years it has been known that domestic and wild animals need salt just as man does. The virtues of salt for animals were extolled by the ancient Greeks. Early explorers in Africa, Asia and North America recorded observations of grazing animals traveling to salt springs or deposits to satisfy ravenous appetites for salt. Animals deprived of salt will risk grave danger or resort to unusual behavior to obtain it. Considerable evidence exists that early nomads and hunters took advantage of this fact to lure and capture animals by locating areas with salt and waiting for animals to come there periodically.

There are seven trace minerals that have been shown to be needed in supplementing animal diets. They are iron, copper, zinc, manganese, cobalt, iodine and selenium. They are needed in very small amounts, or traces, in the diet, and hence their name "traces minerals." Salt is a natural carrier for trace minerals, since all farm animals have a natural appetite for salt. Moreover, when cattle, horses, sheep and other animals are on pasture with little, no or varying amounts of concentrate feeding, producers can supply trace mineralized salt free-choice in the form of a mineral block or as loose trace mineral salt in a box. Then, regardless of the amount of concentrates fed, and especially if none is fed, the animal can still consume salt and the trace minerals it contains. The trace mineral levels in salt or salt-based mineral products are guaranteed on the package. Different levels of various minerals are added to salt for specific and different situations. The cost of adding the six trace minerals to salt is very low, ranging from less than one cent for poultry to 81 cents for dairy cattle for a whole year. Horses, beef cattle and dairy goats can be supplied trace minerals with salt for a year for less than 40 cents; and calves, swine, sheep and meat goats for less than 15 cents.

2.6.4 Highway Deicing:

Salt is the most effective, readily available, and economical highway deicer in use today. It assures winter driving safety and continued mobility in snow areas, even

under the most adverse snow and icing conditions. Salt is the most plentiful and most inexpensive deicer that is both efficient and safe. It is easy to handle. It is non-toxic to man and animals and will not harm the environment when properly used. Salt's benefits far outweigh any detrimental effects. The benefit-to-cost ratio is about 18 to one. Salt saves lives in reducing accidents, reducing response time to medical and other emergencies, provides energy savings by removing snow and ice quickly and reduces the size of economic losses that would otherwise mount up with snow and ice left on streets.

Rock salt and solar salt are used on U.S. highways. In Europe, because of its availability, evaporated salt is sometimes used. The lowest temperature at which sodium chloride will melt ice (the eutectic point) is -21.12°C (-6.02°F), at a concentration of 23.3% NaCl. Salt works best at temperatures near 0°C (32°F) because melting occurs quickly with a relatively small amount of salt. As the temperature falls, it takes more salt and more time to melt ice because a higher concentration of brine is required. Fortunately, most snowstorms occur when the temperature is near freezing, where salt is very effective. More than 40% of the dry salt produced in the United States is used for highway deicing. Salt is an essential part of the winter environment and its use is accepted by a great majority of the motoring public.

A 1972 study by Paul J. Claffey, an independent consulting engineer, presented to the Highway Research Board (now Transportation Research Board) concluded that the roughness of road ice and slippage of wheels can result in an average one third more fuel consumption and as much as 50 percent more on just two inches of snow.

In a 1976 report, *Benefits and Costs in the Use of Salt to De-ice Highways*, by The Institute for Safety Analysis (TISA), Washington, DC, using 1976 prices and rates, the use of deicing salt

- reduces wages lost due to lateness to work by \$7.6 billion
- saves \$3 billion in wage loss because of absenteeism
- reduces production losses by \$7 billion
- reduces losses in goods shipment by \$600 million
- saves 370 million to 1.2 billion gallons of fuel
- has an 18:1 benefit: cost ratio

A study, Accident Analysis of Ice Control Operations, released in 1992 by Marquette University's Department of Civil and Environmental Engineering concluded that "As a winter maintenance service, de-icing pays for itself within the first 25 minutes after the first hour that salt is spread on two-lane highways. . . .Then, during the first four hours after the hour of application of salt, the direct road user benefits were \$6.50 for every \$1.00 spent on direct maintenance costs for the operation." As soon as 71 vehicles drove over the highway, the average direct costs were offset by direct benefits. The study found that costs related to accidents, including medical expenses, emergency services, workplace costs, travel delay, property damage, and administration and legal expenses decrease by 88 percent after application of deicing salt.

2.6.5 Water Conditioning:

Water is considered hard when it contains calcium and magnesium (hardness ions). Hard water requires more soap and detergent for laundering, cleaning and bathing because suds do not form as well in hard water. The reaction between soap and hard water results in a greasy, curd-like deposit which makes fabrics feel harsh and leaves water spots on dishes and utensils. Mineral scale builds up in hot water appliances and industrial boilers, reducing energy efficiency and shortening appliance and equipment life. Water is conditioned or softened by removing the calcium and magnesium ions from hard water and replacing them with "soft" sodium ions derived from salt.

Hard water—water containing excessive calcium and magnesium—is a problem in many parts of North America as well as all over the world. As a result, water-softening systems have become popular, even deemed a necessity in industrial installations, institutions and private homes.

2.6.6 Other Uses:

- Salt is used to fix and standardize dye batches in the textile industry;
- It is used in metal processing and secondary aluminum making, to remove impurities;
- Rubber manufacturers use salt to separate rubber from latex;
- Salt is used as a filler and grinding agent in pigment and dry-detergent processes;
- Ceramics manufacturers use salt for vitrifying the surface of heated clays;
- Soap makers separate soap from water and glycerol with salt;
- Oil and gas drillers use salt in well drilling mud to inhibit fermentation, increase density and to stabilize drilling in rock salt formations; also used for periodic cleaning of wells.
- Hide processors and leather tanners use salt to cure, preserve and tan hides;
- MISCELLANEOUS PROCESSING: artificial sea-water, coal briquettes, dehydrating agent, dye processing, dyestuff carrier, electrolytic milling, emulsion breaker, etching aluminum foil, herbicides, ion-exchange regeneration, rubber coagulant, soap salting-out agent, soil stabilizer, starch manufacture, synthetic leather manufacture, textile dyeing, tile glazing, water softening, weed killing, well-drilling fluids.
- SALT GRADIENT SOLAR PONDS. Recognizing the ability of salt to trap heat, researchers in California and Australia are experimenting with salt gradient solar ponds as a source of energy. Developing and using this energy directly or by making electricity is a possible future energy source. Solar ponds are a promising source of renewable energy -- an inexhaustible source if economic feasibility can be established. A salt gradient pond operates using

layers of different concentrations of salinity to trap heat so it can be recovered. There are many operating ponds throughout the world: El Paso, Texas, USA; Pyramid Hill, Victoria, Australia; Réduit, Mauritius; and Kutch, India are examples.

- METALURGICAL PROCESSING: Chloride roasting, drawing lubricant, foam killer, heat treating baths, iron-re cementation, metallurgical flux, mill scale refining, sink and float baths, molten metal cover, rare metal refining.

CHAPTER 3: FINDINGS

This section of the research study is divided into two parts, the first part outlines the findings on some of the largest salt producing and selling companies in the world and. The research finds it important that this section be included so as to give the reader an idea about the scope both in terms of production and revenue generated, of major salt producing companies. Only once we know for sure this information about worldwide major salt players can we be able to compare with salt scope of Pakistani companies. The second part contains in detail the findings on rock salt in Pakistan. Based on the comparison between the international companies and Pakistani scenario at the end of the chapter the reasons of inefficient salt production in Pakistan are stated.

3.1 Major Salt Players

This section looks at five major salt producing companies in the world: -

3.1.1 Cargill Salt Inc:

Headquartered in Minneapolis, Minnesota, USA, Cargill Salt is the world's leading producer of solar salt. With the ability to produce and sell a whopping over 18 million tons of salt products annually, Cargill Salt is also the world's largest marketer of salt products. Currently Cargill salt is exported to over 50 countries all over the world with the company's production facilities spread all over USA and overseas. Cargill's biggest challengers are Canadian, Mexican and Australian salt producers. In terms of future and current challenges, Cargill's Skip Niman says that rising energy cost is the biggest challenge posed to Cargill today. The company operates a skilled workforce and there has never been a problem in attracting highly educated and skilled workers to the salt industry in the U.S. Cargill has a complement of Chemists, Chemical Engineers, Mechanical Engineers, Environmentalists, etc.

Cargill began shipping grain down the Mississippi River in the late 1940s, but finding cargo to haul back up river proved to be a challenge. In 1955 Ray King,

vice president of Cargo Carriers, made the decision to buy a barge load of Louisiana rock salt as backhaul cargo. Although it took a year to sell the load, Cargill's salt business was underway.

The backhaul salt business grew steadily, and by 1960 Cargill management was convinced that rock salt fit into the company's business model. Cargill acquired mineral rights in Belle Isle, Louisiana, and construction of a rock salt mine was begun. The first barge of Belle Isle rock salt was loaded in December 1962.

Business grew rapidly, and over the years Cargill acquired a number of other salt production facilities. Rock salt mines evaporated salt plants and solar salt operations were purchased in Kansas, New York, Louisiana, California, Oklahoma and Australia. In 1995 a joint venture was formed to construct a solar salt facility in Venezuela.

A tremendous leap in the growth of Cargill's salt business took place in April 1997 when the company acquired the North American assets of Akzo Nobel Salt, Inc. The Akzo acquisition doubled the size of Cargill Salt and made it the world's only salt company with operations on three continents: Australia and North and South America.

Today, Cargill Salt operates vacuum evaporated salt production facilities in New York, Ohio, Michigan, Kansas, Louisiana and California; rock salt mines in New York, Ohio and Louisiana; and solar evaporation facilities in Oklahoma, Utah, San Francisco Bay, Venezuela, Netherlands Antilles and Australia. In addition, Cargill Salt has numerous salt terminals and storage facilities located throughout the United States.

For a company that relies mainly on salt for its revenues, Cargill's financial figures are impressive to say the least.

Cargill had \$480 million in net earnings for the 1999-00 fiscal year ended May 31, compared with \$597 million a year ago.

Operating earnings for the fiscal 2000 year, before charges for a write-down of assets in a number of businesses and a small loss from discontinued operations, were \$659 million, a 200 percent increase from the \$220 million reported for the previous year.

Revenues in fiscal 2000 were \$48 billion, up 4 percent from the previous year. Cash flow from continuing operations was \$1.7 billion. The company had a \$6 million net loss in the fourth quarter due to the asset write-downs taken in that period.

Cargill has earned \$172 million, \$174 million and \$99 million in the first, second and third quarter respectively for the fiscal year 2000-2001.

Five year financial performance chart of Cargill is as below which clearly speaks volumes about the feasibility of running a salt business on sound technical and economics grounds as this company does. Pakistani salt business houses need to learn the lessons from these figures so as to modernize them and try and compete with the world players by effectively exploiting their nature gifted wealth of salt deposits.

	1996	1997	1998	1999	2000
Sales	55,979	55,695	51,418	45,697	47,602
Net Earnings	902	814	468	597	480
Current Assets	14,991	16,500	19,930	16,356	15,355
Property & Other Assets	6,022	6,921	7,139	8,221	8,813
Total Assets	21,013	23,421	27,069	24,577	24,168
Current Liabilities	11,908	12,800	15,507	12,272	11,377
Net Worth	5,942	6,592	6,836	7,165	7,461

Cargill, Incorporated		
Credit Ratings	Moody's	Standard and Poor's
Long-Term Debt	A1	A+
Commercial Paper	P-1	A-1
	Rating	Duns #
Dun & Bradstreet	5A1	00-624-9189

SOURCE:- CARGILL SALT

3.1.2.1 Cargill Salt Asia Pacific:

Over the years Cargill salt has diversified its operations to effectively tap into the worlds markets in different geographical locations. In that regard Cargill Salt's Asia Pacific operations are a division of Cargill Australia Ltd, which is a wholly owned subsidiary of Cargill, Incorporated.

Cargill Salt's modern Australian plant is situated in Port Hedland - a deep-water port on the Indian Ocean in Western Australia's Pilbara region. The port, which handles some of the world's largest bulk carriers, is close to the major Asian salt markets giving Cargill salt products the strategic advantage of penetrating these markets.

The combination of low rainfall, high evaporation and large expanses of low-lying, impervious flat land for the concentration of brine, make Port Hedland the ideal location for a solar salt operation. With production capacity in excess of 3.0 million tones per annum at an average content of 99.7 per cent sodium chloride (dry), Cargill Salt leads the way in quality and production.

Cargill Salt provides high quality solar salt to customers in many Asian countries especially Japan from this plant. The raw material - seawater - and the major source of energy - solar - are in abundant quantities at Port Hedland. Through technology and people, these resources are transformed into high quality, competitively priced solar salt.

Cargill Australia Limited is a wholly owned subsidiary of Cargill Inc. Cargill began in Austral in 1967 as a one man trading office; it has grown to become one of Australia's leading agribusinesses.

Today, Cargill Australia businesses include oilseed-processing, meat processing, grain trading and salt production, employing more than 1,200 people in Australia with annual sales of around of A\$1 billion.

3.1.2 Morton Salt:

Morton Salt Inc. based in Chicago, Illinois, USA is the world's second largest salt producer with an annual production capacity of around 16 million tons of salt and an export market stretching over 60 countries all over the world. At one time the

largest salt producer in the world, Morton lost its global seniority in salt production to Cargill Salt a few years ago. This is mainly due to the diversification of Morton into other businesses including defense industry. However even today Morton now owned by Philadelphia, Pennsylvania, USA based Rohm & Hass Group, with its many subsidiaries spread all over the world, traces its heritage to salt and still plays a major role in salt production and sale in the world.

Morton's roots trace back to 1848 with the founding of Richmond & Company, Agents for Onondaga Salt. Joy Morton later joined the company, and then in 1910 the company was renamed the Morton Salt Company.

Company's ensuing involvement in the chemical processing industry grew, as Morton became a major supplier of basic inorganic chemicals derived from salt. To better reflect it's now branching interests, the name was changed to Morton International, Inc. in 1965.

In 1968, Morton began applying its pyrotechnic chemical processes to the development of automotive airbags, eventually growing the business into the world's largest producer of airbag inflators and modules. In November of 1996, Morton signed an agreement to combine the airbag business with Autoliv AB of Sweden, creating the largest automobile occupant restraint company in the world.

Two significant acquisition agreements in December of 1996 marked Morton's renewed focus on salt and specialty chemicals: With the acquisition of French salt company Salins du Midi, Morton for a short while become the largest salt company in the world. It also purchased Pulverlac, a premier powder coatings company in Italy.

3.1.3 Salt Union Ltd:

Salt Union, the biggest name in the UK salt industry, was established in April 1992 - the result of a buy out of ICI's two salt businesses. Salt Union is now part of the IMC GLOBAL Group - a major inorganic chemical and mineral company, and an integral part of the world salt business.

Unlike the world's two largest salt producers described above, Salt Union's main emphasis is on the deicing aspect of salt. Currently majority of salt produced by Salt Union is used for its deicing operations both in the UK and other major European countries. In spite of a somewhat limited target market in view of some, today the company has a turnover of £60m, and exports to over 50 countries around the world. One of the startling aspects of Salt Union business is that it generates all this revenue from a core mining and management staff of only 70 people – remarkable productivity. How Salt Union achieves this remarkable productivity is by using very modern and mechanized concepts of mining which will be detailed in a later section.

Salt Union is the only UK Company to produce a comprehensive range of both evaporated and rock salt products.

The Rock salt mine, at Winsford in the heart of Cheshire has a capacity to produce up to 2 million tons annually. The mining takes place 700 feet below the Cheshire plain, where there are approximately 70 years of reserves. The Winsford mine is the only mine capable of meeting the huge swings in Local Authority requirements caused by periods of severe weather. Company's revenue generation period is only in wintertime when their salt is used for deicing purposes. In remaining part of the year, Salt Union mines and stocks up supplies for the next winter season. Salt Union stocks on average 500,000 tones of de-icing salt ahead of each winter period.

The evaporated salt business based at Weston Point, Runcorn, produces a high purity 'white' salt. The evaporation plant having a capacity of 1 million tones currently produces some 680,000 to 700,000 tones. Most of this salt is exported.

The brine is extracted from boreholes in mid-Cheshire where it is purified before traveling by cross-country pipeline to the evaporation plant at Weston Point.

Achieving the very highest standards in processes, products and services is a continuing objective of the company. More importantly the company claims to strive as a team to meet the high expectations and increasing needs of today's market place.

Salt Union is a tightly controlled and small outfit as compared to other major salt producing companies. However its revenue generation and productivity achieved is quite phenomenal. It offers to customers the best of both worlds - bringing the substantial benefits of a major global group, together with the customer - focused flexibility of a smaller company.

3.1.4 Dampier Salt:

Dampier Salt, one of Australia's leading international companies, has for more than twenty years actively pursued growth, product quality and a commitment to success in developing solar salt operations in Western Australia's north-west.

Dampier Salt Limited is a member of the Rio Tinto Group of companies. Rio Tinto is the largest mining company in the world and its operations have a reputation of excellence in mining and marketing. Other shareholders of Dampier Salt are the Japanese concerns Marubeni Corporation, Nissho-Iwai Corporation and Itochu Corporation. Japan, which relies entirely on foreign salt procurement for its needs, has invested heavily in salt production facilities in China and Australia to ensure itself a smooth and uninterrupted supply of salt products. In

that regard Dampier salt represents a major Japanese investment in such overseas salt production enterprises. Appearing below is the graphical representation of stakeholders in Dampier Salt Australia.



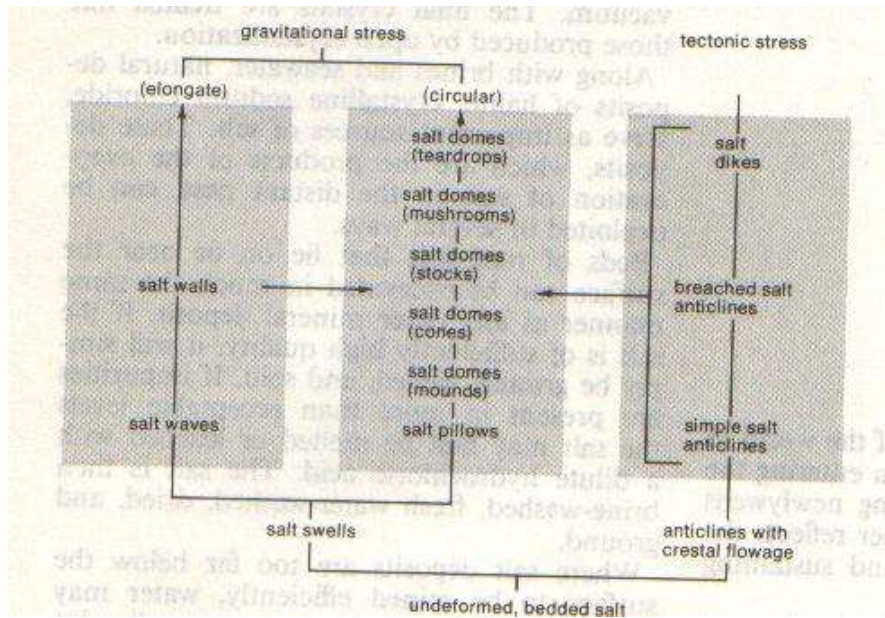
SOURCE: DAMPIER SALT

The Japanese shareholders play a significant role in marketing salt in Japan. Rio Tinto Japan assists with sales to Japan. Purchasing about 60% of Dampier Salt production, Japan is a very significant market.

Dampier Salt Limited operates the salt fields at Lake McLeod and Dampier and prides itself for using some of the most advanced salt production technology available today.

3.2 Rock Salt in Pakistan

An economically important type of rock salt deposit such as is found in Pakistan, is the salt domes, which were formed when earth pressure forced up plugs of rock salt measuring approximately a mile across. The domes appear to result from the pressure, which pushes the salt up through rocks from depths as great as 15,000 meters (50,000 feet). This is a great event of nature that has helped us today mine the rock salt as we do economically and cheaply. Had such rock salt deposits not existed in form of domes, we would have to mined thousands of meters underground to get to them which would have not only been extremely uneconomical but also technologically challenging. Almost all of Pakistani rock salt deposits are such domes deposits hence present an easy target for exploitation on a vast scale.



SOURCE: INSPECTORATE OF MINES, GOVT. OF PUNJAB, LAHORE

3.2.1 Location & Geology:

Geological studies have indicated that Pakistan has unlimited resources of rock salt in its two provinces namely Punjab and NWFP. Punjab rock salt deposits are constituted mainly in the Salt Range region which extends from Kalabagh up to Jhelum in a roughly East-West line covering parts of Mianwali, Chakwal and Jhelum districts. The NWFP rock salt deposits are mainly concentrated in the low-lying salt-cored hill ranges of the Kohat/Karak districts bordering the Mianwali district of Punjab.

Occurrence of rock salt deposits in these regions of Pakistan is known since time immemorial and it is also being utilized mainly for human and animal consumption since the same period. However these deposits have never been used in the way so as to give maximum economic benefit to the country.

It is due to the abundant rock salt deposits that the mountain range from Kalabagh to Jhelum is known as Salt Range. It is a series of hills and low mountains between the valleys of the Indus and Jhelum rivers, located in the northern part of Pakistan. It derives its name from extensive rock salt deposits that form one of the

richest salt fields in the world according to Encyclopedia Britannica. These rock salt deposits are of Precambrian age and range up to more than 4,875 meters in thickness. The range is approximately 186 miles long from east to west, and its width, in the central and eastern parts is from 5 to 219 miles. Its average height is 2,200 feet and its highest altitude at Sakesar is 1,522 meters. In addition to rock salt deposits, the range also contains coal, gypsum and other minerals.

Structurally Salt Range is a highly up heaved block of the northwestern part of Indian platform, or shield, raised to a significant height along the southern fracture, with the sedimentary strata sloping uniformly to the north.

On the southern slope of the Salt Range is located the largest rock salt deposits in Pakistan, at Khewra, Warcha, and Kalabagh. The importance of Salt Range is just not limited to Rock salt deposits. In fact by virtue of many millions of years of geological disturbances and processes, a vast wealth of other important minerals can also be found in Salt Range. Traces of Petroleum associated with limestone and sandstone deposits are found in the western part of the Salt Range. In the salt-bearing series in the eastern part of the Salt Range, layers of bituminous shales and dolomites are found. In the same eastern parts too, occur beds of bauxite. Large deposits of high-grade gypsum and anhydrite, an important calcium mineral, are also found in Salt Range.

3.2.2 History of Salt Mining:

The importance of salt in the beliefs and lives of people who lived in this part of the world, which today comprises Afghanistan, Pakistan and India, was very important. Not only even thousands of years ago, people in this part of the world relied on salt as an important food product but it also played a significant part in the religious beliefs and daily rituals of people. Even today people in the sub-continent have a special liking and taste for salt, which makes an important part of our daily diet. Also since the economy of this part of the world even thousands of

years ago was mainly agricultural based, so salt played an important role in the diet of animals.

The first people to begin a well-thought over and planned rock salt mining operations in Pakistan were the British during the colonial times. For them it was important to have a strong monopoly and control over salt supply in sub continent because of the importance of this mineral in daily lives of both Muslim and Hindu population.

Hence about a two hundred years ago, British starting digging perhaps even today one of the biggest rock salt mines in the world, at Khewra in the Salt Range. This gigantic mining complex was intended to supply salt to all over the sub-continent. Today, this rock salt mine is still quite a spectacle for the human eye. Its gigantic pillars support years and years of digging of rock salt that catered to the salt needs of people in both India and Pakistan. British having realized the importance of Salt Range as a source of salt, also dug up smaller mines in Warcha and Kalabagh area of the Salt Range as well as digging exploratory mines in other parts of the Salt Range. Perhaps it can be safely said, that British were the first to effectively and thoroughly survey and prove rock salt deposits in Salt Range.

After partition, the British owned and operated rock salt mines in Pakistan were turned over to the newly created Pakistan Mineral Development Corporation (PMDC) which to date also runs these mines. In spite of 200 years of head start, these mines have not been modernized and upgraded to the extent that they may become a viable source of rock salt and other salt-based products export. In fact today majority of the rock salt being mined here is supplied to the ICI's giant Soda Ash production factory located just adjacent to the Mine.

Since 1985 has seen the arrival of private sector companies in rock salt mining in Pakistan. Before that Government had complete monopoly over salt production. However since 1985, operating licenses were given to a few private companies to

explore and develop rock salt mines. However most of these private companies are small to medium sized operations based on primitive mining methods and styles. Historically investors as well as professional enterprises have been hesitant to get into mining sector especially rock salt mining. It is felt as mostly people are unaware of the true potential of rock salt and are also scared of very harsh conditions that have to be worked under to have an effective mining operation. Therefore while a few private rock salt mining companies have been somewhat successful in their endeavors they still lack to investment, resources and expertise to develop the kind of gigantic rock salt mining and salt processing complexes that can be big foreign exchange earners for Pakistan and its economy.

3.2.3 Salt Deposits:

The existence of huge deposits of high quality salt lying at and near the surface has been proven in Salt Range. It was estimated some years ago that a large mechanized rock salt mining complex using “continuous manners” in Salt Range could produce salt at about one third the present cost and could easily meet the total salt demand of Pakistan, India, North Africa and the Middle Eastern countries, all of which apart from Pakistan and India, are presently consuming imported salt and salt products.

It is interesting as well as fascinating to note that at Warcha in Salt Range, after an intensive program of geological mapping and diamond drilling during early eighties, the PMDC has proved a total salt reserve of 2.65 billion tons! These reserves are enough to support a salt mine, with a production capacity of 2 million tons per year for a period of 1300 years. The reserves at Bahadurkhel area, though lesser in quality, based on PMDC-GSD data have been calculated at 10.54 billion tons which are enough to support a salt mine of 2 million tons a year capacity for the next 5,000 years – and inexhaustible supply! Furthermore if these figures are to be compared with the current annual salt output all over the world that stands at

about 214 million tons, can only the true potential of the massive rock salt deposits of Pakistan be realized.

However due to the mainly small sized mining operations in Pakistan combined with crude and primitive mining methods and the hereditary system of mine labor employment, the cost of production of Pakistani rock salt mines is much greater than that salt production costs in other parts of the world like India, Germany, USA and Canada most of which use the more expensive and “Un-Natural” method of seawater evaporation to produce their salt. In Pakistan a general lack of knowledge about the true scope of salt in the world also hampers any new developmental schemes and ideas to take hold. Unfortunately in Pakistan one knows salt only as an edible stuff. However as the earlier sections of this report prove, salt is much more than just an edible material. Its importance in daily lives of humans as well as in world economic engine is undeniable.

3.2.4 Types of Salt Produced:

3.2.4.1 Rock Salt:

Pakistani rock salt traces its history back to the 18th century, when firstly the indigenous people used to exploit the presence of natural rock salt to fulfill their dietary needs. The British rulers of the Subcontinent were the first who actually started a well-planned and systematic way of exploiting these natural rock salt reserves by first formulating and then operating rock salt mines in Pakistan’s Punjab province. The massive rock salt mines of Khewra and Kalabagh are a testament to the British engineering and thought.

As the British left Sub-Continent in 1947 and existence of Pakistan, these British operated rock salt mines were taken over by the Government. The period from 1947 till early 1980 saw nearly no progress in Pakistani rock salt production or modernization since the government controlled mines were too un-imaginative and inefficient to chalk out any dynamic

strategy both in terms of modernization of mining methods and marketing strategies for local and export markets. However in 1985, the Provincial government of Punjab for the first time handed out rock salt mining leases to private sector companies. Certain areas within the Salt Range were map-marked and areas were allotted to interested parties to commence rock salt mining and marketing on their own while paying a twice yearly fixed royalty to the Provincial government.

Although the policy was designed with the right objectives however most of the parties who were able to get rock salt mining leases at the time lacked the financial resources and marketing imagination to create a major impact. Starting from 1984 to 1986, twenty rock salt mining leases each valid for five years were handed out to different private sector companies. These leases were further renewed for five more years after the initial expiry of lease based on how much progress had been made from start-up to date by the mining company in question. Today out of the initial 20 mining leases, 12 are still running while the other 8 have been either withdrawn or had their leases cancelled due to unsatisfactory work and progress. These current mining leases are valid till 2015.

There are two major regulatory agencies, which maintain a constant check on private sector mining operations. These include the offices of Inspectorate of Mines and Director Industries and Mineral Development. Both are Provincial bureaucracies and each one is responsible for safety and technical aspects of mining operations while the other is for overall mining lease and production respectively.

As in future sections we will come to know according to the private sector mine operators of Pakistan, both these bureaucracies have actually now

swelled to big size as with any other government office and have now become quite a drag in their mining operations rather than of help.

Majority of private sector rock salt mines are located in the vicinity of Salt Range as described geographically previously.

On the other hand, Government owned mines are also still working. These are all basically mines that were initiated by the British rulers of this area in some cases more than a century ago. It may be noted that private sector rock salt mines are all brand new mines developed by the mine operators themselves unlike the Government owned mines. The largest Government owned mining company is Pakistan Mineral Development Corporation (PMDC), which along with other mines operates Pakistan's, and perhaps the region's largest rock salt mine at Khewra. This is a Federal Government owned company. More than 80% of its production is intended for use by ICI's gigantic soda ash and caustic soda production facility. PMDC also operates other rock salt mines in places like Warcha and Kalabagh of the Salt Range. These mines though large are still significantly smaller than Khewra mine, which is quite a spectacle for human eye.

Another Government owned company called Punjab Mineral Development Company (PUNJMIN) also operates some rock salt mines within Salt Range. The Provincial Government of Punjab owns this company.

In spite of the rich heritage these Government owned mines have and the advantage of head start as compared to private sector mining companies, for years these companies have run in the red with excess employment and

extreme inefficiency that is reflected year in and out on their annual balance sheets.

3.2.4.2 Evaporated And Refined Salt:

Along with rock salt Pakistan does also produce limited quantities of evaporated or solar salt. This is the type of salt, which is abundantly produced in India. Vast majority of Pakistani solar or evaporated salt facilities are located within the Sindh region along the Arabian Sea coastline. The methods of production are very primitive and production almost negligible. Basically giant ponds are used to trap seawater and then using the abundant sunshine of Southern Sindh, this water is evaporated leaving behind salt residue, which is collected and sold in local market for human consumption. This is probably the crudest form of evaporated salt production.

In Pakistan currently there is one large and very modern salt refinery located in Hub Industrial Estate near Karachi. HubPak Salt refinery is perhaps Pakistan's only salt refinery that produced Pure Dried Vacuum (PDV) salt. This is intended for use basically in Industry. This refinery that has been constructed totally using local technology and know how has been able to offer good quality product with reliability and in reasonably large production quantity. Vast majority of PDV salt produced by this refinery is exported to Japan for use in a number of industries.

Second refined salt refinery in Pakistan belongs to National Foods. A Swiss manufacturer by the name of Kerbs Swiss has constructed this refinery. Salt produced from this refinery is solely intended for local market human consumption. Nowadays this refinery has incorporated local salt crushing facility also as described before which works in conjunction with the Kerbs Swiss plant. According to experts, National

salt bag like the ones available in grocery stores costs not more than Rs. 2 to produce and yet is sold at Rs 7 per bag on the grocery store shelf.

3.2.5 Production:

One of the major problems that confront the salt mining industry in Pakistan is the general lack of large-scale production. Although the local demand is being met adequately by mines in operation, the lucrative export market is not being tapped into because the production numbers just don't exist to make these Pakistani salt companies a viable and potent competitor on the international market. The research study has already given an indication of the type of production numbers for salt that exist globally right now. Compared to these Pakistani production numbers are meager to say the least.

Here is a very rough estimation of yearly Pakistani rock salt production:

Rock Salt Mines	Production Figures Per Annum in Metric Ton (MT)
PMDC (Khewra Mine)	360,000
PMDC (Warcha & Kalabagh Mine)	180,000
PUNJMIN	186,000
Private Sector (Tier 1)	72,000
Private Sector (Tier 2)	36,000
NWFP Production	30,000
Others (Evaporates & Refined Salt)	60,000
TOTAL YEARLY	924,000*

**Note: - Accurate Production Figures Are Hard To Come By. This a Approximation by Salt Companies and maybe $\pm 10\%$ of the actual number*

SOURCE: WANHAR SALT CORPORATION LIMITED,

SECRETARY INDUSTRIES & MINERAL DEVELOPMENT, GOVT. OF PUNJAB, LAHORE

PMDC & PUNJMIN

INTERNATIONAL SALT MINING COMPANY LIMITED

The chart shows Pakistan’s meager salt production at 0.924 million tons per year – A one month’s production of some of the larger salt production companies of the world. Perhaps it would be better to compare this production number with some international salt production figures:

Pakistan Salt Production	Sampling of Salt Production of Some leading manufacturing Countries
Pakistan Annual Salt Production 0.924 million MT/Year	USA – 45 million MT/Year China – 28.1 million MT/Year Germany – 15.7 million MT/Year India – 14.4 million MT/Year Canada – 12.5 million MT/Year Australia – 10 million MT/Year Mexico – 8.5 million MT/Year

*SOURCE: SALT INSTITUTE, USA
 WANHAR SALT CORPORATION LIMITED,
 SECRETARY INDUSTRIES & MINERAL DEVELOPMENT, GOVT. OF PUNJAB, LAHORE
 PMDC & PUNJMIN*

This figure is especially shameful to see since most of the countries in the above list apart from perhaps USA have no significant natural sources of salt as we have here in Pakistan in abundance. Yet the production figure for these countries is astronomical as compared to Pakistan.

3.2.6 Markets:

Majority of salt produced by private sector companies in Pakistan is intended for local market for the purpose of human consumption. Cheap price of mined rock salt makes it ideal raw material for crushing it into edible crushed or granulated salt. Hence it is no surprise that the biggest local salt markets tend be the largest cities. Karachi, Lahore, Rawalpindi are all hubs of local salt trading in Pakistan.

Various salt traders come to these areas to strike deal for purchase of salt, which is then shipped to all corners of Pakistan.

Normally rock salt is produced from mines in Salt Range. This is transported to major salt trading centers of Karachi, Lahore and Rawalpindi. Here it is crushed into fine granules and packed. From here salt dealers buy this salt and ship to various destinations all over Pakistan. Karachi seems to be salt center of trade for all of Sindh and parts of Baluchistan. Lahore caters to markets in Southern and Central Punjab including Faislabad, Multan etc. While Rawalpindi is main salt trading center catering to all of NWFP and Northern areas. Interestingly till ten years ago, rock salt mining companies were not interested in establishing relationship with end sellers of salt. The mined rock salt was merely handed over and sold to middlemen who would then supply it onwards to end-sellers all over Pakistan. This practice has now changed to some extent as mining companies discover the advantage of dealing direct with end-sellers hence eradicating the middleman's commission. This has had on over all good effect on both quality and payment terms for salt trading according to private sector rock salt mining companies.

In future it is the recommendation of this research study that salt mining companies should further try and establish direct relationship with end-user i.e. consumer in the grocery or supplies store.

Some private sector rock salt mining companies have started doing exactly that by incorporating rock salt crushing facilities within their mining complex. However, currently only two such private companies exist in Pakistan. In the past a third party to make it end-consumer ready crushed the rock salt. The method of choice for this crushing is locally fabricated salt crushing plants. These plants, which range from very crude and simple to complex, can range in price anywhere from 1 million rupees to 30 million rupees. The more modern and pricier ones have full-fledged capacity to produce crushed salt of various granule sizes for various

purposes both for human consumption and industrial use. Furthermore, the newer and more expensive salt crushing plants also have the capacity to add Iodine as per WHO guidelines into salt. Anti caking agents can also be added in salt during the process of crushing to prevent it from clumping together. However such modern salt crushing plants are very few in Pakistan while the vast majority are very simple and crude.

Private Sector mining companies have now also started targeting industrial customers for their salt. This is typically a higher revenue market area for these companies, as industrial customers tend to offer better prices and reliability of prompt payments.

Government owned mines are largely catering to such industrial customers. These companies which as described before are very inefficient and unimaginative find it much more convenient than anything else to deal with industrial customers. For example the Khewra mine of PMDC supplies more than 80% of its total annual salt production to the gigantic ICI soda ash and caustic Soda production facility located just near the mine. As described in previous chapters, Chlor-alkali industry is one of the largest users of salt. Hence this ICI factory consumes well-over 80% of total Khewra mine production. Similarly other PMDC as well as PUNJMIN mines supply vast majority of their salt to big industrial units such as Ittehad Chemicals of Kamoke and Sitara Chemicals of Faisalabad.

3.2.7 Economics

There is no hard concrete data available on the economics of salt mining and trading in Pakistan. Currently rock salt is being traded in the region of Rs. 280 to Rs 400 per Metric Ton in major salt trading centers of Karachi, Lahore and Rawalpindi. Corresponding prices to Industrial customers tend to be 10-20% higher than the ones mentioned above. Similarly crushed salt in powdered form sells anywhere from Rs. 1,200 to Rs. 1,400 per Metric Ton, while the human grade granulated salt goes anywhere from Rs. 1,400 to 1,800 per Metric Ton. As

clear, these prices are very low as compared to international market prices. Furthermore most of rock salt trading tends to be based on a revolving credit basis which means that large chunk of a salt mining company investment will always be stuck in the market place without any hopes of recovery. This is a major reason that these salt mining companies cannot seem to invest more in other areas of their business since this large sum of the capital remains stuck in the marketplace.

However there is a separate data available for a group of commodities consisting of salt, rock salt and chilies. The data set is form 1950-51 to 1996-97. The results as shown in table below, estimates of elasticities are consistent with prior expectations on having negative signs and appropriate magnitudes. Salt and rock salt have statistically significant estimates while chilies do not. As for their response to changes in consumer incomes, salts and chilies are considered as the cheapest items in daily food preparations, therefore they are expected to have low-income elasticities. However, contrary to our expectations, their income elasticities are somewhat on the higher side. Nevertheless, they are yet normal consumption goods for Pakistani households.

Table 1 gives a brief analysis of own-price and income elasticities of some daily use food commodities in Pakistan

Table – 1

<i>Commodity Groups</i>	<i>Elasticities for Pakistan</i>	
	<i>Price Elasticities</i>	<i>Income Elasticities</i>
<i>Meats</i>		
Beef	-0.463 (-2.64)	0.414
Mutton	-0.371 (-1.37)	0.919
Chicken	-0.144 (-0.62)	0.990
Fish	-2.847 (-10.99)	0.608
Eggs	-0.838 (-6.93)	0.377
<i>Vegetables</i>		
Potato	-0.240 (-1.05)	0.357
Onion	-0.241 (-2.12)	0.324
Tomato	-0.164 (-0.74)	0.383
Garlic	-0.257 (-1.57)	0.206
<i>Fruits</i>		
Mango	-0.250 (-1.90)	0.139
Apple	-1.496 (-3.56)	0.75
Banana	-0.196 (0.35)	0.221
<i>Tea & Beverages</i>		
Tea	-0.107 (-0.55)	0.721
Beverages	-0.838 (-3.43)	0.663
<i>Salt & Chilies</i>		

Salt	-0.775 (-9.97)	0.58
<i>Rock Salt</i>	-0.783 (9.77)	0.573
<i>Chilies</i>	-0.387 (-1.07)	0.606
<u>Diary</u>		
Ghee	-0.003 (-0.01)	0.748
Milk	-0.861 (-5.60)	0.553

Source: HIES & Time Series

PIDE

Over the last few years as private owned salt companies have diversified their areas of marketing, newer more economically feasible markets have emerged within Pakistan for salt sale. One of the perhaps most rewarding and promising seems to be the oil & gas sector. Salt is used extensively in oil & gas well drilling and operations. Furthermore due to unique geological composition of Pakistan's possible oil and gas reserve areas, salt is used in drilling operations with much abundance. Currently salt supplied to oil & gas sector in Pakistan is selling anywhere from Rs. 2,000 to Rs 7,000 Per MT which is an enormous premium on prevailing prices in local market.

Another niche, salt producers have discovered are the decoration items manufacturing market. There seems to be growing trend in the Western countries for watches, toys, candlesticks and fire places made up of rock salt. A very specific type of rock salt called Pink Salt, which is found in Pakistan, is most suited to this application. This Pink salt has inter-mingled shades of pink, yellow, red and white mixed together with remarkable beauty and grace. Hence only this type of rock salt is needed and demanded by Western buyers in USA and Western Europe to make items out of them described above. Economics for this type of rock salt supply for this application is also very favorable to the mining

companies since a value-added item is being made out of their product so the price offered is much greater.

3.2.8 Exports:

After looking at local salt market, it is the conclusion of this research study that the area, which needs to be most concentrated upon, is the export sector. Currently Pakistan is exploiting very little of its nature given salt reserves and even little is being exploited towards export potential of the same.

Export of rock salt can also be a major moneymaker for not only the mining companies but also the country itself. Pakistan is very strategically located to fully exploit the major salt export markets of Middle East, Southern Central Africa and Far East, most notably Japan, which imports each and every grain of salt it, consumes.

In that regard Export Promotion Bureau has been for years pressing local companies to explore such export markets. In fact the 1987 study conducted by Pakistani embassy in Lagos, Nigeria which has been described in an earlier section, determined that Nigeria imports US\$ 55 million of salt products every year just for human consumption from all over the world. Although no new and updated corresponding figures are available for now, but it is only logical to conclude that it would have grown over a period of time. Current sea freight to Nigeria from Pakistan is US\$100 per MT. Add a further US\$ 15 per MT as cost of shipping from mines to Port, the transportation cost comes to around US\$115 per MT for shipping rock salt from Pakistan to Nigeria. According to 1987 study, the prices at which Nigeria is importing salt into its country range from US\$100 per MT to US\$ 400 per MT. The major supplier of salt to Nigeria is U.K. whose 1987 export price to Nigeria was US\$ 192 per MT. Keeping in view that these figures are seventeen years old, there exists every likelihood that the potential of exporting salt products from Pakistan to Nigeria is very real and very much possible.

Similarly Middle East is another big market for salt. Not only for human consumption but also for industrial use especially the oil & gas sector. Currently Indian salt producers have a strong hold on Middle Eastern salt market in spite of the fact that Pakistan's geographical proximity is much nearer to this region than India's. Again the production numbers come into play. India with its 14.4 million MT production per year can easily overcome this difference in sea freight by offering a better price and a better product in terms of quality.

Ironically for the past two years, the Indian state of Gujarat, which is the major salt production hub of India, has been hit firstly by a massive cyclone and then last year by a devastating earthquake. In spite of these set backs and a major jolt to Indian salt production capability and capacity, Pakistan has not been able to pick up the tab and make any significant headways into Middle Eastern market. The reason for this is once again the fact that we are just simply not producing enough to be able to supply our salt on along term basis to clients in the Middle East.

Our current exports of salt products are very limited. Some companies in the private sector have been able to make some export headways in Japan but the number is not too great. Ironically our biggest rock salt export market has been India. It may seem strange to hear that India, which produces 14.4 million tons of salt itself each year, would why import salt from Pakistan. The reason is this. Although India does produce large salt products, all that is through artificial means i.e. solar evaporation and refined salt. There are two reasons why India imports rock salt from Pakistan. Firstly a major portion of Indian population especially the Punjab state as well as Northern Indian states have an inherent taste for naturally occurring rock salt, which Pakistan has, in abundance. It may be noted that India does not have any rock salt deposits. Second reason is more interesting. In Indian and Hindi mythology, cow has a very special significance and Indian population feels that they need to feed their cows with only natural rock salt and not any artificial salt product.

This was a big issue in India since before that salt was not being imported into India from Pakistan. However a coalition of religious leaders fought a court battle, which went all the way up to the Indian Supreme Court asking the Government to permit them to import rock salt from Pakistan in order to feed their cows. The case was won and hence a market for Pakistani rock salt export to India developed.

However lately the volume has gone down due to logistical reasons. The only way of salt export to India is via train from Lahore. However this train service is unreliable at best and coupled with deterioration of ties between two countries in the past few years has meant that salt export potential to India as of now was not very great. It remains to be seen if the currently improving relations between two countries would bode well for salt trade between the two countries

Another growing area of export for Pakistani rock salt has been Western Europe and USA where there is strong demand for a particular type of Pakistan rock salt used for manufacture of decoration items such as candlesticks, lamps, toys and fireplaces. These areas of export need to be thoroughly explored and the initial good results be followed up by better ones in future. Prices offered for such rock salt tend to be on the high side than normal.

Two major obstacles exist in establishing a proper export business for salt products from Pakistan. First is the issue of lack of adequate production figures, which this research study has already described from before. A Pakistani private sector salt mine producing 30,000-50,000 MT of salt every year cannot be expected to compete in the international markets with the likes of India, US, British and Australian salt companies which produce millions of MT of salt each year. With this disparity in production numbers, Pakistani salt product will be much higher priced as compared to its competitor from these countries described above.

Second big obstacle is vast distance between mining sites and nearest port. This problem is being further compounded by the rising energy costs in Pakistan mostly the sharp increase in Diesel cost. We will have to wait and see what effect petroleum pricing deregulation has on Diesel prices in future. Currently high Diesel cost not only makes salt pricier to mine but also to transport to Karachi Port. Depending on time of the year, a typical rock salt mine located in Salt Range will incur charges of anywhere from Rs. 1,250 to as high as Rs. 1,600 Per MT for just transportation from Mines to Karachi Port. A mine can only offset this excessive freight charge with very high production number. This way the high production numbers will compensate this high freight cost to Port.

Lastly Pakistani salt business just as many other Pakistani businesses have a problem of maintaining quality. International tenders for salt supply are huge. These range in thousands of MT in one go. An example of such a tender floated by Finnish National Highways Authority will be discussed in a later chapter.

3.3 Reasons for Inefficient Salt Production:

Following reasons have been identified by this research study for low production figures of Pakistan's salt mining companies.

- Pakistan has not been able to project a favorable image to capture export markets. International companies and businesses are reluctant to do business with Pakistani exporters. International media has played its role in projecting Pakistan, as an unstable country where, contacts with people in power is more important than competence.
- Pakistani businessmen lack professionalism and expertise to deal effectively internationally. In this era of competition and globalization any importer of salt expects professionalism from the other party and is ready to pay a higher price to do so.
- The total annual production of salt in Pakistan does not justify the potential it has. The cost of production is very high due to this reason. Although there are reasons

associated to high price, but this is also one of the major reasons. We have not been able to achieve economies of scale which ironically India has been able to achieve successfully although their method of salt production is more expensive

- Government owned mining companies are inefficient and full of inertia lacking imagination both in terms of enhancing production numbers and export marketing strategies
- Government owned mining companies have been in the red for many years as with many other Government owned entities. These are over-staffed, and extremely inefficient in working. New generation of management is trying to make PMDC more efficient and commercially viable operation. However first task is to break-even and then formulate a new strategy for the company for future. Whether it can be implemented remains to be seen.
- Private owned salt companies, while some of them have shown imagination and skill to enhance production and explore export markets are still dragged by the fact that they lack the skilled, resourceful and educated workforce to make them a more potent force on the world scale. Due to harsh areas where these mining operations are located away from big city centers, it's difficult for these companies to attract and lure skilled workforce to come and work for them.
- Ignorance of private sector investors and bankers means that the investment capital just simply does not exist for salt companies to truly realize its potential.
- Salt production in Pakistan is still stuck with primitive mining methods, which can produce results to a certain level. For more modern mining technologies and equipment, massive new investment is required, capital for which is hard to come by.
- Salt Mining companies have small production figures as compared to worldwide leaders hence their international market price is not competitive as compared to others. Compounding the problem is the fact that mining sites are located at least 2,000 Km from nearest port city. This vast distance adds up to the cost of salt being offered on the international market.

- Rising energy cost both for diesel and electricity the two largest raw materials required for production and transportation of salt are having an adverse effect on competition in international market.

CHAPTER 4: ANALYSIS

4.1 Case Study Of A Pakistani Salt Mining Company

4.1.1 Introduction

WANHAR Salt Corporation Limited is a “Public Limited” company with a paid up capital of Rs. 30,000,000 (Rupees Thirty Million). This company has been incorporated in Pakistan and is principally engaged in the business of extraction and marketing of rock salt.

The company was established in 1985 as one of the first private enterprises in rock salt sector of Pakistan. This sector was initially monopolized by state-run organizations which had inherited a relatively well developed and modern rock salt mining infrastructure from the British when they left the Sub-Continent in 1947.

4.1.1.1 Some Historical Perspective

The British rulers had a very strong interest in maintaining control over essential daily use commodities which included salt at the time. To maintain a efficient and smooth flow of salt in the market where the people not only have an inherent taste for salt in daily diet but also hold it important somewhat to religious extent especially amongst Hindu population, the British had established a very well run Salt production infrastructure. This infrastructure was mainly in Northern parts of Punjab which is nowadays Pakistan Punjab because of the presence of naturally occurring rock salt deposits here.

British of course had their own illustrious history of salt production by using naturally occurring rock salt deposits in Cheshire area of the United Kingdom. Hence while establishing the rock salt infra structure in the Sub Continent they brought with them considerable skill, knowledge and experience. It was perhaps for this reason combined with the importance

British gave to developing a good rock salt production infra structure here, that even to date some of the largest state owned rock salt mining operations in Pakistan are direct descendents of that very same British system. And their marvel and grandeur reflects the years of hard work and innovation that had gone into it for a period of many decades.

4.1.1.2 Company Overview

WANHAR Salt Corporation Limited did not inherit an already established mining operation from the British period. In fact they conducted their own geological surveys and analysis to identify an area of interest for mining and later applied for a mining lease from Government of Punjab. So it would be right to say that this company started from scratch.

4.1.1.3 Mining Area

WANHAR Salt Corporation Limited mining site is located some 200 kilometers south of Islamabad/Rawalpindi region. It is part of the world famous “Salt Range,” which is one of the most fascinating geological occurrences in this part of the World. Located in the Northern parts of Punjab province, Salt Range derives its name from extensive deposits of rock salt that form one of the richest salt fields in the world¹.

WANHAR Salt Corporation Limited mining site is located on the Southern slope of the Salt Range within the Khewra region.

4.1.1.4 Area and Hand over Condition

The mining lease covers 500 acres and was handed over to the company in form of a land block without any pre-existing mines, civil works, roads, electricity and other allied infra structure.

• 1 According to Encyclopedia Britannica 1995 edition, Chicago, IL, USA

4.1.2 Main Founding Objectives

The company started off with the following three strategic objectives:

- a. Prospecting, mining and development of rock salt mines on scientific and modern lines
- b. Export of mined rock salt to world markets especially India and Southern Parts of Africa
- c. Setting up a chemical Plant near mining site to use the salt deposits as raw-material for production of Soda Ash and Caustic Soda.

4.1.3 Business Philosophy

WANHAR Salt Corporation Limited considers itself a small company with big ideas. “Small Company” wants to be uncluttered, simple and informal. Ideas are welcomed and problem solving is simple, with clear and straightforward argument. Company wants to keep on growing since it feels that the real potential of Pakistani rock salt deposits has not been achieved yet. In fact that target is still far ahead. Company ever since its inception in 1985 has invested time and resources to patiently build an efficient mining operation, yet has had severe set backs, also on account of flooding in 1996.

4.1.4 Mining Lease Allotment and Renewal

The mining lease of rock salt was allotted to this company on 04 April 1985 by Ministry of Industries and Mineral Development, Government of Punjab. The lease has been allotted over an area of 500 acres, located near Village Bhal in District Chakwal. The area is commonly known as “Nila Wahan.” A notification this effect has already been published in the Punjab Gazette. A permission to start mining operation in the allotted area was granted on 18 April 1985. This mining lease was further extended for five years in 1990 and 1995 respectively. In 1995, on account of good progress in mines development by the company the lease was extended for 20 more years till 2015 by Government of Punjab

4.1.5 Rock Salt Reserves Estimation

Company produces two different types of rock salt from the mining site. Reserves details for the both are as below:

a. SOHAL MARL MEMBER (WHITE SALT)

Seam Thickness	-	120 Feet
Eatable Seam Thickness	-	40 Feet
Recoverable Deposits	-	1,000,000 Metric Tons

b. BILLIAN WALA SALT MEMBER (PINK or ROSY SALT)

Seam Thickness	-	650 Meters
Total Deposits	-	36,000,000 Metric Tons
Recoverable Deposits (50%)	-	18,000,000 Metric Tons

Total Recoverable Deposits	-	19,000,000 Metric Tons
Life Expectancy	-	is at 50,000 MT per Annum 200 Years

4.1.6 Developments

The company has made significant investments in developing the mining operation. Some areas are detailed below:

4.1.6.1 Salt Mines

Over the mining site the company had initially developed three separate mines for mining of rock salt from underneath the ground. Two mines are producing the while color Rock salt (*Sohal Marl Member*) while one mine is used to produce Pink Color Rock Salt (*Billianwala Salt Member*). Driveage and Excavation details are appearing on page 66 in Fig 1 Dec 31, 2003

Mine No.	Driveage (Ft)	Mine Size
1	3940 ft	15' - 18' High 16' Width
2	3058 ft*	15' - 18' High 14' Width
3	3600 ft	15' - 18' High 14' Width

** This mine was shut down in July 1997, due to flooding*

4.1.6.2 Link Road

Mining complex is not located on the main metal road. The complex is located about 30 kilometers off the main metal road and hence the company had to build its own all-truck non-metallic road to link the mining complex with main road. The first phase of this 25 feet wide Link road to Chakwal-Khushab road comprising 11 kilometers of distance was completed in 1992 at a cost Rupees 1,634,872. The second phase was completed in 1997 at cost of Rupees 2,341,843. Although building this road was a Government responsibility however due to lethargic attitude of Government, the company decided to use its own resources to build this road.

4.1.6.3 Civil Works

The Mining Site had no pre-existing living quarters and office buildings. Living and general accommodation involving 22 sets were initially built at a cost of Rupees 7,186,963. These civil works include mine managers and staff accommodation, canteen hotel, stores, mosque, mine offices, machinery sheds, labor accommodation, work shop, water reservoir and salt storage sheds. All initial above mentioned civil works were completed in June 1992. Total area covered so far is about 47,187.57 sq. feet. However continuous improvements as well as maintenance of existing civil works have been carrying on throughout.

4.1.6.4 WAPDA Electricity and Electrification of Mines

The company had identified that availability of electricity through WAPDA grid was essential to operating an economic mining operation. Since area was not in the WAPDA grid, therefore initial source of electric power at the mining site were diesel generators. This was a very cost-ineffective method of electricity production due to relatively high cost of Diesel. The company had requested WAPDA for electrification of the area, but since no WAPDA budget was available at the time to do this, the company had to pay from its own pocket to WAPDA for electrification of mines. Major infrastructure work for electrification of mining area including installation of transformers, electric wires and poles was completed in 1991 at cost of Rupees 1,023,497 that was paid to WAPDA by the company. Complete electrification of the site was achieved in December 1991 at a total cost of Rupees 2,755,720. Two 100 kVA independent transformers have been installed as part of electrification of Mining Complex. Stand by diesel electric generators are available as well to take care of WAPDA electricity failures.

4.1.6.5 Drainage and Disposal of Brackish Water

Brackish water disposal tanks and drainage system have been constructed. Pumping machinery is also available. Disposal of brackish water is the company's prime consideration to control salinity in the area which is harmful to civil structures as well as mines in the area. Major reservoirs have been constructed to store and dispose brackish water.

4.1.6.6 Water Supply System and Reservoirs

The water supply system is installed and operational at site. Five water reservoirs have been constructed so far. Due to horizontal incline of the mining area the system is working on gravity and hence no pumping machinery is being used. The over all existing storage capacity is about

87000 gallons. The initially installed 1" pipe line was replaced with a 4" pipe line in December 1992.

4.1.6.7 Communication Network

The mining site, as is mostly the case in mining industry, is located in a relatively remote part of the country. Private connection from T&T exchange located at Monara has already been acquired and is working. A VHF station has been set up near the mining site, which was constructed with sanction of T&T department. This VHF station was to be directly link the mining site with Khushab Exchange to give direct line access to the mining site. However due to bureaucratic wrangling this is not operational yet in spite of the fact that company has already constructed the VHF station out of its own pocket for the last 5 years. Currently the mining site has been linked with outside with the help of INSTAPHONE boosters at mining site. Company plans to invest in THURAYA satellite communication gear by the end of 2004 for a more versatile and efficient communication network.

4.1.6.8 Mining Machinery and Transport Vehicles

Acquisition of modern machinery is critical to maintaining a good as well as safe production flow. Although the mining operation of WANHAR Salt Corporation Limited in terms of modern machinery is not to the standard of international mining standards, but as compared to other local private sector companies, is still relatively modern. Initial company investment in equipping the mines for mining machinery is Rupees 8,724,251. Some of the major machinery components comprise of the following:

- Air compressors
- Rock Drills and Rods
- Pneumatic Drills and Rods
- Generators, Lighting sets
- Stand by engines

- Centrifugal and Displacement Pumps
- Hoists and Haulages
- Ventilators and Tubes
- Rail Track and Connected Equipment
- Weighing Bridges and Connected Equipment
- G.I Pipes for water and Air Supply
- Mine Haulage Transport
- Electrical Transmission Equipment
- Electric Motors.

Additional Requirement of Machinery

The company has allocated a sum of Rupees 10,100,000 for procurement of new machinery for mining operation in the next two years. New equipment that has to be procured includes the following:

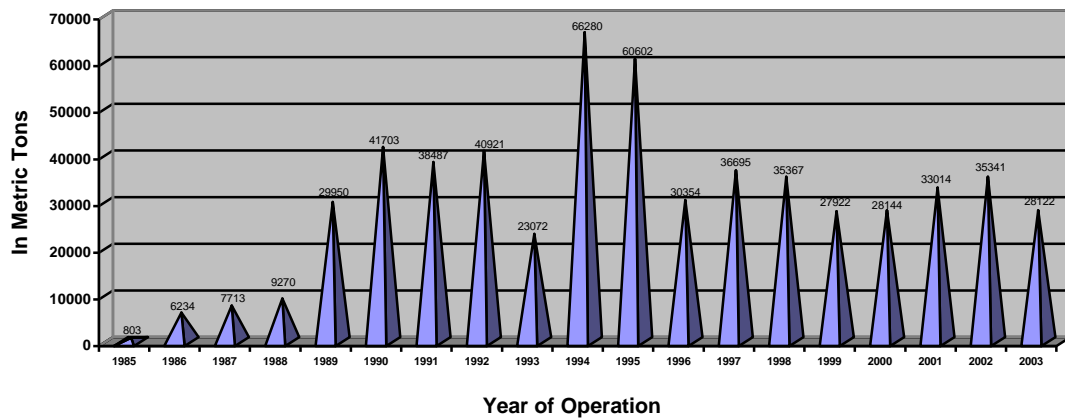
- Air Compressors Diesel Engine Driven
- Air Compressors Driven by 440 Volts 30 HP Electric Motor
- Stand by generators, Diesel engine driven
- Pneumatic Drills
- Haulages and Hoists
- Dump Trucks for use inside the mines
- Water Tankers
- Ventilators

4.1.7 Production

Annual Production figures of this company are as under:

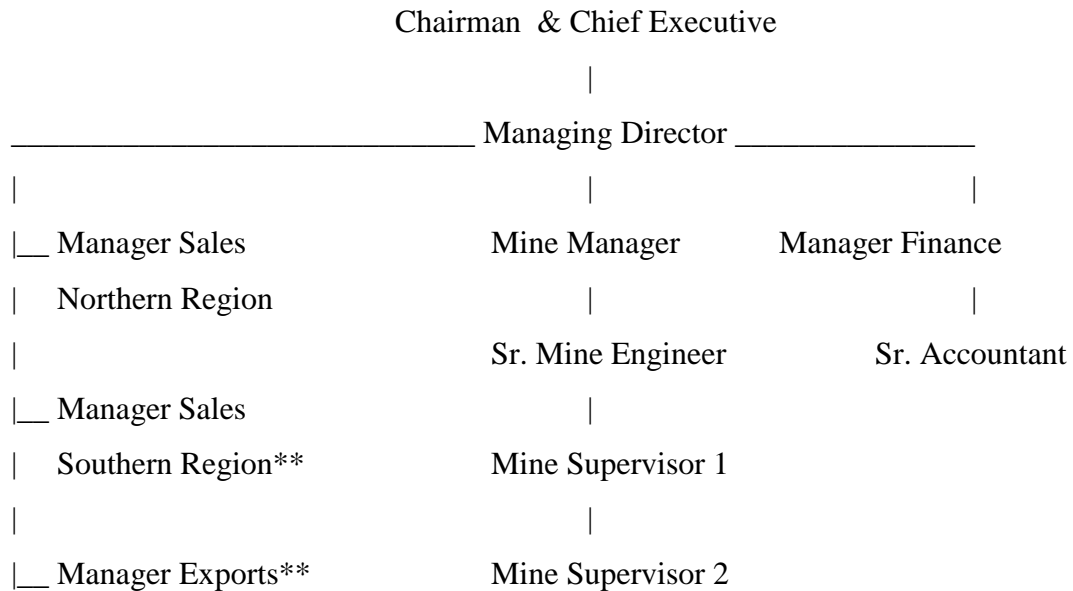
<i>Year Of Operation</i>	<i>Production in Metric Tons</i>
1985	803
1986	6234
1987	7713
1988	9270
1989	29950
1990	41703
1991	38487
1992	40921
1993	23072*
1994	66280
1995	60602
1996	30354**
1997	36695
1998	35367
1999	27922
2000	28144
2001	33014
2002	35341
2003	28122
	<i>*Mines closed for 4 months for maintenance</i>
	<i>**Mining Site Severely Affected by Flooding. One Mine completely destroyed due to flooding.</i>

Yearly Production Figures



4.1.8 Organizational Chart

WANHAR Salt Corporation Limited at peak staff strength was 400 employees in 1996. Currently staff strength is 200 which include labor force (miners) also. Below is a loose organizational chart of the firm.



***Position Temporarily Suspended Due to Less than targeted production*

4.1.9 Future Plans of the Company

The company is very forthright in admitting that it's earlier and one of the main business objectives to build a solid export market for its salt has not been fulfilled. While the company has had some success in salt exports most notably to India, however the production figures just do not support an aggressive export push. Nor does it allow a competitive price in the international market.

WANHAR Salt Corporation Limited is also interested in setting up a Soda Ash and Caustic Soda producing chemical industry at its mining site. Both these items are essential for use in many industries including Glass, Paper, Pulp, and Soap to just name a few. Basic ingredient and raw material for these products is salt. Since

the company already operates a salt mining operation so it is quite ideally placed to develop a Soda Ash and Caustic Soda production facility there also.

The capacity of proposed Soda Ash and Caustic Soda production factory will be as follows:

- Light Soda Ash will be produced at 135 Metric Tons per day and this will be utilized to produce the following products:
 - o Heavy Soda Ash - 65 Metric Tons per day
 - o Caustic Soda at 50% concentration- 45 Metric Tons per day

The project value is estimated at around US\$ 11,000,000 with another US\$ 10,000,000 for the accompanying power plant. The project envisions a partnership with a Chinese manufacturer like the CMC.

4.2 Analysis of the Company

Out of all the companies that I came across in private sector in rock salt mining, this company showed the most potential, vision and will to be competitive. Company showed some sign of potential in its endeavor to be a major export player but after some initial successes, it has not been able to get to a position where it aspires to be.

I have identified the following three areas which stand most in the way of this company becoming a competitive export company:

- Low Production
- Lack of Interest from Investors and banks
- Geographical Location with relation to nearest seaport

These can now be discussed in some detail. At the end of this chapter is a case study analysis of a salt tender from Finland which demonstrates how the problems outlined

above prevent Pakistani rock salt mining companies to establish a worthwhile export business.

4.2.1 Production

At the moment the company's production of rock salt is quite simply not enough to offer its product on the export market in a competitive way. In spite of very promising opportunities to sell salt overseas, it has not been able to do well in this area. Then to further compound the problems it was hit by massive flooding in 1996 which resulted in major financial losses for the company as it lost half of its production capacity.

The meager production numbers in relation to world standards for large global salt producers is biggest hinder ness to this company expanding its export sales. It is the view of the analysts as well as this paper that the market for salt products is available. I have already touched on this in previous chapters. Some of that market is in act located in close proximity of Pakistan. However just as rest of Pakistan salt mining operations, WANHAR Salt Corporation Limited is just simply not producing enough salt to offer it competitively in international market.

Mining is a dynamic and a fast paced industry with new ideas and methods constantly evolving. All metal prices as well as other mined minerals including salt are decreasing in a long term perspective and this puts a hard cost reduction pressure on most mines. Hence maintaining adequate production numbers to offset cost of production is critical for a thriving mining company.

4.2.1.1 Investment in Technology – Key to Production



If there was one factor that could boost a mines production to give it the competitive edge over rivals, its investment in latest and highly cost effective new technology. In the case of Pakistan salt company in question; if they ever want to be a player on the export scene they need the investment in new mining technology to boost production.

A characteristic of a successful mining company is the willingness to exchange new technologies and experiences. Every deposit of mineral is unique in regard to geology, grade, and shape (etc). Knowing the rareness of the mined mineral adequate type of mining machinery, technology and tools must be available to maintain large production numbers.

This section will later talk about in detail the technologies and modern mining methods necessary to achieve large production for the company under consideration.

For better understanding about WANHAR Salt Corporation Limited's production methods in comparison to more modern mining operations, I have drawn a parallel with mining operation of a UK based mining company called SALT UNION LIMITED of Cheshire. An analysis of both these operations will give a better understanding as to why Pakistani salt production is simply not even close to what is required to tap effectively into the export market.

A - Salt Mining – Basic Approach to Mining

Basic method of mining employed by both WANHAR Salt Corporation Limited and SALT Union Limited is the same. Both companies employ a

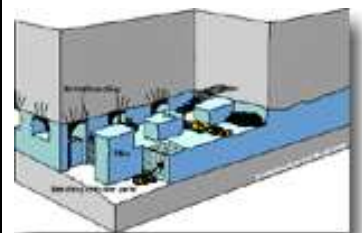
method of mining called Room-and-Pillar. Room-and-Pillar is designed for mining of flat, bedded deposits of limited thickness. Examples are sedimentary deposits, like copper shale, limestone, dolomite or sandstone containing lead, coal seams, and potash layers. For Rock Salt mining also this is the most cost effective and safe method of mining.

By Room and pillar methods the mineralization is recovered in open stoops, leaving pillars of Rock Salt to support the hanging wall. To recover maximum Rock Salt, miners aim to leave smallest possible pillars. The roof must remain intact however and this is prime consideration for safety of mine.

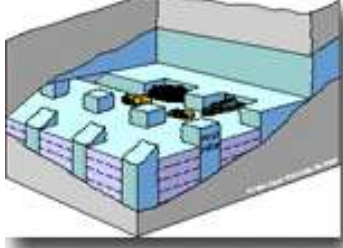
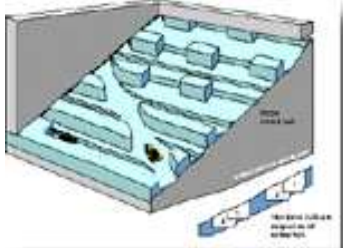
Rooms and pillars are normally arranged in regular patterns. Pillars can be designed with circular/square sections or shaped as elongated walls, separating rooms. Rock Salt contained in pillars are not recoverable and therefore not included in the mine's ore reserves.

Varieties of room-and-pillar mining are found, due to differing geological conditions. Three typical varieties are described in following text.

"Classic" room-and-pillar applies to flat bedded rock salt deposits with moderate to large thickness, also to inclined deposits with larger thickness. Mining the rock salt creates large open stoops where trackless mining machines as well as haulage trucks can travel on the flat bottom. Rock Salt with large vertical height is mined in horizontal slices, starting at the top, benching down in steps. This is the most used method of mining by WANHAR Salt as well as UNION Salt



Classic" room and pillar mining

<p>"Post" room-and-pillar applies to inclined rock salt bodies dip angle from 20 to 55 degrees with larger vertical height, where mined out space is back filled. The fill keeps the pillars stable and serves as work platform while mining the next ore slice, lift. This method is also used in some mines by WANHAR Salt.</p>	 <p><i>Post- Room-and-Pillar mining</i></p>
<p>"Step" room-and-pillar is an adaptation of trackless mining to rock salt bodies with too steep dip for traveling with rubber tired vehicles. A special "angle" orientation of haulage drifts and stoops related to the dip creates work areas with level bottoms. This allows trackless equipment applied to drilling and mucking in the inclined rock salt deposits. Mining advances downward, along the step room angle.</p>	 <p><i>Step-Room mining of inclined orebody</i></p>

	WANHAR Salt, Pakistan	Salt Union, U.K.
<p>Basic Mining Method/Approach</p>	<p>Room-and-Pillar with use of both <i>Classic</i> and <i>Post</i> methods. However <i>Classic</i> method most widely used.</p>	<p>Room-And-Pillar with <i>Classic</i> approach. However due to vastness of mining area all three <i>Classic</i>, <i>Post</i> and <i>Step</i> approaches used based in seam of mined area of mine.</p>

B. Salt Mining – Operations, drilling and Blasting

While the basic mining approach of both companies is the same, it is the process of mining and level of technological mechanization that differs.

Salt Union uses a high level of mechanization sophistication in its daily mining. WANHAR Salt on the other hand does not have a very mechanically sophisticated ways and means of mining. This obviously translates into big production numbers for Salt Union but not so for WANHAR Salt. Lets take a look how exactly these companies mine the salt.

UNION SALT

The basic concept of actual mining the rock salt is simple enough. Undercut the face of the face and blast Rock Salt away. The fallen load is then picked up by a loader or put on the conveyor belt for transport to designated crushing or processing area.

A more detailed explanation is as follows. Once the mining face is identified, the first step in this very sophisticated and mechanized method of mining employed by this company is to bring in the cutter, which undercuts the salt face. Its cutting blade resembles a giant hedge trimmer, except that this has blades tipped with extremely sharp tungsten carbide.

The cutter is the first step in mining a face. It undercuts the floor of the face, each face being 60 feet wide, 25 feet high and going 16 feet.

Next step is to bring in the fully mobile drill rigs. The purpose of these fully mobile platforms is to drill holes in the face of mining wall that have been earlier undercut by cutter. These holes are drilled to place explosives in them for blasting.

Appearing Fig. 1 below is an illustration of a typing mobile drilling rig. Notice the undercut done with a cutter already before drilling of blast holes starts

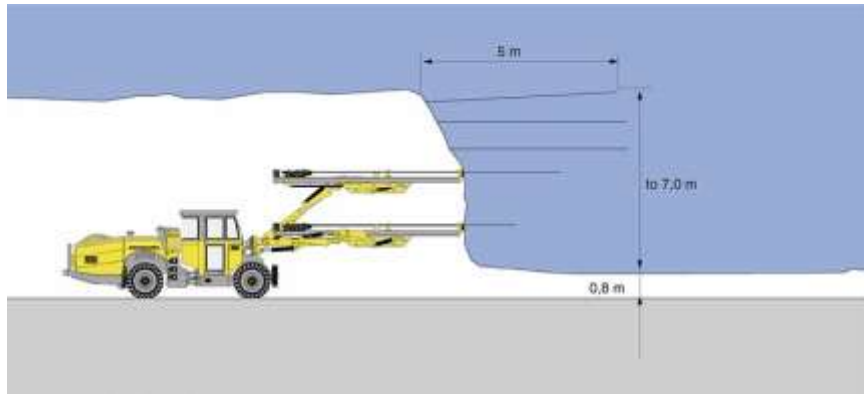


Fig. 1

There are various other variants of the same machines, some with hanging platforms for workers to stand in as they fill holes with explosives as shown in fig. 2 below:

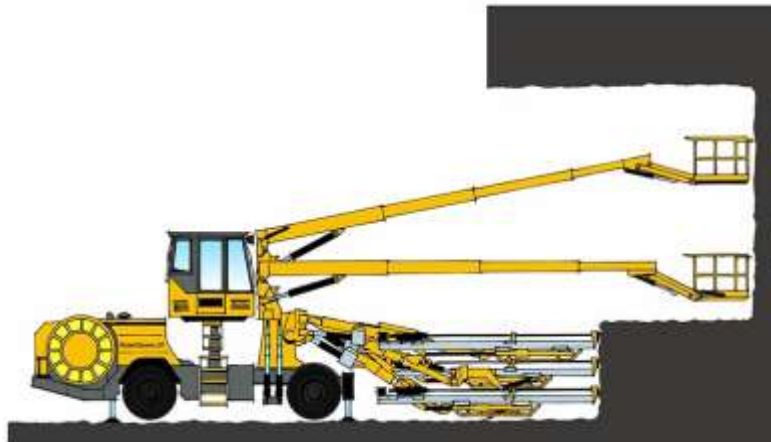
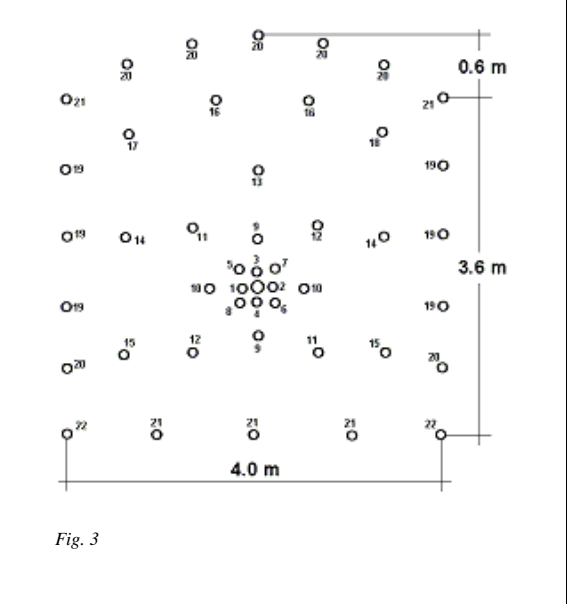


Fig. 2

These mobile drilling rigs drill anywhere from 45 to 73 holes in the face of mine in an already computer fed drilling pattern. Each blast hole that is drilled by the machine has a diameter suggested to 48 mm to 76 mm for large holes, and the drill depth 3.30 m. Blast holes drilled are in a specific computer fed pattern in order to bring down the maximum tonnage in one blast and also to bring the whole pile down in a relatively neat manner.



This allows for easy pick up of the load. The illustration above represents of a typical blast hole drilling patter in Fig. 3:

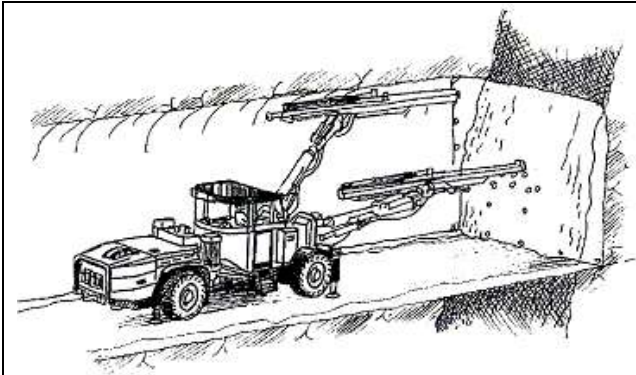


Fig. 4

Fig. 4 to the left represents illustration of mobile drilling rig at work while Fig. 5 below shows an actual picture of a small sized drilling rig at work. Notice the wall face which clearly shows blast holes already drilled.

Once the blast holes are in place explosives are placed inside the same. Explosives such as Ammonia Nitrate or pump-able emulsion explosives are used. These explosives are later detonated to bring down somewhere around 1,400 Metric Tons of Rock Salt in one go!



Fig. 5

This type of process of undercutting, drilling blast holes and detonation is done about 4 times in a day for one working mine face. Altogether Salt Union at a time operates anywhere from 14 to 16 mining faces. So while one mine face is undergoing blast hole drilling the other may be going through undercutting while the next one blasting. And the one after that may be cleared up by lifting the fallen pile.

The next step in this mechanized method of mining is to bring in the loaders. These machines are the real giants of the mining industry. These are some of the biggest machines working underground in the world. The biggest loader can be worth as high as US\$ 2.5 million apiece! With its 9½ feet high tires each costing up to US\$ 30,000 apiece, 70,000 Kgs of operation weight and 150 gallons an hour Diesel consumption, the biggest loader using its front bucket can lift up to 20 Metric Tons of Rock Salt in one go and transport it to either the conveyor belt or processing area in mine!

Appearing below are pictures of such giant loaders as Fig. 6 and Fig. 7



Fig. 6



Fig. 7

The fallen rock salt is transported to the nearest conveyor belt by these loaders. The belt then leads it to the main underground crushing plant where it is broken down to the size required for various customers. Salt Union has 40 miles of conveyor belt working underground for transportation of mined rock salt.

The salt continues on its journey by belt conveyor to the shaft where it is weighed prior to being fed into nine ton capacity skips and hoisted to the surface. The skips discharge the salt onto other conveyors which transport it to bulk stockpiles for later loading onto vehicles.

Summary:-

This mechanized approach to mining by SALT UNION allows it to produce around 1 to 1.5 million tons of salt every year. It allows the mine production to be about 8 tons per man hour which is highly efficient by world standards. Due to such large production the cost of production is easily offset and the investment in modern mechanized technology for mining operation is justified. High production has given the mine a very vast and grand look. Appearing below is an illustration of the mine in Fig. 8:

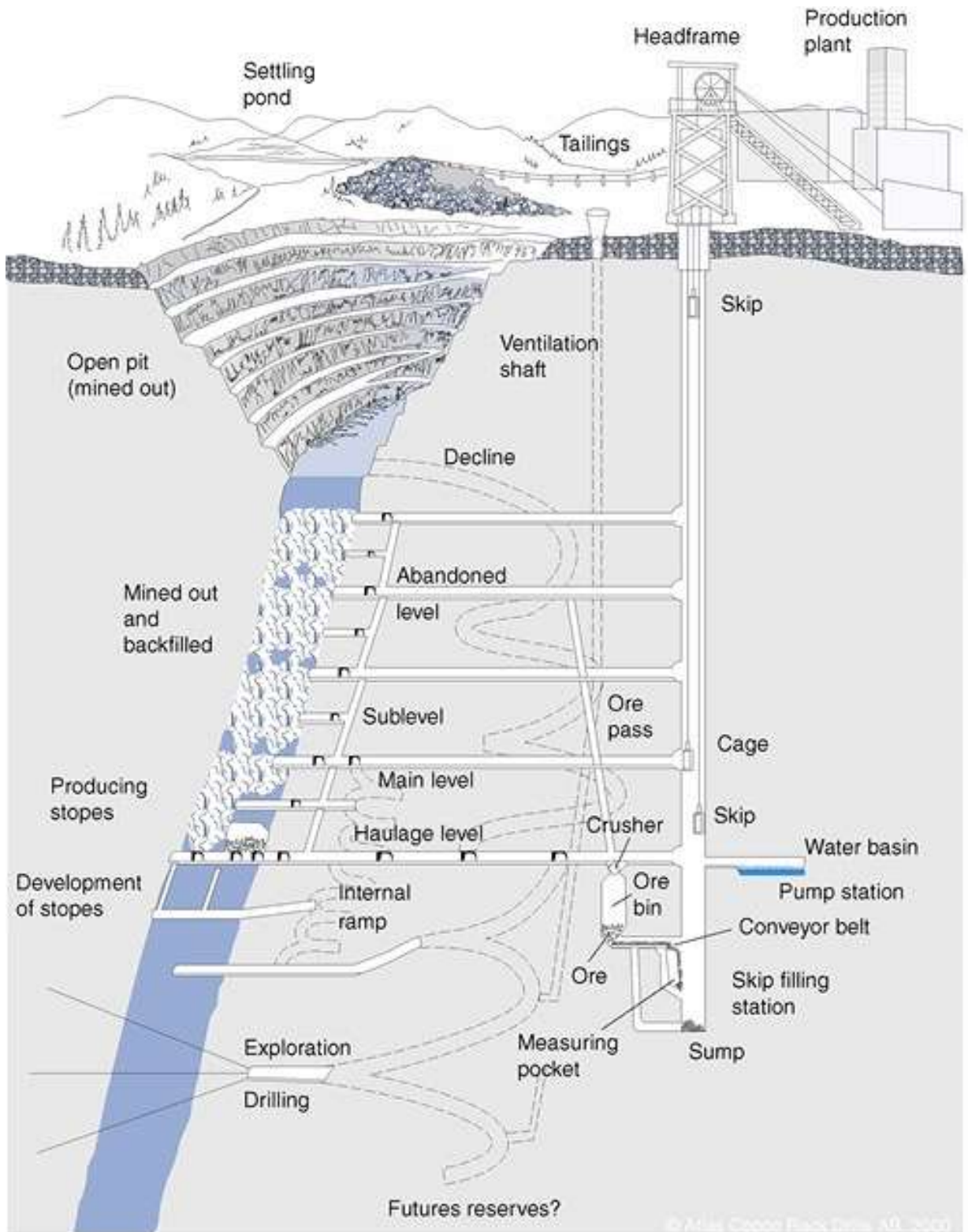


Fig. 8

WANHAR SALT

Unlike Salt Union, this company although progressively ahead in terms of mining mechanization and presence of other infrastructure as compared to its competitors, is not at a point to show the production figures that are necessary for export player.

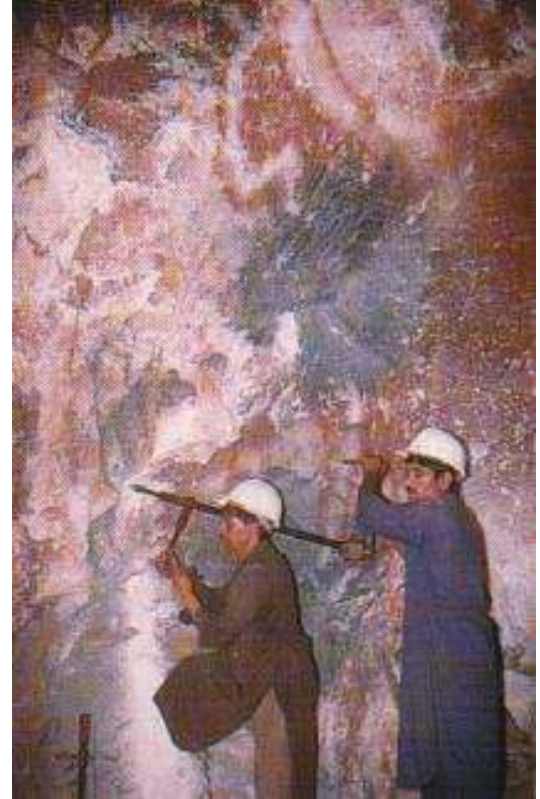
Basic concept of mining is almost the same as Salt Union. The mining face is first drilled with blast holes which are later placed with explosives. A series of detonations brings down certain portion of the same mining face. This fallen pile is loaded onto haulage trucks for transport to outside mines from where it is re-loaded onto transport trucks for respective customers.

The scale however of the same is very limited in terms of WANHAR Salt.

Firstly WANHAR Salt does not undercut the mining wall face with a cutter due to lack of these machines. This severely cuts down the amount of rock salt that would fall from a single detonation.

There is no use of mobile drilling rigs for blast holes drilling. Instead either an air compressor which is fitted at one end by a hand held drilling machine is used or in some cases miners manually make the holes in walls with specialized hand held tools as shown in picture to right as Fig. 9.

This obviously takes more time and gives less blast holes which means the miners cannot bring down the 1400 Metric Tons of rock salt from one detonation which Salt Union does using cutters and mobile drilling rigs. The most that can be



brought down in one go is about 10 to 30 metric tons for this company in one go – a astronomical difference from what Salt Union can achieve!



Fig. 10

Fallen pile of rock salt is hand picked by laborers and loaded onto an 8 metric ton capacity dump truck which transports the same to outside of mine. This is a highly time consuming process because the fallen pile of rock salt is hand loaded on to dump trucks as shown in Fig 10 and 11 to the left.



Fig. 11

This slows the turn around time to prepare the mining face for another blasting.

There are also no conveyors belts inside the mines for transportation of salt to other areas.

Company also does not have various many mining faces to work on. At a time at the most the company will be working on 5 to 6 mining faces. And even that would be its peak of its efficiency and

production. Salt Union simultaneously works on 14 to 16 mining faces at a time.

Summary: -

It is evident that lack of mechanization is severally halting this company to come up with good sustained productions figures. This translates into fact that although can offer the product competitively in local market but for big number export market, it is not competitive. There is always a strain on company bottom line because due to lack of high production, the company will always find it difficult to offset the very high price of electricity and diesel that exists in Pakistan. Both these ingredients are very important in mining operation as both these have the highest consumption for maintaining a mining operation. The next portion of the research study will try to explain why this company has not been able to do the kind of mechanized modernization as described in salt mining method of SALT UNION.



Fig. 12 – WANHAR Salt Mining Complex (partial view)

4.2.2 Lack of Interest from Investors and banks

Historically in Pakistan, banks and other investors have never shown any interest towards mining sector. Hence this sector of the economy with huge potential has been left underdeveloped for far too long.

Banks in Pakistan have in the past been only attracted by large “glamorous” ventures such as chemicals and textiles for investing. They simply have in the past shy away for extending loans to mining sector. This has two reasons. Firstly it has to do with the fact that most companies in mining sector do not have the professional approach towards their work which would warrant an interest from bank. They lack the ability to convince the bank about their projects and to begin with don’t even think in the scales they should to make their mining operations to international level. Secondly reason of the neglect from banks has been due to their own ignorance about this area of work. Most of them, just as us, view salt as something which is there on our dining tables every day. Very few know the true potential and uses of salt which have already been described by this research

study in earlier chapters. Hence rock salt mining is just simply not “glamorous” enough for the banks for investment! – A very unprofessional approach.

The company in question WANHAR salt has tried on many occasions to gather the interest of both banks as well as private sector investors towards their mining operation and business with no success. Banks are just not willing to take risk in this area of work which they to begin with don't understand. On the other hand private sector investor is more concerned about “immediate returns” and is not willing to wait out the long haul to see mines developed and production increased to international standards before the returns start pouring in.

Mining business is not necessarily a very high-tech operation, but it certainly does need a good level of industrial mechanization which has been described before in this chapter. To achieve this level of industrial mechanization a major capital investment is required. A giant loader for example can cost as high as US\$ 2.5 million apiece; A cutter can cost as much as US\$ 250,000 apiece and a mobile drilling rig can cost as high as US\$ 150,000 to US\$ 350,000 for a single rig.

However these are long term investments and can give the returns back over a period of time. A giant loader although costing US\$ 2.5 million apiece can last as long as 10 to 15 years without major maintenance required. This is achieved due to the tremendous leaps in technological achievement over the years. New products being produced are reliable and their efficiency is remarkable. Although all rock salt mining machinery works in a salt environment and runs the risk of damage due to corrosion, remarkably due to absence of moisture in a salt mine, this does not happen and the metal does not corrode over period of time inside the mine. However in open air, the metal does run the risk of corrosion.

Summary:-

It is absolutely essential that if Pakistani rock salt mining operations have to be competitive to world standards, the banks must take an active interest in financing

such projects. They have to be more progressive and imaginative in their thought and how they view projects in mining industry. No investment is risk-free. Same is true with mining industry. But if the banks properly understand what salt is, its areas of application worldwide and the export potential from Pakistan they will be in a better position to weigh risk and reward scenario.

New banks like SME Bank have extended some loans to mining entities but these are very small loans for small type mines.

As has been discussed in this section, modern mechanization of a rock salt mine requires major capital investment. This can only be financed with the help of lending from banking sector since no one company or individual can cope up with such tremendous amount of financing on their own.

4.2.3 Geographical Location with relation to nearest seaport

Another factor that has been a hinder for WANHAR Salt in establishing an export business is the geographical location of the mining area from nearest seaport of Karachi. WANHAR Salt as well as other major mining operations in Pakistan both state run and private are located in Salt Range area of Northern Punjab. This area is quite far from the nearest seaport which happens to be Karachi. The cost of transportation of salt on trucks from mines to Karachi is so high that the export price becomes uncompetitive for the mining companies. Pakistan has been witnessing a rising trend in Diesel prices, which is used by all transport trucks. Naturally as the Diesel price goes up so does the cost of transportation of salt from mines to Karachi seaport.

Since in Pakistan we do not have an efficient rail network for transport of Goods to seaport, so we the companies are left only with transportation of Goods via trucks which is by far the pricier option.

For exports to India, which is an important export market for Pakistani salt and in the short-term the most viable, such problem does not exist. That is so because almost all rock salt exports to India takes place via Wagha through rail. Most of mines including WANHAR Salt mines are located in close proximity of Khushab rail yards. From here rock salt is directly loaded onto rail bogeys for transport to Lahore. Here it is loaded on to freight carriages of “Samjotha Express” for transport to Amritsar in India.

Summary:-

Although geographical location is a problem, however this problem can be solved. And the only way to solve the problem is to boost production Naturally if a mining company will be producing their rock salt in millions of tons they will be in a much better position to offset this cost of transportation.

4.3 Case Study Analysis – Salt Tender from Finnish National Highway Authority

As discussed in earlier chapters, one very important use of salt is as a highway deicer. Salts ability to deice makes it an idea highway deicer of choice in areas where there is lot of snowfall.

Finland located in Nordic region of Northern Europe is a major consumer of salt for deicing purposes. In 1998 Finnish National Highway Authority invited WANHAR Salt to bid for its yearly requirement of highway deicing salt. The quantity required was 80,000 metric tons over a period of one year.

Dilemma our salt mines face in establishing good export business is quite evidently underscored by this example. Firstly to begin with no company in Pakistan in the private sector has the capacity to produce 80,000 metric tons of salt in a year!

Even if they were to produce this salt, they had to compete with the existing cost at which Finnish National Highway Authority was buying its salt in 1998. The target price given to bidders was US\$ 48.00 per metric ton or US\$ 3,840,000 C&F Finland for the entire project. This is because US\$ 48.00 per metric ton price was the price at which National Finnish Highway Authority was buying salt from Germany before 1998. So anybody who had a chance of getting the tender had to offer a price less than what the Finnish National Highway Authority was already buying the salt at before 1998.

Had WANHAR Salt bid for this project, they could only quote a price of US\$ 52.50 per metric ton C&F Finland. If the company can come so close to the target price with meager production levels and all other problems already described in this chapter it is worth noting had the company not been confronted with such problems, what their possible bid price could have been.

In short this real life example demonstrates that how three areas of difficulties identified by this chapter are playing their part in not allowing Pakistani rock salt mining companies to establish good sustainable export business.

Chapter 5: Conclusion & Recommendations

5.1 Afghanistan Scenario:

Afghanistan has emerged as a potential market for salt producers. With the Russian insurgency civil war and American assault Afghanistan has been left with very little indigenous food capability. This has been compounded by recent years of drought and famine. The question arises why this demand has emerged now? The demand for food products has always been there but in the past all monetary resources were spent on war. Now this money is available for social rehabilitation and reconstruction. Money is also flowing in from agencies of United Nations, International Red Cross, various NGOs and donors countries. These resources are now being spent to provide basic necessities to poor & deprived Afghans.

The world food program of UN is playing a pivotal role in providing these bare essentials and salt is an important component in these consignments. Pakistan being geographically close to Afghanistan is the ideal hub for WFP to buy salt for human consumption. In fact presently up to 3000 tons has been sold to WFP by Wanhar Salt Corp Ltd, which is 20% of the total requirement. This salt is being used for human consumption. This opportunity is good news for salt exporters as instead of selling to scrupulous Afghan buyers Pakistani salt producers can sell to reliable and reputable agencies like WFP. This not only ensures timely payments but will also go a long way in clarifying the negative image of Pakistan. This association with the WFP will enhance the prospects of such exporters when they enter international markets. The fact that the UN would feature on business portfolios of Pakistani companies will increase the acceptability of these companies.

In the coming time Afghanistan, along with other products will be a good user of Pakistani salt. Hence a good potential is there to tap into this market due to availability of cheap salt products in Pakistan as well as geographical proximity to Afghanistan.

5.2 EPB Pakistan:

Pakistani government has taken some concrete steps in order to boost exports of salt. The export promotion bureau has recently requested its consulates in various countries to promote rock salt through by creating awareness that Pakistan has the highest quality salt in the world. These consulates periodically get in touch with salt importers and give them information about the viability of importing salt from Pakistan.

This step helped in attracting prospective international customers. During the interview with the Director of Wanhar Salt Corp Ltd, we came to know that a 2 member Japanese team from Royal Mint Japan is expected to visit Pakistan in order to explore the Pakistani market. The EPB is also contacting local exporters requesting them to be fully prepared as to entertain such visits and convert them into business deals. According to Mr. Malik (Director of Wanhar Salt Corp Ltd) this has helped in them, as they would be able to make the required arrangements, which would meet international standards.

Although EPB is making substantial effort in promoting Pakistani salt producers, yet a few areas still require attention. The trade fairs arranged by EPB in various countries only project leather and textile sector of Pakistan. Such fairs only attract buyers of these goods. If due coverage to rock salt is given in these fairs Pakistan would be able to capture the salt market.

Pakistani Salt also needs to be projected internationally through other forums. For example the just recently concluded Dubai Shopping Festival carried a good sampling of premium Pakistani products in the Global Village. However salt products were not on display. A forum like this would have been a good place to introduce salt products. Wanhar Salt does have plans to introduce some of its salt products in the Dubai Shopping Festival of 2005. Although of course an event like this would only be limited to displaying and introducing Pakistani salt products like lamps, candle holders and other decorative items.

For Industrial use and big scale human consumption markets, trade fairs will remain the forums of choice to market Pakistani salt.

5.3 Recommendations:

The first and foremost recommendation of this research intends to give after thoroughly analyzing Pakistani rock salt sector, is for immediate steps for modernization of rock salt mining facilities in Pakistan. Both the private and public sector needs to immediately improve the mining methods by introducing and investing in modern mining machinery and technology in order to boost production from the meager levels it stands at right now. Although we have no major domestic worries due to low production levels but to compete in international market, a mine with large production capacity is must in order to compete effectively.

The kind of modern rock cutting machines used in many industrialized countries have the capacity to produce anywhere from 200 to 1000MT of rock salt per hour. Our primitive system of hereditary labor in Pakistan cannot come to even 5% of this figure and hence the parity in production numbers between a typical Pakistan rock salt mine and one in the West clearly shows. Rapid introduction of these heavy rock-cutting machines is very important if a credible export oriented rock salt mine is to run in Pakistan. Such rock cutting machines are available in places like U.K., Germany and Austria. These range in prices from Rs. 40 million to Rs. 90 million a piece. Although the investment in such a machine looks enormous, but since it is a one time investment intended for long term use, the benefits can be reaped in time once the positive results of this modernization start trickling in form of increased lucrative exports. These machines as complicated as they may look, are very easy to operate and maintain and deliver long-term return on investments.

One must also realize that rock salt is a vital and necessary ingredient for a vast number of other chemicals and salt-based agents that are indispensable in daily life cycle of the world industrial complex. This research study also proposes for a study to be conducted into feasibility of establishing a high production rock salt mine in Pakistan in conjunction

with a modern chemicals complex. This way salt mined from the caves can be used for export market while the rest over in form of smaller salt rocks and pebbles which are unfit for export can be used a raw-material for a salt-based chemicals production complex. Currently we are importing a large chunk of such salt-based chemicals from Eastern European countries.

It is now high time to take some positive decisions for the proper exploitation of our inexhaustible and high quality rock salt deposits. A highly mechanized rock salt mine is needed to really reap the benefits of our large rock salt deposits. Key will remain the tapping into export-oriented market for our salt. Our geographical location puts us in a position to tap into lucrative salt export markets of Southern Africa, Middle East and Japan. These are three areas where bulk of Pakistani salt can be exported. All these areas currently rely on 100% of foreign sources for their salt needs, both human and industrial. Most of Southern Africa is being supplied salt from Europe, Middle East from India and Japan from Australia, China and Mexico.

Here are some more specific recommendations:

- Private company's needs to do more to think big and modernize themselves. Out of 12 private rock salt companies in Pakistani, unfortunately only 1 has shown the foresight to modernize itself and tap into new markets for its salt.
- The banking and lending institutions need to take more interest in this area. Large investments are required to bring our salt production facilities at par with rest of the world and without bank and lending agencies cooperation this cannot be achieved. Banks have to look beyond their narrow field of view limited to large "glamorous" projects from which they have taken hits after hits in failed investments. Instead new areas of investment with promise such as salt production need to be properly looked into these banks and financial institutions.

- Government's bureaucratic regulatory agencies have become too big and cumbersome to work with in view of almost all private sector rock salt mining companies in Pakistan. These bureaucratic entities do nothing else but hamper any new development plans of private sector rock salt mining companies by demanding regular "cuts" in form of bribes or else they burry a company under bureaucratic wrangling and burden. Such so called bureaucratic regulatory agencies need to be done away with if private sector rock salt mining in Pakistan is to flourish.

- Salt mining companies need to do more in order to attract skilled manpower and expertise. Although lots of such salt mines are located in very inhospitable parts of the country away from cities but adequate facilities need to be provided in order to attract reasonably skilled and educated personnel to come and work for them.

- As said again and again, this research study once again stresses the importance of enhancing production numbers for salt. Being a raw material, salt needs to be competitively priced in order to compete on export market. Keeping in view large transportation cost from mines to nearest port is further compounding the problem here in Pakistan. It is therefore important that quantity produced be large so that these excess costs can be offset.

- Modern approach and thinking towards salt is needed as well. Salt cannot be just looked at as that white granular substance that we see on or dining tables every day. It is much more than that. For a salt company it is important to understand that so that every aspect of salt can be marketed effectively. Cargill Salt produces hundreds of different kinds of salt as outlined in APPENDIX-A at end. This list of salts produced is an eye-opener for anybody who considers salt just as something that is lying on his or her dining table every day.

- Support of Government is essential also to develop good export oriented salt business. Although considering any type of financial assistance from government in this regard is out of the question in the prevailing circumstances but there are some areas where Government can be of some help. For example the government can do more in providing basic necessary infrastructure to salt mines in Pakistan. Currently of the 12 private sector rock salt mines in Pakistan only 1 is connected to WAPDA while the rest use expensive diesel fuel as their source of energy. And even this one salt company used its own financial resources and efforts to get itself connected to WAPDA grid by erecting poles and necessary electrical infrastructure solely out of it's own pocket. One tends to feel that Government should at least be helpful in such areas. Similarly the same private sector rock salt mining company used its own financial and technical resources to construct a road that links its mining complex with the main highway. Although this one private sector company, which also happens to be Pakistan's largest, and most well run in private sector had to foresight to invest in such areas where surely was Government's responsibility, others have not.

- Pakistani salt companies and entrepreneurs need to constantly keep themselves informed about what is happening in the world of salt mining and sales in the world. Currently our view scope of this area of world business is very limited. The 9th annual Salt Symposium held in The Hague in Netherlands in May 2000, which attracted thousand of salt professionals and companies from all over the world had only a single Pakistani salt company attended it.

- Private sector rock salt mining companies also need to look at the pay structures for their labor. Currently these are some of the lowest paid workers in the industry. Under such circumstances laborers cannot be expected to give their 100%. Implementation of a more rational pay structure will surely boost efficiency and production of salt mining companies.

5.3.1 Export Strategy:

If a company decides to take this major step of entering export markets it has to develop a strategy on these lines. Exporting and international marketing requires a far broader range of managerial skills and knowledge. Hence, without a comprehensive export & marketing strategy the company cannot expect to be successful in international business. The Wanhar management admitted that although they are exporting salt but presently they do not have a specific set of guidelines policy for exports. In this age of competition a company cannot imagine stepping into the world arena without a plan. Pakistani companies must emphasize the need to develop such policies so to give them a clear direction.

After conducting this research and gathering data through primary and secondary sources I have come up with a few critical steps that must be undertaken to succeed in international markets.

A. Organizing for Exports:

At an early stage in exporting it is necessary to give some consideration to how the export department is or should be organized with the aim of developing an export department that can undertake all the appropriate marketing sales and distribution activities. In a small company an export manager could do every thing from soliciting orders, to designing packages, to shipping the goods. In a larger company there would be a need of support staff to undertake specific tasks and responsibilities.

In Pakistan most of the private entities are family owned, and it is observed that no specific person is formally given the responsibility to export. Although such companies do not need export departments but at least one person should appointed to manage exports. This would give specific focus on exports. On the contrary PMDC does have an export

department but rock salt is not one of its priorities. Adequate attention to this area could be given by designating an officer to this job.

B. Preliminary Desk Research:

Overseas travel is expensive so as much preliminary desk research as possible should be done from the home base. This step helps in identifying and quantifying opportunities. Basic research pays dividends in terms of time saved in gaining market entry and in providing a base to more realistic plans and objectives. A common scenario in many smaller companies is to approach exporting like a blindfolded man at a duck shoot – pointing in the general direction, firing a load of buckshot, and hoping some hits a target. Comprehensive research will normally narrow interest to a manageable number of markets where companies can use their own expertise to create market demand and to have the best chance to succeed. As a starting point the exporter must make study of home market export statistics, which would show

- ❑ Whether exports are taking place already?
- ❑ Where they are going?
- ❑ The volume and value of exports?
- ❑ Who is exporting?

In addition to this they must be aware of

- ❑ Comparative export prices
- ❑ Competitive export quantities
- ❑ Magnitude to input trade to key markets
- ❑ & Any seasonal trends

The above steps would help in identifying target markets. Additional desk research is needed in a number of years before making the first shipment.

- ❑ Labeling and packaging
- ❑ Import licenses and quotas
- ❑ Exchange restrictions
- ❑ Enquiry correspondence

After a thorough trawl of all available desk research the exporter is in the position to prioritize in terms of which export market to focus initially. The exporter could list criteria relevant to his products that will help in categorizing markets into priorities.

Typical criteria used in prioritizing markets are:

- ❑ Existing or potential consumer or user demand in the foreign market.
- ❑ Suitability or adaptability of the products to meet specific needs
- ❑ Sales volume and value potential for the exporting company in the face of competition from other sources (e.g. competition in terms of price, availability, quality, traditional supply sources etc.)
- ❑ Existence of foreign market manufacturers with compatible production facilities or products, either to utilize exporters products as inputs or to compete with local products on advantageous terms.
- ❑ A local distribution infrastructure suited to the products need.
- ❑ Existence of local distributors capable of marketing the product.
- ❑ Current or potential protection from imports for locally produced products.
- ❑ Availability for foreign exchange for imports.
- ❑ Availability of export licenses.

C. Market exploratory visit:

Time spent in foreign market is costly and therefore, benefit from exploratory visits can only be derived when desk research has been undertaken. These visits should be undertaken to achieve the following information.

- ❑ To meet with potential local market representatives
- ❑ To meet with potential customers and end users
- ❑ To understand the local distribution systems and related trade and customs practices

- ❑ To further assess market sales potential
- ❑ To obtain additional data that will aid market planning and market management

An important aspect is to follow up these leads. To maintain goodwill and continuity of contact it is essential to write immediately upon returning home to the contacts that have assisted. This will reflect positive and serious commitment on the exporter's part and will ensure finalization of these deals.

D. Marketing in global context

Increased international travel and international communications media makes it easier to communicate product messages between markets and help promote an environment that favors a global approach to marketing which is both desirable and practical through

- ❑ Product branding
- ❑ Promotion
- ❑ Target market positioning
- ❑ And product pricing

Global marketing is primarily about maximizing worldwide sales, market shares and profits through active foreign market management and flexible approach to product sourcing. Global marketing is driven by the pursuit of economies of scale in production and distribution and supported by gradual convergence of consumer needs and requirements in pan national markets as a result of global marketing strategies. Global marketing needs:

- ❑ An organized strategy
- ❑ Active market management & policies
- ❑ A flexibility recognizing local market differences

In respect of,

- Developing distribution channels through:
 - Local specialist distributors
 - Foreign associates branches and subsidiaries
 - Licensing and joint ventures
- Market concentration in markets where market penetration and share can be developed with security and profitably.
- Promoting products and services that lend themselves to international branding and promotion.

E. Export pricing

Price is a critical factor in international as well as domestic markets. Price has a direct effect on sales volume through extending or limiting the users ability to afford the product. Price is influenced by

- Exporters marketing strategy
- Distributors consideration
- Trade buyers consideration
- Competitive activity
- Market environment

Pakistani salt in international markets is expensive due to the lack of economies of scale. However, weak rupee against the dollar makes our exports cheaper. This factor along with the fact that salt is a cheap commodity should make Pakistani salt especially attractive to international buyers. Ironically, Pakistan still is unable to price this product competitively.

F. Packaging

Export packaging serves both as a mean of protecting product from damage and transit and as a marketing communication vehicle. Many

suppliers make minimal use of packaging to convey product messages.

Export packaging has a number of function and objective. It must:

- ❑ Ensure that the product arrives in as good condition as it leaves the exporter
- ❑ Comply with laws, rules, regulations or trade conventions that apply in that market
- ❑ Identify the product clearly to the end user and relate to local culture
- ❑ Comply in each and every respect with the specifications of the importer
- ❑ & Facilitate ease of handling and storage

This recommendation is further consolidated with the incident related to us by the Director of Wanhar Salt Crop. Ltd. A whole consignment of salt was sent back for repackaging just because instead of printing the UN logo in blue it was printed in black.

G. Export administration and performance monitoring

The preparation of timely and efficient performance monitoring data reports is essential to effective international business. A meticulous record of different procedural systems must be kept. It is also necessary to control order processing and shipping procedures. These reports and documents need to be accurately detailed and timely in presentations.

Few exporters attempt to measure the profitability of export markets. The exporter must not panic when there are low profit margins but clearly this should only happen where there is long-term security of market access supported by strong strategic marketing reasons such as building market share and gaining market entry. Good export management practice should require that attempts be made to measure the profitability of all export operations. This can be done:

- ❑ On market by market basis
- ❑ On shipment by shipment basis

APPENDIX-A

CARGILL SALT PRODUCTS

Agricultural Salt Products:



- [Cargill Kiln Dried Salt Medium](#)
- [Cargill Kiln Dried Salt Medium](#)
- [Cargill Mill Feed Kiln Dried Iodized Salt](#)
- [Champions Choice® Cobalt Iodized Salt Bag and Block](#)
- [Champions Choice® Fortified Trace Mineral Blocks](#)
- [Champions Choice® Iodized Salt Block and Brick](#)
- [Champions Choice® Kansas Rock Salt #4 Fine](#)
- [Champions Choice® Mix-N-Fine® Salt](#)
- [Champions Choice® Natural Livestock Salt Block](#)
- [Champions Choice® Rancher's Stock® Salt](#)
- [Champions Choice® Selenium "90" Trace Mineral Salt Bag and Block](#)
- [Champions Choice® Sheep Salt with Selenium Bag](#)
- [Champions Choice® Sulfur Salt Block](#)
- [Champions Choice® Trace Mineral and White Salt Spools](#)
- [Champions Choice® Trace Mineral Bag and Block](#)
- [Champions Choice® Trace Mineral Deer Salt Brick with Apple Flavor](#)
- [Champions Choice® Trace Mineral Horse Salt Brick](#)
- [Champions Choice® Trace Mineral Salt with EDDI](#)
- [Champions Choice® White Salt Block and Brick](#)

Food Processing Salt Products:



- [Cargill Alberger® Brand Fine Flake Improved Salt](#)
- [Cargill Alberger® Brand Butter-Flavored Popcorn Salt](#)

Food Service Salt Products

Produced:



[Cargill Alberger® Brand Coarse Topping Flake Salt](#)

[Cargill Alberger® Brand Fine Flake Salt](#)

[Cargill Alberger® Brand Fine Prepared Flour Salt](#)

[Cargill Alberger® Brand Flake Salt](#)

[Cargill Hi-Grade Iodized Evaporated Salt](#)

[Cargill Pretzel M Salt](#)

[Cargill Top-Flo® Evaporated Salt](#)

[Diamond Crystal® Canning and Pickling Salt](#)

[Diamond Crystal® French Fry Salt](#)

[Diamond Crystal® Halite Winter Melt® Deicing Crystals](#)

[Diamond Crystal® Iodized Salt and Salt for Canning, Pickling, and Table Use](#)

[Diamond Crystal® Jiffy Melt® Deicing Crystals](#)

[Diamond Crystal® Kosher Salt](#)

[Diamond Crystal® Pellets with Softener Care® Additive](#)

[Diamond Crystal® Plain and Iodized Table Salt](#)

[Diamond Crystal® Popcorn Salt](#)

[Diamond Crystal® Red-Out® Pellets with Iron Fighter® Additive](#)

[Diamond Crystal® Restaurant Rounds](#)

[Diamond Crystal® Rock Salt](#)

[Diamond Crystal® Salt Sense® Plain and Iodized Salt](#)

[Diamond Crystal® Solar Salt Extra Coarse](#)

Grocery Store Ready Salt

Products:

[Colonial® Plain and Iodized Salt](#)

[Diamond Crystal® Canning and Pickling Salt](#)

[Diamond Crystal® Ice Cream Salt](#)

[Diamond Crystal® Iodized Salt and Salt for Canning, Pickling, and Table Use](#)

[Diamond Crystal® Kosher Salt](#)

[Diamond Crystal® Plain and Iodized Table Salt](#)

[Diamond Crystal® Popcorn Salt](#)

[Diamond Crystal® Salt Sense® Plain and Iodized Salt](#)

[Diamond Crystal® Sterling® Salt](#)

[Leslie® All Purpose Table Salt](#)

[Leslie® Ice Cream Rock Salt](#)

[Red Cross® Plain and Iodized Salt](#)

**Industrial Salt Products
Produced:**



[Cargill Driller's Choice® Evaporated Salt with YPS](#)

[Cargill Driller's Choice® Fine Rock Salt](#)

[Cargill Hi-Tex® A-100 Evaporated Salt](#)

[Cargill Hi-Tex® Evaporated Salt](#)

[Cargill Kansas Rock Salt Medium](#)

[Cargill Kiln Dried Salt Extra Fine](#)

[Cargill Kiln Dried Salt Medium](#)

[Cargill Microsized® 86 Salt Fine](#)

[Cargill Mill Feed Kiln Dried Iodized Salt](#)

[Cargill Mill Feed Kiln Dried Salt](#)

[Cargill USP Grade Sodium Chloride](#)

[Dust-Off® Anticorrosive Dust Suppressant](#)

**Water-
Conditioning Salt
Products
Produced:**



[Diamond Crystal® Brine Block](#)

[Diamond Crystal® Hardi-Cube Red-Out® with Iron Fighter® Additive](#)

[Diamond Crystal® Hardi-Cube® Salt](#)

[Diamond Crystal® Pellets with Softener Care® Additive](#)

[Diamond Crystal® Potassium Chloride Pellets](#)

[Diamond Crystal® Red-Out® Block with Iron Fighter® Additive](#)

[Diamond Crystal® Red-Out® Pellets with Iron Fighter® Additive](#)

[Diamond Crystal® Rock Salt](#)

[Diamond Crystal® Solar Salt Extra Coarse](#)

[Diamond Crystal® Sun Gems® Crystals](#)

[Diamond Crystal® Sun Gems® Red-Out® with Iron Fighter® Additive](#)

[Hardy® Rustop™ Tabs with Rust Remover](#)

[Hardy® Zeo Tabs®](#)

[Pro's Pick® Dura-Cube®](#)
[Pro's Pick® Pellets with Softener Care® Additive](#)
[Pro's Pick® Red-Out® Dura-Cube®](#)
[Pro's Pick® Solar Salt Crystals](#)
[Pro's Pick® Undried Process Solar Salt Crystals](#)

De-Icing Salt Products **Produced:**

[Bulk Deicing Salt](#)
[CG90® Original](#)
[CG90® Surface Saver®](#)
[ClearLane™ Liquid](#)
[ClearLane™ Treated Salt](#)
[Hydro Melt™](#)
[Technical Grade Magnesium Chloride](#)

APPENDIX-B **B-QUESTIONNAIRE**

1. Name of Company:
2. Based at:
3. Owned by:
4. Year of Commencement of Operations:
5. Employees:
6. Yearly turnover:
7. Operating expenses:
8. Post-taxation profit:
9. Last five years financial figures:
10. Major salt products?
11. No Of salts brands produced?
12. Biggest Salt product by type i.e. rock, evaporated, industrial etc?
13. Major salt markets?
14. Biggest Salt market by geography?
15. Source of salt? Mines, Salt Refineries, Evaporation Plants etc?
16. Actual workforce involved in salt production?
17. Actual workforce involved in salt marketing?
18. Extent of modernization of salt production facility/s?
19. Method of choice for producing salt?
20. Why?
21. Favorite salt market segment?
22. Biggest production challenges?
23. Biggest export challenges?
24. How much of total salt revenue from exports?
25. Yearly production capacity?
26. Producing surplus or under-capacity?
27. If under capacity, reasons?

28. Future growth potential?
29. Market trends? Consolidation or diversification?
30. International competition?
31. Future plans?
32. Production and market share targets for future?
33. Biggest untapped salt market potential for company?
34. Why untapped so far?
35. Future of salt in company's view?
36. Challenges posed by arrival of other Potassium based salts for industrial use?
37. Challenges posed by arrival of other than salt based highway deicers?
38. Challenges posed by warnings of health risk due to high salt intake by humans?
39. Importance of salt growth for the company?
40. Is finding well-trained workforce for operations a challenge?
41. Salt lacks glamour associated with other industries. Is this a major drawback?
42. Are highly educated and skilled workers harder to attract in salt-based business?
43. Is bank financing a problem for salt-based industry?
44. Biggest challenge and opportunity for the decade?

APPENDIX-C

SALT SURPRISES

- The sea contains an estimated 40 million, billion tones of salt;
- If the world's oceans evaporated, enough salt would be crystallized to cover Britain to a depth of 50 miles;
- Cattle need more salt than they can normally obtain from grazing, so salt blocks are provided for them. Grass scattered with rock salt is more appetizing for beef cattle. They eat more and gain weight;
- Salt added to cattle silage inhibits the growth of micro-organisms which can destroy it;
- Rock salt is used to fertilize soil with sodium, which makes sugar beet yield more sugar;
- Salt is used to removed traces of water from aviation fuel after it is purified;
- Being hygroscopic, salt spread on dusty floors in equestrian centers and indoor arenas retains moisture and keeps down dust;
- Some primitive tribes actually produced coins from salt, denoting its very high value as an essential of life;

- Until relatively recently, salt bars were the standard currency of Ethiopia and cakes of salt, stamped to show their value, could be used as money in countries as far apart as Tibet and Borneo;
- Total annual worldwide salt production is equivalent to the amount contained in two cubic miles of seawater. Now, that's a lot of water!
- It comes from water, but it makes you thirsty
- It corrodes metal, but preserves your food
- It is hard, yet softens water
- It's a mineral, and yet you eat it!
- Superstitions
- Salt has been thought of as a powerful magical substance.
- Spilling salt was a dangerous omen. Even today, some people throw salt over their left shoulder after spilling some, to cancel the 'bad luck'.
- It was also thought to be unlucky to help anyone to salt. An old phrase says "Help me to salt, help me to sorrow".
- Superstitious sailors would not mention salt whilst at sea, and would never throw it overboard.
- In old Japanese theaters, salt was sprinkled on to the stage before each performance to prevent evil spirits from casting a spell on the actors and ruining the play.
- On a happier note, it is customary in some countries to greet newlyweds with gifts of salt and bread, instead of throwing confetti.
- In Arab countries salt was used to seal a bargain, and also as a sign of friendship, if you ate another man's salt, you could not harm him in any way whilst in his home, and he would not harm you.
- The Druids used salt in their rituals at Stonehenge. It is thought that this was as a symbol of the life-giving fruits of the earth.

APPENDIX-D

World Wide Salt Production

(Million metric tons, includes salt in brine)

Country	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990
<u>United States</u>	45.1	45.6	45.0	41.3	41.5	42.3	42.2	39.8	39.3	36.1	36.4	37.0
China	32.0	31.3	28.1	22.4	30.8	29.0	29.8	29.7	29.5	28.1	24.1	20.0
Germany	15.8	15.7	15.7	15.7	15.8	15.9	15.2	10.5	12.7	12.7	14.9	15.7
India	14.5	14.5	14.5	12.0	14.3	14.5	12.5	9.5	9.5	9.5	9.5	9.5
<u>Canada</u>	12.5	11.9	12.7	13.3	13.3	12.2	11.0	11.7	10.9	11.2	12.0	11.3
<u>Mexico</u>	8.6	8.9	8.2	8.4	7.9	8.5	7.7	7.5	7.5	7.4	7.5	7.14
<u>Australia</u>	8.0	8.8	10.0	8.9	8.8	7.9	8.1	7.7	7.7	7.7	7.8	7.23
<u>France</u>	7.1	7.0	7.0	7.0	7.1	7.9	7.5	7.5	7.0	6.1	6.5	6.61
Brazil	7.0	6.0	6.9	6.5	6.5	5.4	5.8	6.0	6.2	5.3	4.9	5.37
<u>United Kingdom</u>	5.7	5.8	5.8	6.6	6.6	6.6	6.7	7.0	6.8	6.1	6.8	6.43
All Other	57.7	58.5	58.0	59.1	54.4	53.8	52.5	53.1	41.0	53.8	60.6	45.59
Totals	214.0	214.0	211.0	200.0	207.0	201.0	199.0	190.0	187.0	184.0	191.0	183.0

Source: U.S. Geological Survey Mineral Commodity Summaries, January 2002

