ECONOMIC DIVERSIFICATION IN RESOURCE ABUNDANT ECONOMIES: THE CASE OF THE MINERALS INDUSTRY IN SAUDI ARABIA

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by

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Mohammed Ibrahim Aldagheiri

Abstract

The macro-economy of Saudi Arabia has been dominated by oil exports which between 1970 and 1995 accounted for more than 85 per cent of total export earnings. Due to the fact that oil is an exhaustible resource, the price of which fluctuates considerably, and is produced in an enclave economy, the Saudi Arabian government had recognized the needs to diversify their economy away from oil as the main source of income to avoid the economic problems that are usually, associated with the resource curse. Therefore, since the oil price crashed in 1986, the Saudi Arabian government has adopted a new policy to develop non-oil sectors, such as manufacturing, agriculture and more recently, non-oil minerals. This study focuses on the minerals sector in Saudi Arabia which is considered one of the economic activities which has already started to achieve the strategic goal of economic diversification away from oil activities as the main source of national income. The considerable attention has been paid to the large reserves of strategic minerals that have been found such as, phosphate and bauxite. The mining has been embraced by the Saudi government not only to diversify the national economy, but also to stimulate the economy, generate employment opportunities, attract foreign capital, and encourage citizens to invest their money. Therefore, an exploitation of these minerals requires a high demand for transportation infrastructure, the provision of which has become a necessity. The development of transportation infrastructure plays an important role in the economic development of a country, and therefore the railways is considered an economic lifeline for minerals development in the Kingdom, as it will facilitate the transport of raw materials and provide mobility for workers to reach the work place and products to the market place. Moreover, it should facilitate the diversification of the national economy and has the potential to be a powerful instrument in promoting long-term growth and employment.

List of Publications

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List of Abbreviations

Ma'aden: Saudi Arabian Mining Company.

UNDP: United Nations Development Programme.

EITI: Extractive Industries Transparency Initiative.

AGT: Australian Government Treasury.

SGS: Saudi Geological Survey.

LDCs: less developed countries.

TRIP: The Road Information Program.

MEED: Middle East Economic Digest.

SACTRA: Standing Advisory Committee on Trunk Road Assessment.

EDRG: Economic Development Research Group.

MPMR: Ministry of Petroleum and Minerals Resources.

MOT: Ministry of Transportation.

MOC: Ministry of Communication.

MOP: Ministry of Planning.

MOI: Ministry of Information.

KACST: King Abdulaziz City for Science and Technology.

SRO: Saudi Railways Organization.

SPA: Saudi Ports Authority.

PIF: Public Investment Fund.

SOCAL: Standard Oil of California.

CASOC: California Arabian Standard Oil Company.

ARAMCO: Arabian America Oil Company.

AOC: Arabian Oil Company.

LPG: liquefied petroleum products.

SAFCO: Saudi Arabian Fertilization Company.

EDC: Economic Development Committee.

IBRD: International Bank for Reconstruction and Development.

UN: United Nations.

CPO: Central Planning Organization.

GDP: gross domestic product.

SAMA: Saudi Arabian Monetary Agency.

SABIC: Saudi Basic Industries Corporation.

SIDF: Saudi Industrial Development Fund.

SR: Saudi Riyal.

GCC: Gulf Cooperation Council.

ECC: European Economic Community.

DMMR: Deputy Ministry For Mineral Resources.

USABC: U.S.-Saudi Arabian Business Council.

SCPM: Saudi Company for Precious Metals.

ASMIC: Arabian Shield for Mining Industries Company.

FSU: Former Soviet Union.

USGS: US Geological Survey.

DAP: Dominium Phosphate.

DGMR: Directorate General of Mineral Resources.

SAMS: Saudi Arabian Mining Syndicate.

BRGM: Bureau de Recherches Geologiques et Minieres of France.

IRF: International Road Federation.

BOT: Build Operate Transfer.

DBOT: Design, Build, Operate and Transfer.

HADEED: Saudi Iron and Steel Company.

NSR: North-South Railway.

SAR: Saudi Arabian Railways.

SAGIA: Saudi Arabian General Investment Authority.

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CHAPTER ONE

INTRODUCTION

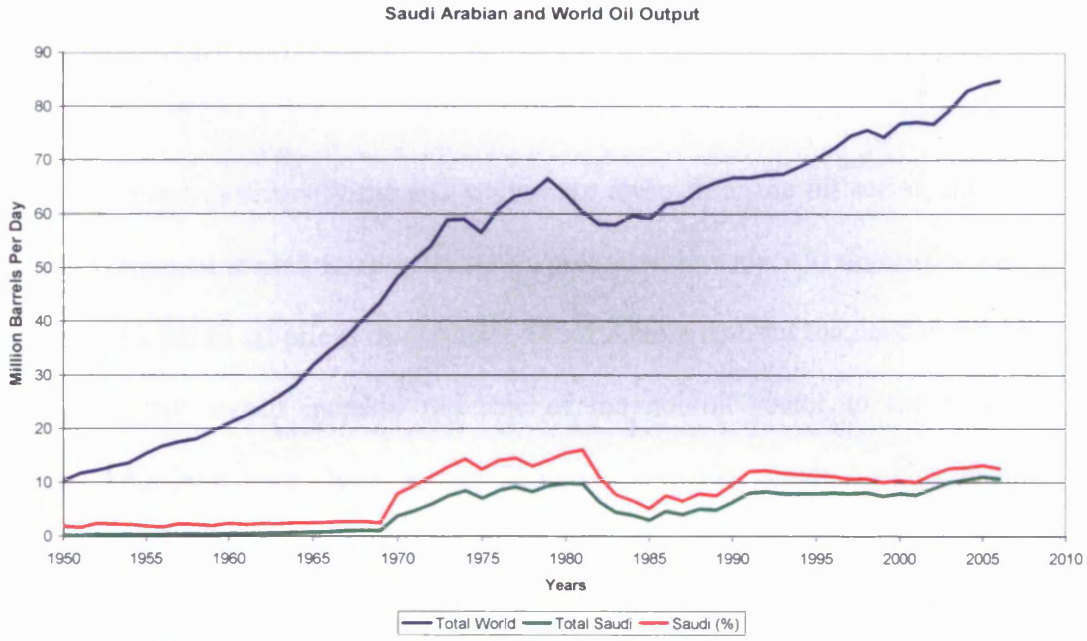
1.1 The study background

Saudi Arabia is a country of around 22 million people that occupies the greater part of the Arabian Peninsula. It differs from the majority of developing countries which generally have low per-capita income, high population to land ratios, a high proportion of agriculture in their GDP and high foreign debts. Saudi Arabia is well known as one of the major oil exporting countries in the world. Thus, the oil sector plays a crucial role in the economic activity of the country and the Saudi Arabian economy can be characterized as oil-dependent due to the high proportion of oil exports in the country's total exports and of the oil share in the overall GDP. Oil exports account for an average of 85 per cent of total exports, while government revenues from oil varied between 70 percent to 90 percent on average between 1970-1995. Moreover, it has the world's largest estimated oil reserves and is also the largest oil exporter (Eglin and Seekins, 1991).

From the history of the Saudi economy, it can be seen that any decline in oil prices or in the country's production of oil has an immediate impact on the economy in terms of budget deficits (Anderson, 1981; Cordsman, 1983; Nawwab, et al., 1995). This uncertainty is due to the economy's heavy reliance on a single export commodity, oil. According to Alkhelaiwai (2001), the oil windfall which accrued to the government in the aftermath of the Arab-embargo of oil in 1973 led the country to spend heavily in order to accelerate economic development. Similarly, the Saudi Arabian economy

experienced an oil export boom during the 1970s and early 1980s due to an unexpected sharp increase in oil price and production, resulting, amongst other factors, from the Arab-Israeli war and the Iranian revolution. Therefore the national income rose and the balance of payments went into surplus. Such an outcome would normally have been considered a "blessing".

Figure 1.1: Saudi Arabian and World Oil Output



Sources: ARAMCO and Earth Policy Institute

The boom was followed by a gradual and then dramatic decline in oil revenues. This occurred particularly after the mid-1980s (see Figure 1.1) when Saudi Arabia stopped practising the role of a "swing producer" in OPEC in order to maintain the price of oil, as it had been adversely affected by OPEC members and independent oil producers increasing their quotas at the expense of the Saudi quota. Accordingly, the production of Saudi Arabia declined from five to less than three million barrels in the mid 1980s, and it might be expected that there would be consequences of this decline in oil price and

production. Fluctuations in oil revenues over time may reflect and affect the Saudi small and open economy positively and/or negatively both through the oil export boom and the oil export slump. However, oil is a finite resource and reserves will eventually be exhausted or an alternative source of energy discovered. Moreover, fluctuation in oil prices mean the economy has faced a series of external shocks during the last two decades. In such circumstances, it is important that the Kingdom of Saudi Arabia reduce its reliance on oil resources.

1.2 The importance of the study

In its commitment to diversify the economic base away from the oil sector, the Saudi Arabian government started to re-evaluate its policy with respect to diversification. In response to the fall in oil prices of 1982-83, Saudi Arabia realised the need to establish new policies that would increase the role of the non-oil sector in the economy. Throughout the Five-Year Development Plans (1970-2010), Saudi Arabian planners focused on economic diversification as a strategy to increase production in the non-oil sectors, such as manufacturing, agriculture and non-oil minerals in order to reduce dependency on oil exports as a major source of government income. Hence, the Saudi government established the state-owned Saudi Arabian Mining Company (Ma'aden), which will consolidate all mining projects in which the government is involved. This company is a 100 percent Saudi governmental holding company with an initial capital of more than $1 billion.

Therefore, one of the government's aims has been to develop and promote the minerals sector in order to enhance its weak role in the Saudi Arabian economy, often by providing substantial incentives to develop the sector. The reasoning behind the new

policy can be summarised as follows. Firstly, large reserves of both metallic and non-metallic minerals such as gold, iron, copper and clay have been found. Secondly, it is believed that the minerals industry has relatively strong links with other sectors inside the country. Thirdly, minerals exports, as well as other non-oil commodities, could help in reducing the instability in exports and in turn reduce Saudi Arabia's total revenues fluctuation (Al-Attas, 2001).

As Saudi Arabia is a vast country, the government has therefore focused not only on locating mineral deposits, but also on making them accessible for exploitation. Saudi Arabia occupies over 70 per cent of the Arabian Peninsula, a huge area which is larger than Western Europe and which encompasses a territory of about 2.25 million sq. km. As a result, the issue of transportation infrastructure has been prominent on the government's agenda. The government's policies aim to better maintain, restore, rebuild, and invest in our highways, bridges, transit facilities, rail lines, airports, and ports. For example, the minerals railway will run from Al-Jalamid in the far north of Saudi Arabia to Riyadh, where it will connect to an existing rail link to Dammam.

According to Ministry of Plan (MOP) (1985) a critical issue for most mining projects in remote areas is the extent to which the costs of the require infrastructure facilities, including transportation, are shared or allocated to the mining project alone. This affects the profitability of the mining projects considerably. Provision does exist for the Government to contribute to the costs of mining infrastructure. It is the Government's intention that this should have a major positive effect on the development of mining projects. In order to enhance the potential of the mineral sector a number of initiatives have been taken in the past couple of years. These initiatives as follow:

- it recommends solutions to infrastructure problems and methods for reducing mineral development costs;

- facilitates access by mineral exploration companies to geoscientific databases;

- simplifies and encourages investment in the mining sector; and

- establishes regulatory protocols to protect the environment and determine mining impacts on local communities (Dew, 2003, p: 15).

Therefore, to provide information about the ability of the existing transportation infrastructure to contribute to any exploitation of minerals, it is necessary to identify and evaluate the level of the existence of the transportation infrastructure in the Saudi Arabia.

1.3 Aims and objectives of the study

There are two principal aims of this study:

1. To investigate the impact of the minerals sector on the economic growth of Saudi Arabia, through the following objectives:

- To analyse the characteristics of the "Resource Curse" and the mechanisms proposed to overcome it.

- To assess the Saudi diversification plans seeking to increase non-oil export earnings and reduce their instability.
- To present a summary of the distribution of minerals resources in Saudi Arabia.
- To highlight the main characteristics of the Saudi minerals sector and its role in national economic performance.
- To estimate the economic impacts of potential new minerals projects on the Saudi Arabian economy.

2. To examine the role of transportation infrastructure in development of Minerals sector, and to put forward suggestions that could lead to its improvement in light of the following objectives:

- To present an historical review of the transport sector.
- To assess the role of the transport sector in the potential development of the minerals sector.
- To assess the current challenges facing the expansion of the transportation system.

1.4 The structure of thesis

The thesis is divided into eight chapters. The layout of these chapters is illustrated in Figure 1.2. A brief description of each chapter is included here to serve as the thesis' summary.

Chapter One presents a brief introduction to the thesis which is covering areas of interest in the study and providing a background to the economy of Saudi Arabia. Moreover, it contains the importance of study, the study's aims, and its objectives.

Chapter Two provides a review of the literature on the relationship between natural resources wealth and economic development. The major aim of this review is to examine the negative association between resource abundance and economic growth in recent decades. Additionally, to explain the term of 'Resource curse' in respect of its reasons and its solutions. The theoretical and empirical considerations of concepts of transport and development are examined as a historical background study. Also, this chapter reviews the economic importance for minerals sector and transportation infrastructure.

Chapter Three begins with selection of a research strategy, then focuses on the development of a model framework designed to examine the role of transportation infrastructure in the development of the minerals sector in Saudi Arabia. After that, it provides a definition of the variables of the research study and the data requirements. Furthermore, it presents the methods used by the researcher in this study for their potential contribution as data collection techniques, such as, interviews, documentation and observation. The final section of this chapter looks at data limitation.

Chapter Four provides a general historical review of the economic development of Saudi Arabia. This chapter divides the economic structure of Saudi Arabia into two important periods: the first period is the structure and performance of the economy prior to the economic development plans which itself is divided into two: the economy before the discovery of oil and the economy after the discovery of oil. The second period is the

structure and performance of the economy after the economic development plans, and this period also divides into Eight Development Plans.

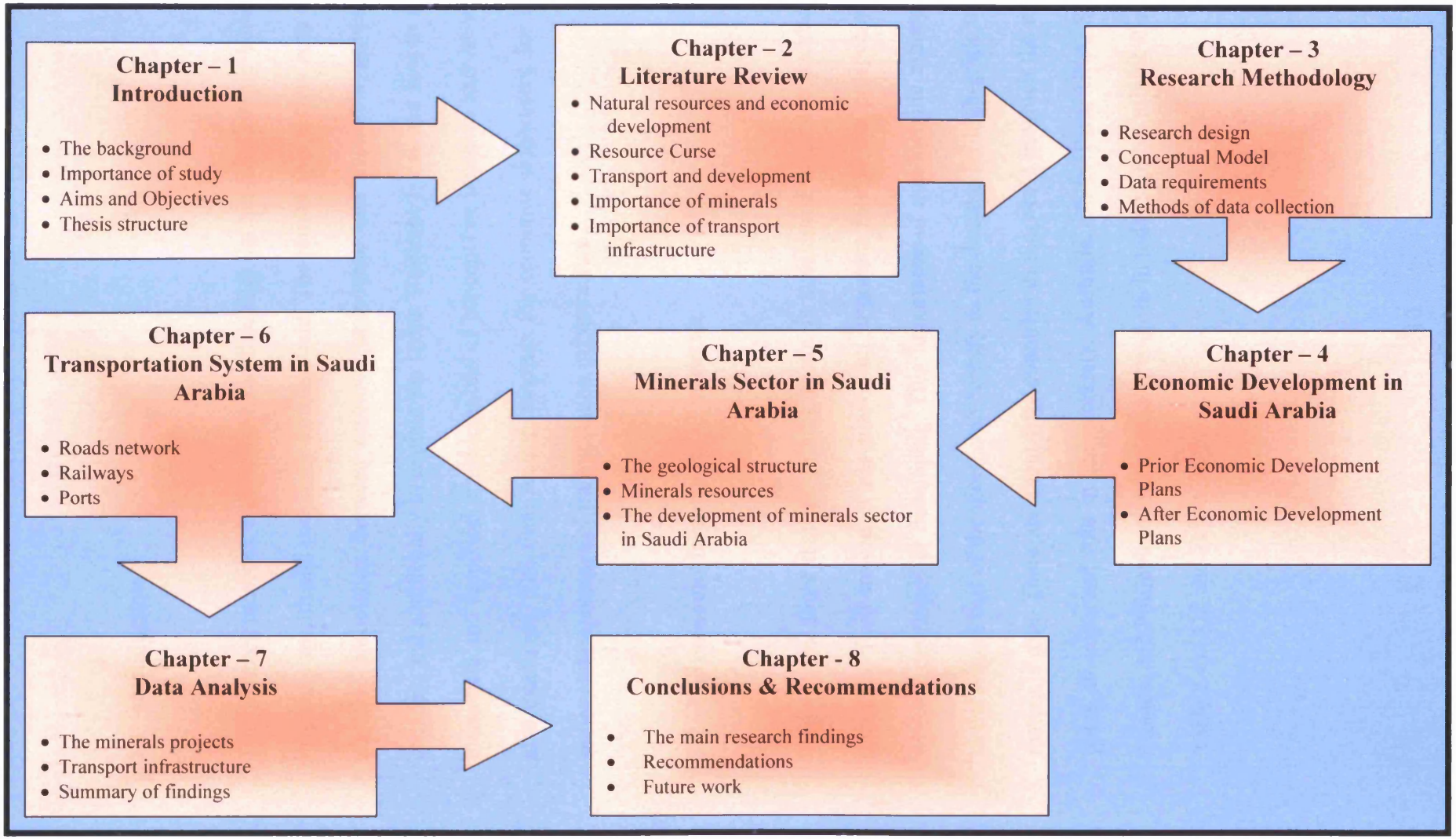
Chapter Five provides the background to the Saudi Arabian mineral sector and its industrial base. Specifically, the chapter presents an overview of the main known mineral resources and production in Saudi Arabia as well as the structure of the industry. In addition, the minerals sector and its role in the Saudi Arabian economy is examined. This chapter also presents the impact of government policies and planning efforts in the minerals sector, particularly during the period of the development plans which started in 1970.

Chapter Six presents the history of the evolution of the three most important infrastructural systems, namely the road network, the railway network and sea ports in the Kingdom of Saudi Arabia.

Chapter Seven presents the analysis of the relationship between transportation infrastructure on the one hand and phosphate and bauxite as strategic minerals on the other hand and thus the impact of this relationship on economic development in Saudi Arabia. This chapter uses the case study analysis which focuses on Al Jalamid Phosphate and Az Zubirah Bauxite as strategic minerals in Saudi Arabia. The final section of this chapter presents a summary of findings of the case study analysis.

Chapter Eight links the study's aims and objectives with the major findings as a conclusion for this study. Additionally, a number of recommendations are presented based on empirical findings. This chapter also presents some suggestions for possible future research.

Figure 1.2: Layout of the Thesis



CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter provides a review of the literature on the relationship between natural resources wealth and economic development. The aim of this review is to examine the negative association between resource abundance and economic growth in recent decades, and additionally to explain the terms 'Resource curse' and how to avoid it. The theoretical and empirical considerations of concepts of transport and development are also examined. The final section assesses the economic importance for the minerals sector and importance of transportation infrastructure.

2.2 The economic importance of minerals

There is no doubt that the mining sector is considered to be the backbone of many countries. Furthermore, it has played an important role in the prosperity of nations, whether developed or developing. This importance of non-metallic minerals increased in the second half of the nineteenth century as the demand for high-grade industrial raw materials rose. There are about fifty countries in the world in which the mining sector plays an important role in the economy. Australia, Chile, Peru, USA, South Africa, Canada, and Philippines are the leading regions in today's global mining investment (see Table 2.1) (Alfi and Zagan, 2004).

Table 2.1: The World Leaders in Mining

Country	Investment Total (billion $)	% of World Total
Australia	12.2	14
Chile	8.1	9
Peru	6.2	7
USA	6.1	7
South Africa	5.2	6
Canada	4.7	5
Philippines	4.0	5

Source: Alfi and Zagan. (2004).

The importance of minerals comes from the essential needs of manufacturing, construction, energy requirements and agriculture and thus for the sustainable development of a modern economy. Relying on Highley et al. (2004, p: 5) minerals are basic and essential raw materials for:

- construction to develop, maintain and enhance our built environment and transport infrastructure;
- manufacturing for the production of a wide range of industrial and consumer goods;
- transportation and electricity generation for use in the home, industry and commerce and;
- agriculture to improve the productivity of the soil.

Figure 2.1 shows a classification of the major groups of economic minerals in terms of the downstream industries in which they are consumed and this serves to illustrate the reliance of many critical sectors of the economy on the products of the extractive industries. Individual minerals are consumed in more than one sector and each market area requires a number of different minerals. In the light of this, minerals play a

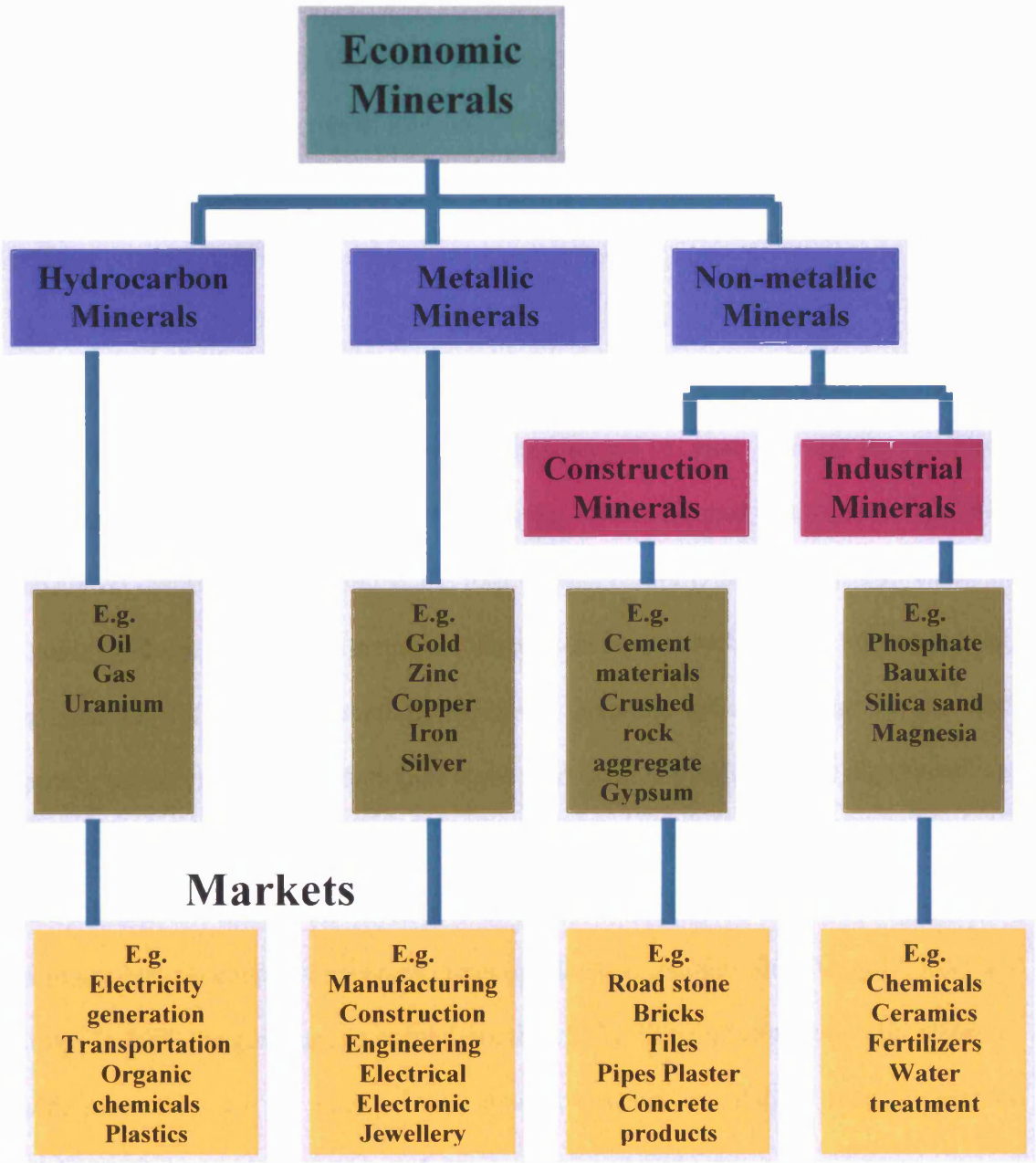
fundamental role in underpinning growth in the economy and in contributing to the standard of living in many countries.

Mining has played a vital role in the economic development of many southern American countries, including Chile, Peru and Brazil. Relying on Wright and Czelusta, (2003, p: 19) since 1990, Chile has been "Latin America's star economy". Copper production in Chile was resurrected in the first half of the twentieth century and took place in the absence of strong domestic technical capacity. According to Patricio Meller, "in the 1950s, one could have learned more about Chilean copper in foreign libraries than in Chilean ones... [Nor] was there training of Chilean engineers and technicians specializing in copper" (cited in Wright and Czelusta, 2003, p: 18). Chile is the most important country in Latin America, for copper or minerals and has gained 46 per cent of export revenues and 8 per cent of GDP on average during the 1990s.

The mining sector is a major contributor to Peru's sustained economic growth. Peru hosts vast quantities of minerals such as gold, copper, silver, lead and zinc. After more than twenty years of isolation from direct foreign investment, the mining scene is changing as political and economic stability have brought renewed interest in Peru as a resource rich investment opportunity for foreign companies. Most of the restrictions have been removed and the government has instigated a variety of incentives for foreign investment. After the privatization programme, which started in 1992, mining exports doubled to $3.01 billion by 1999. As at the end of 2001, Peru ranked second in the world in production of silver and tin, fourth in zinc and lead, seventh in copper and eighth in gold (Wright and Czelusta, 2003). In 2005, mining production represented 13.5 per cent of the GDP and comprised nearly 54 per cent of total exports, about US $

8.9 billion. Gold, silver, copper and zinc represented roughly 97 per cent of mining production in 2005 (Jochamowitz, 2005).

Figure 2.1: A Classification of the Economic Minerals



Brazil is considered one of the leading industrial nations in Latin America. Mineral production grew at more than 10 per cent per year in the 1980s. Between 1988 and 1994 exploration was interrupted because of restrictions imposed by the Constitution of 1988 on foreign participation in mining. These restrictions were lifted in 1995 and exploration activities expanded significantly in the 1990s, increasing both production and reserves of most minerals. Brazil produces more than 60 mineral commodities and is the world's largest exporter of iron ore (Wright and Czelusta, 2003). Also, during the present gold rush, Brazil ranks first in South America and second in the world in gold production (Malm, 1998).

Minerals are a principle source of income for many developing countries in Africa as well. For example, the minerals sector has played a vital role in the economic development of Namibia. The mining industry was developed relatively early, based mostly on diamonds discovered at the turn of the century (Hartmann, 1986). Based on Coakley (2003), the diamond remained the most important sector of the mining industry in Namibia, followed by uranium, for which Namibia ranked as the world's sixth leading producer. The contribution of zinc to the economy will increase significantly as the Skorpion zinc operation builds up to full operating capacity in 2006. Namibia was also the second leading producer of salt in Africa after Tunisia. Other important mineral products include copper, dimension stone (granite and marble), fluorite, gold, lead, and silver. In 2003 the government spent more than $35 million on exploration for minerals, with more than 80 per cent of this amount devoted to offshore marine diamond exploration.

Mining is a vital sector in the economic development of many industrialized countries such as Australia, United States of America, United Kingdom, Canada and Sweden,

which have largely depended on their natural resources for the development of their country (Alfi and Zagan, 2004). Relying on Wright and Czelusta (2003), in 1913 the United States was the world's dominant producer of virtually every one of the major industrial minerals of that era. The coefficient of relative mineral intensity in US manufacturing exports actually increased sharply between 1879 and 1914, the very period in which the country became the manufacturing leader (Wright, 1990). Based on Highley et al. (2004), the complex geological history of the UK and its adjacent Continental Shelf has contributed much to its national wealth, in that coal and iron ore resources supported the development of the Industrial Revolution. Now the UK produces a wide range of construction minerals, notably aggregates, and industrial minerals such as salt, potash and kaolin. This domestic mineral production will be of continuing economic importance. Australia is considered the most striking success story. At the beginning of the 1960s, Australia witnessed a simultaneous resurgence of successful minerals search and economic growth. From 1989 to 1999, Australian mineral reserves expanded alongside production. The Australian minerals sector has created much more wealth than it has depleted, in that the real value of the mining sector's capital stock increased by 40 per cent during 1990-1998, almost twice the rate for all other industries. Australia has emerged as one of the world's leaders in mineral exploration and development technology: "Australia leads the world in mining software and now supplies 60 to 70 per cent of mining software worldwide" (Stoeckel 1999, p: 25).

The Kingdom of Saudi Arabia has natural resources that are highly diverse, both in terms of their variety and their location throughout the country. According to Dabbagh, the President and CEO of Ma'aden Company, is quoted in an interview as saying "The Arabian Shield rock formation in the west of the Kingdom is a little smaller than the

Canadian Shield, and we are optimistic that it contains a similar amount of riches" (2004b, p: 11). So, Saudi Arabia has a large variety of metallic and non-metallic mineral resources that range in size and value occurrences of limited potential to deposits large enough to sustain profitable exploitation. During the fifth development plan, from 1990-1995, the government attempted to overcome the administrative and legal complications that constrained private sector participation in the minerals sector through the new mining code which has streamlined the procedures for obtaining licenses and added more predictability and transparency to the application process. The Saudi mining industry was in its infancy and lacked the necessary expertise, so every possible effort had to be made to promote the participation of specialized international foreign companies in investment in the Kingdom to facilitate the transfer of technical knowledge. Additionally, mining and tax laws were modified and a business-like approach adopted with a view to keeping abreast of on-going progress in this field (MOP, 1985).

In April 1997 the Saudi government established the state-owned Saudi Arabian Mining Company (Ma'aden), which consolidated all mining projects in which the government was involved. This company is a 100 per cent Saudi governmental holding company with an initial capital of more than $1 billion. Moreover, in October 1999, the Saudi Geological Survey (SGS) was established as an independent entity by Royal Decree and attached to the Ministry of Petroleum and Mineral Resources. The role of the SGS is similar to that of most geological surveys worldwide and includes geological research, geochemical, geophysical and hydro geological surveys. It uses the most advanced methods in research and exploration for mineral resources. Moreover, it introduces prefeasibility studies on promising ore deposits to assist the mining industry and offers consultancy services relating to its activities to government and private agencies. These

well capitalized bodies are parts of the Saudi Government's national planning objectives to diversify the income of the Kingdom into the non-hydrocarbon sectors.

Within the context of these endeavours, enormous knowledge about the Kingdom's geology and mineral potential has been gained, and as a result, a data base has been established that has helped to identify a number of mineral projects and deposits that give a sound basis for the development of the Kingdom's mining industry. The respective roles of the government and the private sector are determined by the Mining Code, which confirms that the government will continue to play an important administrative and regulatory role, but the driving force for the development of mining activities will be provided by private enterprise. These incentives have contributed to making investment in the Saudi mining sector highly lucrative, and have boosted interest in the sector among local and foreign investors. In the Seventh Development Plan the annual growth rate for the non-oil mineral sector was set at 8.34 per cent a year and was expected to grow at a target rate higher than any other sector of the economy.

2.3 The relationship between natural resources and economic development

Based on Gylfason and Zoega (2001), natural resources are considered an important source of national wealth around the world, but experience shows that natural riches are neither necessary nor sufficient for economic prosperity and progress. One of the surprising features of economic life in the 20th century was that natural resource abundant economies tended to grow more slowly than economies without substantial resources (Sachs and Warner 1995a, 1997a,b). For example, the Asian tigers,: Korea, Taiwan, Hong Kong and Singapore, are all resource-poor, while growth laggards such as Nigeria, Zambia, Sierra Leone, Angola, Saudi Arabia, and Venezuela, are all

resource-rich. Furthermore, there is an extensive and still growing literature aimed at explaining what drives this inverse relationship between resource abundance and growth (e.g., Mikesell, 1997; Auty and Mikesell, 1998; Ross, 1999; Auty, 2001a; Manzano and Rigobon 2001; Isham et al., 2003; Sala-i-Martin and Subramanian, 2003; Neumayer, 2004).

In the past there was also a negative association between resource abundance and growth. Typical examples include the Netherlands versus Spain in the seventeenth century, where resource-poor Netherlands eclipsed Spain despite the overflow of gold and silver from the Spanish colonies in the New World, and Switzerland and Japan who surged ahead of resource abundant economies such as Russia in the nineteenth and twentieth centuries (Sachs and Warner 1997a; Stijns, 2001).

Stevens (2003) observes that the problems associated with an influx of natural resource abundance were discussed in the 1950s and 1960s. However, he suggests that it was the oil crisis of the 1970s that led researchers to focus specifically on the impact of oil and mineral revenue. In general, a negative relationship between high natural resource intensity, namely a high value of resource-based exports to GDP, and the rate of growth appears as a robust empirical fact, with many examples showing resource-poor economies that outperform resource-rich economies in economic growth (Aznar-Marquez and Ruiz-Tamarit, 2002). Consequently the first use of the term 'resource curse' in the literature was Auty (1993). Auty examined the political economy of six countries and their macroeconomic responses to a series of external shocks. Auty's main aim was to investigate the suggestion that 'not only may resource-rich countries fail to benefit from a favourable endowment; they may actually perform worse than less well-endowed countries' (Drysdale, 2004, p: 4). In the next section, different theoretical

contributions are examined that suggest explanations as to why natural resources might be a 'curse'. In addition, some examples from developing countries are considered.

2.3.1 The 'Resource curse'

The traditional view is that countries that are considered natural resource abundant economies are fortunate: these resources are assets - part of a country's natural capital. Mining is the key that converts mineral wealth into public infrastructures and other forms of capital that directly contribute to economic development (Davis and Tilton, 2005). According to Davis and Tilton (2002, p: 6), "mining plays an important role in the development process by converting mineral resources into a form of capital that contributes to a nation's output". Further, according to the traditional view, mining, like other economic activities, plays an important role in the development process and can convert 'a mineral resource in the ground into sustainable improvements in people's lives' (Togolo, 1999, p: 597).

However, an opposing view, which has emerged over the past three decades, is more negative regarding the relationship between mineral extraction and economic development. Mehlum et al. (2006a), conclude that this view is considered one of the important empirical findings in development economics in the 20th century and proposes that natural resource abundant economies have tended to grow more slowly than economies without substantial resources. Humphreys et al. (2007, p: 1) state that "The term of "Resource curse" is used to describe the failure of resource-rich countries to benefit from their natural wealth. Perversely, many countries rich in natural resources are poorer and more miserable than countries that are less well endowed".

The so-called curse of natural resources has attracted considerable attention in the economic literature. For example, recent empirical evidence and theoretical work provides strong support to a 'resource curse' hypothesis (Gylfason 2000, 2001a, 2001b, Leite and Weidmann 1999, Rodriguez and Sachs 1999, Papyrakis and Gerlagh 2003, Sachs and Warner 1995a, 1997c, 1999a, 1999b). These studies present a diverse set of explanations covering, amongst others, terms of trade effect, Dutch disease, a staple trap, debt overhang, institutional quality and other political economy arguments.

Papyrakis and Gerlagh (2003) conclude that resource riches such as oil reserves have not proved to be the panacea to underdevelopment. On the contrary, they have become associated with a slowdown in economic growth across the world during the last three decades. For example, growth losers, such as Nigeria, Zambia, Sierra Leone, Angola, Saudi Arabia and Venezuela, are all resource-rich, while the Asian tigers such as Korea, Taiwan, Hong Kong and Singapore, are all resource-poor. One of the most striking manifestations of the resource curse hypothesis is the disappointing performance of the oil cartel countries. Some of the OPEC countries have actually experienced a negative rate of GDP per capita growth over the last four decades (Gylfason, 2001b). There are many modern analysts who consider that the advent of oil has led to economic deterioration, if not ruin, for "petrostates" (Wright and Czelusta, 2003).

Mehlum et al. (2006b) stated that we should not jump to the conclusion that all resource rich countries are cursed, and many growth winners such as Botswana, Canada, Australia, and Norway are rich in resources. Moreover, of the 82 countries included in a World Bank study, five countries belong both to the top eight according to their natural capital wealth and to the top 15 according to per capita income (World Bank, 1994). So, while a poor economic performance has undoubtedly been the experience in some

situations, recent empirical case studies have shown that while this might be true in some countries it is not the case in others (Roe, et al. 2004; DiJohn 2002).

As mentioned before, the curse of natural resources gives rise to a large array of political and economic processes that produce adverse effects on an economy. One of the greatest risks concerns rent-seeking behaviour. Particularly in the case of natural resources, a gap exists between the value of that resource and the costs of extracting it. In such cases, individuals, be they private sector actors or politicians, have incentives to use political mechanisms to capture these rents. Rampant opportunities for rent-seeking by corporations and collusion with government officials thereby compound the adverse economic and political consequences of natural resource wealth (Humphreys et al., 2007). According to Mikesell (1997), rent-seeking may breed corruption in business and government, thereby distorting the allocation of resources and reducing both economic efficiency and social equity. Furthermore, empirical evidence suggests that import protection and corruption both tend to impede economic growth (Bardhan, 1997).

The second explanation of the resource curse suggests the failure of resource-rich countries to promote a highly productive manufacturing sector, which is regarded as the principal source of technological progress, to replace the reduction in export earnings following a decline in export prices. For example, in Saudi Arabia, much of the oil revenues have been consumed by the middle- and upper-income classes, for defence, and for public works that yield a low rate of return. The country has failed to direct enough oil revenue for investment in manufacturing, agriculture, and education (Mikesell, 1997).

The third explanation of the resource curse refers to the natural resource abundance that often results in an over-valuation of the national currency. This phenomenon is addressed in the literature under the term 'Dutch disease', which is where a natural resource boom and the associated surge in raw-material exports drive up the real exchange rate, thus damaging other exports (Gylfason, 2001a). The imports increase, exports decrease, productivity falls and a shift away from the tradable sector to the non-tradable. Simply, the Dutch disease is the 'contraction of the tradable sector' (Stevens, 2003). According to Rodriguez and Sachs (1999) oil-rich Venezuela is considered to be one of the world's most significant development failures. Jones (2002) stated that Venezuela ranked among the ten wealthiest nations at the beginning of last century but her vast oil reserves did not prevent her continuous downward spiral. This negative performance for twenty years or more confirms that a favourable mineral endowment is no guarantee of sustained economic progress.

Ricardo Hausman wrote (2003, p: 246) "Venezuela's growth collapse took place after 60 years of expansion, fuelled by oil. If oil explains slow growth, what explains the previous fast growth?. Moreover, the growth collapse occurred when oil revenues were declining, so that the Dutch disease should have operated in reverse, facilitating the growth of output in non-oil tradeables: it did not happen". Some economists, however, believe that oil and gas are not the only causes of Dutch disease. Corden, for instance, argued (1984) that the boom in the technologically advanced part of Japan's manufacturing sector in the 1960s had adverse effects on the less dynamic tradeable sectors. Corden also stated that the discoveries of gold in Australia in the eighteenth century and in Spanish colonies in the sixteenth century are other examples of 'Dutch disease'. Drysdale wrote (2004) that 'Dutch disease' was first described in the Economist in 1977 and has since been discussed widely (for example, Corden and Neary 1982 and

Krugman 1987). It refers to a situation where a rapid influx of resource rent comes from the export of natural resources that result in high domestic absorption, thus causing appreciation of the domestic currency.

The fourth explanation suggests that natural resource dependency causes a series of political dynamics, which when associated with oil and gas dependence can exacerbate adverse economic effects. For example, natural resource exploitation creates large economic rents, which accrue either to the government or to a few private owners of the resources. The rents are often distributed to those in control of the government and their relatives, rather than being used for broadly based national development (Mikesell, 1997). Based on Humphreys et al. (2007, p: 11) "the political leaders who control these assets can use that wealth to maintain themselves in power, either through legal means (e.g., spending in political campaigns) or coercive ones (e.g., funding militias)". Roe et al. (2004) concluded that the difference between 'better' and 'poorer' performing countries was essentially to do with the quality of governance and the quality of macro-economic management. Moreover Auty (2000), stated that the variations in economic performance are caused by differences in the quality of governance that are linked through the type of political state and the pattern of structural change to the natural resource endowment.

For example, Nigeria is often cited as a country that seems to suffer from a curse of natural resources. Although it has enjoyed huge oil windfalls since the late 1960s, its per capita GDP in purchasing power parity terms is among the lowest in the world (Hodler, 2004). The reasons for this situation are waste and corruption, not Dutch disease (Sala-I-Martin and Subramanian, 2003). The average Nigerian in the late 1990s was poorer than before oil was discovered (Collier, 2001). Moreover, Gylfason (2001a) has stated

that Nigeria's Gross National Product per capita today is no higher than at independence in 1960.

Furthermore, it is suggested there is a positive relationship between growth performance and the political system, in that mineral exporting countries are more likely to be oligarchies than democracies (Lal, 1995). Relying on Humphreys et al. (2007) no oil states are less likely to become democratic than states that do not export oil. This relationship has been found in cross-national studies that relate the discovery of oil in a given period to democratic changes over the coming decades (Tsui, 2005). Political leaders use the oil wealth to successfully repress or co-opt their opposition through electoral competition. Mikesell (1997) concluded that none of these relationships appear to be valid: where there are four good performers, two are oligarchies (Indonesia and Oman) and two are democracies (Botswana and Chile). Therefore, democracy does not ensure good government, nor are all oligarchies poorly governed. Thus, the form of government does not provide a satisfactory explanation for the resource curse.

The fifth explanation of the resource curse comes from potential relations between resources and conflict. Relying on Ross (2003) since the mid-1990s, one of the most surprising and important findings of research on the causes of civil wars is that natural resources especially, oil and gemstones have a key role in triggering and prolonging these conflicts. Moreen (2006) concluded that the same incentives that result in increased rent-seeking and political patronage can also increase conflict in resource-dependent states. The risks of civil war also increase with dependence on primary commodities (Collier and Hoeffler, 1998; Collier, Elliott et al. 2003; Collier and Hoeffler, 2005). Collier and Hoeffler (2004) find that primary commodity exports are significant predictors of the risk of civil war, with the effect being nonlinear and

peaking when these resources constituted one-third of GDP. A country with this level of exports has a 22 per cent risk of civil war compared to a 1 per cent chance for countries with no primary commodity exports.

Furthermore, Le Billon (2007) argued that the resources motivate rebellion because of high potential gains (resource revenues) and low opportunity costs (prevalent poverty and lack of revenue alternative in many low income and resource dependent countries). According to Ross (2003, p: 2) "resource dependence can promote civil war through four types of effects: by harming a country's economic performance; by making its government weaker, more corrupt, and less accountable; by giving people who live in resource-rich regions an incentive to form independent states; and by helping finance rebel movements". There are many countries suffering from resource-based conflicts and most of them in Africa as in Angola, Somalia, the Sudan, and the Democratic Republic of the Congo (Human Rights Watch, 2003; Bray et al. 2004).

The sixth explanation of the resource curse suggests that the resources interact with the quality of institutions such that resource abundance is a blessing when institutions are good and a curse when institutions are bad (Mehlum et al., 2006b). This view is in line with a growing literature on governance that suggests that successful market-based economies need "good" governance institutions (Aysan et al., 2007). Mehlum et al., (2006a, p: 1) stated that "countries rich in natural resources constitute both growth losers and growth winners. We claim that the main reason for these diverging experiences is differences in the quality of institutions. More natural resources push aggregate income down, when institutions are grabber friendly, while more resources raise income, when institutions are producer friendly". Therefore, in the absence of

strong domestic institutions, resource rich economies are more vulnerable to the 'resource curse'.

The seventh explanation of the resource curse comes from devoting inadequate attention to and expenditure on education. It is perhaps no coincidence that school enrolment at all levels tends to be inversely related to natural resource abundance, as measured by the share of the labour force engaged in primary production across countries (Gylfason et al., 1999). For example, the OPEC countries send 57 per cent of their youngsters to secondary school compared with 64 per cent for the world as a whole and they spend less than 4 per cent of their GNP on education on average compared with almost 5 per cent for the world as a whole. However, there are some exceptions, such as Norway, from the world's largest oil exporters, but the government shows no signs of neglecting education; on the contrary, the proportion of each cohort attending colleges and universities in Norway rose from 26 per cent in 1980 to 62 per cent in 1997 (Cited in Gylfason, 2001a). Thus, the countries that start relying on natural resource wealth seem to forget the need for a diversified and skilled workforce that can support other economic sectors once resource wealth has dried up and they start trying to diversify (Humphreys et al., 2007).

2.3.2 How to avoid the resource curse

Countries endowed with an abundance of natural resources are faced with substantial opportunities, but they also faced with a 'resource curse' risk. After a series of negative economic and political outcomes of the 'resource curse', it is assumed that governments sometimes have to attempt bold and difficult solutions to try to minimize these risks. Weinthal and Luong (2006) stated that the most popular solutions emphasize macro-

economic policies, economic diversification, natural resource funds, transparency and accountability, and direct distribution to the general population. Sharpe (2006) concluded that the resource curse has the potential not to be a curse at all if resources are efficiently extracted and traded in a competitive market, with an absence of bad dealings or corrupt behaviour.

Humphreys et al. (2007; p: 323) stated that if countries want to make progress in dealing with the resource curse, governments in both consuming and producing countries will have to change what they do: the international community will have to act in concert, corporations will have to take an active role and so too will civil society. We can ask corporations to act more ethically, in a more "socially responsible way," but they are more likely to do so when pressure is brought to bear. They cannot rely on goodwill alone. Therefore, many policies have been suggested to protect countries from the economic and political problems that can accompany resource wealth. The key recommendations to avoid the resource curse are outlined below.

Good governance:

There is a positive relationship between growth performance and good governance. Based on Iimi (2006), good governance has an important role to play in transforming resource abundance into economic development, as data from 89 countries reveals that an abundance of natural resources does not guarantee growth. However, governance is what determines the degree to which natural resources can contribute to economic development. For example, Norway is a major oil exporter; the government takes in about 80 per cent of the oil rent through taxes and fees and invests the revenues from oil in foreign securities in order to divide oil receipts fairly between present and future

generations, as well as to shield the domestic economy from too much income too quickly. Thus, good government's policies can turn abundant natural resource riches into an unambiguous blessing (Gylfason, 2001a).

There are some principles which should guide governments to prevent rent-seeking and corruption in relation to natural resource revenues and rents, such as democratic accountability, political stability, the rule of law and enforcement, and revenue and expenditure transparency. Democracy should be fully practised through a written constitution to which all organs of government are subjected and elections are held on a regular basis. Furthermore, the government is accountable to the people and executive actions are subject to review. Additionally, the independence of the judiciary should be apparent in practice (Eigen, 2005). Korhonen (2004) argued that a higher level of democracy contributes positively to economic growth in the presence of resource dependency. He also stated that dependence on metal ores, in particular, seemed to have a direct negative effect on growth, but this effect could be alleviated with more democratic political systems and a greater political freedom. Better governance improves the investment climate by improving bureaucratic performances and predictability (World Bank, 2003). Also, as reported by the United Nations Development Programme (UNDP) (2006) deregulation removes bureaucratic forms of rent-seeking and replaces them with private sector competition.

As to transparency, this is widely considered to be the key to resolving issues of waste and corruption (Department for International Development, 2003). Relying on Moreen (2006), transparency is currently a popular recommendation to overcome the "curse". Transparency can be particularly useful in clarifying the boundary between the public and private sectors (Kopits, 2000). Therefore, some Governments have established a

number of initiatives in order to improve accounting mechanisms between energy companies and governments. In addition, transparency supports credible commitment by allowing public officials to obtain a reputation (Stasavage, 2003). Moreover, transparency has positive effects on the management of public monies, and is associated with higher credit ratings, better fiscal discipline and lower corruption levels (Adsera et al., 2003; Hameed, 2005). According to the website of EITI, the Extractive Industries Transparency Initiative (EITI) is an important step in defeating the 'resource curse'. This initiative is about supporting improved governance in resource-rich countries through the verification and full publication of company payments and government revenues from oil, gas, and mining. Further, it is now a global initiative, about twenty countries have committed to EITI around the world in Africa, Asia, Europe, and South America.

Institutional reforms:

The strength of institutions appears to be a key factor in avoiding or mitigating the resource curse. The literature showed that the negative growth effects of certain natural resource types can be counteracted with institutional and political reforms (Korhonen, 2004). Togolo (2006) argued that macro-economic stability is not sustainable without effective structural reforms and institutional integrity. Thus, addressing governance issues and implementing institutional reforms that would capture the benefits of mineral development, can help to avoid the resource curse. Gylfason and Zoega (2001) proposed that the savings and investment effected through institutional reforms pave the way to a linkage between abundant natural resources and economic growth.

Kolstad (2007) concludes that good institutions are vital for averting a negative impact of natural resources. Moreover, good governance institutions are viewed as reducing

uncertainty and promoting efficiency (North, 1981). According to the Australian Government Treasury's website (AGT), developing countries in the early phases of resource sector development should focus on strengthening domestic institutions to enforce property rights and contracts and achieve macro-economic stability. Murshed (2004) concluded that institutions and institutional functioning are the crucial links between resource endowments, geography and policies, on the one hand, and economic outcomes on the other.

Privatization:

Privatization is considered another solution to the resource curse, for example the sale of state-owned oil industries and oil production rights to private-sector investors. Privatization usually promotes productive efficiency by restoring the profit motive. It also resonates with political agendas aimed at shrinking state economic involvement (Alayli, 2005). Moreover, privatization leads to better management of the enterprise, and reduced opportunities for diversion of revenues to "off-budget" priorities (Boardman and Vining, 1989; Ascher 1999). As cited in Weinthal and Luong (2006; p:47) "thus, even though domestic privatization can be a highly contentious process, it remains the only solution that can generate the incentives for governments in mineral-rich countries to both acquire the will and build the capacity to manage their resources effectively".

Therefore, domestic privatization is considered to be a strategy for combating the resource curse, especially for new producers of mineral wealth, as they create the necessary institutions to turn their mineral wealth into a blessing rather than a curse. Summers and Pritchett (1992) stated that despite the advantages of privatization, this

does little to address broader development problems plaguing these countries. Also, Rose-Ackerman (1998; p: 27) says ". . . the process of turning over state assets to private owners is fraught with opportunities for corruption and self-dealing." Thus, privatization is likely to be a weak tool to address the root problems of the "curse" (Megginson and Netter 2001; Palley 2003; Birdsall and Subramanian 2004).

Economic diversification:

Among the wide variety of strategy recommendations on how to avoid the resource curse, a number emphasize economic diversification to reduce natural resource dependence and support sustainable long-term economic growth and employment creation (Aissaoui, 2007). For example, transportation as a tradable sector is considered a catalyst for economic diversification by increasing production, reducing travel times, increasing employment and improving accessibility (Aldagheiri and Bradshaw, 2006). Relying on Moreen (2006), diversification is an important component of a vibrant economy and society, and can benefit not only the economic robustness of a country, but can also significantly change the political dynamics within it. To shield economies from shocks caused by market volatility, mineral-rich countries have long been advised to invest windfalls in economic diversification.

Economic diversification is also directly linked to sound fiscal and monetary policies: when the local currency is not allowed to appreciate, the chance of decline in non-expanding sectors is reduced. From the 1960s until the early 1980s most mineral-rich countries made considerable investments in promoting other economic sectors, with the support of developmental economists and international organizations such as the United Nations Conference on Trade and Development, the United Nations Economic

Commission, and the World Bank (Weinthal and Luong, 2006). According to UNDP (2006) the pending resource revenues on infrastructure including transportation infrastructure, and the promotion of domestic savings and inward investment, are part of a general 'annuity policy' recommended for Africa. Another suggestion to encourage diversification includes using resource revenues as a guarantee for foreign investment (Mane, 2005). Amineh (2006) stated that with democratic reforms, an attractive climate for transnational companies and foreign direct investment can create opportunities and markets that could lead to economic diversification.

Sufficient investments in education:

Relying on Gylfason (2001a), a further recommendation to avoid the resource curse is more and better education, which is a prerequisite for rapid economic development around the world: education stimulates economic growth and improves people's lives through many channels, by increasing the efficiency of the labour force, by fostering democracy (Barro, 1997) and thus creating better conditions for good governance, by improving health and enhancing equality (Aghion et al., 1999). Disputes over the control of oil and gas resources and their effects, such as ethnic or religious hostility, terrorism, poverty and politics, create serious challenges to economic development. Education and the work of NGOs are the solutions that are necessary to create middle classes and minimise chances of radicalization (Amineh, 2006). Gylfason (2001a) finds a positive relationship between secondary school enrolment and economic growth and concludes that about half the natural resource curse works through the education channel. Korhonen (2004; p: 32) stated that "fostering education can partly counteract negative growth effects".

Gylfason et al. (1999) showed by empirical evidence that school enrolment at all levels is inversely related to natural resource dependence, as measured by the share of the labour force engaged in primary production. Also, there is other evidence that, across countries, public expenditure on education relative to national income and expected years of schooling and secondary-school enrolment rates are all inversely related to the share of natural capital in national wealth (cited in Gylfason and Zoega, 2001; p: 9). The need for a diversified and skilled workforce that can support other economic sectors once resource wealth has dried up should not be forgotten. The effects of this investment are likely to become more significant in the long run as soon as economies start trying to diversify (Humphreys et al., 2007).

2.4 Transport and development: historical background

This section examines the theoretical and empirical considerations of two basic phenomena: "transport" and "development". It would be inappropriate to write this section without defining transport and development. Transport is the means by which people and commodities are moved from one place to another by a number of physical modes including roads, waterways, railways, airways, pipelines etc. as well as intermodal means. Regarding "development" the definition of development has changed over the past five decades according to economic, political, and social trends. "... development was understood, philosophically, as the improvement of humankind. Practically, development was understood by political elites as social engineering of emerging national societies. It meant formulating government policy to manage the social transformations wrought by the rise of capitalism and industrial technologies". (McMichael, 2004, p: 2). Development also means the whole range of economic, political, social and cultural progress to which peoples aspire. The UNDP Report (1991)

states: "The basic objective of human development is to enlarge the range of people's choices to make development more democratic and participatory. These choices should include access to income and employment opportunities, education and health, and a clean and safe physical environment. Each individual should also have the opportunity to participate fully in community decisions and to enjoy human, economic and political freedoms".

In the Saudi Arabia context, the main objective of this study is to investigate the impact of the transportation system on economic development. By definition, "economic development" is the process through which economic activity in an area is expanded to provide more jobs and income to the area's residents. The primary means of economic development are considered to be business establishment, expansion, attraction, and retention (Ertekin, 2003). "Economic development policies are generally designed to improve the quality of life in an area by increasing income, job choices, activity choices, stability and amenities" (NCHRP, 2001, p: 107).

According to Hoyle (1973) the relationship between transport and development is a subject of considerable theoretical interest and practical importance. It is also one that was recognized early in the history of economic thought in both advanced and less-developed countries. Hoyle (1988) stated that the relationships between transport and development differ both spatially and over time, and so can become very complicated. These relationships are interesting in terms of geographical theory, and are of considerable practical importance. Development of any kind is virtually impossible without transport. Where transport is available, however, many forms of development may become possible and some may be encouraged. The existence of an effective, modern transport system can open many doors leading towards development; and

transport can be seen as an initiator of development and as an indicator of levels of development already achieved. The analysis of these aspects will take the form of a summary of some countries' experiences, such as Britain, USA and various 'developing world' countries. Theoretical discussions about transport and development in many countries, whether developed or underdeveloped, are varied. Even within the developed countries, the evolution of transport has been different and varies from one country to another. To explain this one needs to understand the historical background of these various countries. From a historical point of view, there is an argument that suggests that some developments (e.g. agricultural, commercial or industrial) existed before modern transport arrived. Thus modern transport is seen to have speeded up the development process by economics in the transport distance. The discussion here concerns itself with the possible understanding of whether transport is needed for development or development requires transport.

Relying on Yeser's analysis (1990), Britain before the Industrial Revolution in the late eighteenth century, was considered a peasant society, but by the middle of the nineteenth century "over 5000 miles of railroad lines were in service" (Lansing, 1966, p: 75). During the seventeenth century, internal commerce within the country by land depended upon travelling merchants and pedlars, who used horses and mules to carry their goods. The journey from Exeter or Edinburgh to London by stagecoach took two weeks at an average speed of 6 km/h (Barke, 1986). Furthermore, heavy commodities were moved by sea. For instance, coal was moved by sea from Newcastle to London. Exports of cloth and other manufactured goods and imports of raw cotton and raw silk were also by sea, with an active trade with Constantinople and Smyrna in Turkey. In addition, the ocean trade was comparatively well developed at the beginning of the eighteenth century. From these examples there is no doubt that even before modern

transport had been created, commercial and industrial activities were already existent. "But since the improvement of transportation in the early stage of the Industrial Revolution in Britain, the relationships between industrial development and the provision of transport facilities had become a reciprocal one. On the one hand the existence of such activity had generated a demand for transport; on the other the provision of facilities had affected the level and nature of the activity" (Yeser, 1990, p: 57).

Based on Maltby and White (1982), in 1800 London and Birmingham were considered as centres of commerce and industry in Britain, thus creating a demand to close the 179 km gap between them by reducing the journey time. This gap was turnpiked in 1730, by 1805 there was direct canal communication, and in 1838 the railway was opened between London and Birmingham. These actions stimulated economic growth and consequently a continuing upgrading of the transport links. The Industrial Revolution in the nineteenth-century speeded up these processes and further reduced the cost of transport. Yeser (1990), has mentioned that many economic historians have observed that the Industrial Revolution cannot be considered in isolation from development in transportation. Indeed, it has been suggested that the Industrial Revolution, at least in its early stages, might more realistically be termed the "transportation revolution". Development of the steam engine in the eighteenth century, first used in water-based transport and later in land-based transport in the form of the locomotive. "The major breakthrough came with two closely associated innovations: the application of steam power as a means of propulsion and the use of iron and steel for trains, railway tracks and ocean-going vessels" (Dicken, 2003, p:91). This heralded the beginning of the massive expansion in a series of transportation improvements that have continued during the nineteenth century to the present day.

The contribution of the British railroads to the economic development of the country was to substantially reduce transport costs. In many cases costs of shipment were reduced by fifty per cent or more (Reid, 1954). The greatest advantage of the railroads in the early period, however, was in increased speed. In the early nineteenth century, some significant improvements in road surfacing were made by engineers such as Telford and Macadam, and these substantially affected the speed of travel. For example, in 1830, fast passenger and mail stagecoaches had an average speed of 14-16 km/h, double that of 1700 which was an average speed of 6 km/h (Barke, 1986). It is notable that the British experience of transport development showed that the transport system came to speed up the process of industrial and commercial activities and connected developed centres: in other words, transport was needed for development.

In the United States, the situation was rather different. The United States in 1800, like Britain in 1700, was an agricultural and trading economy. However, these activities were focused only in the eastern part of United States, as settlements were primarily along the Atlantic seaboard with a few outposts on the western side of the Appalachian Range. Transportation was primarily by ship along the seaboard or along the rivers of the coastal region. The reason why the United States economy was not expanding in the west was the geographical nature of the United States, which gave rise to two main barriers: the first was the Appalachian Mountains and the second was the Rocky Mountains. The Appalachian Mountains extend from the northern boundary of the states 1200 kilometres to the south. The system was too long to be outflanked so had to be pierced. Beyond the Appalachian Mountains, the central parts of the country presented no major obstacles to the development of a transportation system or to settlement.

However to the west side of the continent, there are the Rocky Mountains, desert, and the Sierras forming another series of even more formidable barriers (Yeser, 1990).

The success of these activities in the eastern side of the United States was highly dependent upon a transportation system which connected state-produced commodities with their respective markets. Where there was a vital agricultural production area including grains, fruits, and vegetables, as well as livestock and forest products, these industries needed access to markets outside of the state to survive (Casavant, 1999). Thus transportation was needed in advance of demand especially in the less developed areas of the country. What was especially needed was transport that penetrated the major geographical barriers. So the United States continued to grow in tandem with its transportation network: the steamboats, early turnpikes and the rail system developed to meet the economic and social needs of the growing nation. In addition, the development of transportation allowed the United States to expand from states hugging the coast of the Atlantic Ocean to all of the land between the Atlantic and Pacific (Coyle et al, 1990; Tolley and Turton, 1995; Francois, 2002).

Rostow (1990, p: 55) assigns to the railroad a crucial role as the leading sector in the United States, and suggested that "the railroad had three major kinds of impact on economic growth. First, by lowering the cost of transportation railroads brought new areas and new products into the market. They broadened the market and thus facilitated the division of labour. Second, railroads have been a prerequisite to the development of a major new export sector which, in turn, has served to generate capital for internal development, as, for example, the American railroads before 1914. Third, the development of railroads has led to the development of industries to supply the factors of production required by the railroads, namely, coal, iron and engineering industries".

In the 1840s railway and manufacturing development occurred in the east, but in the 1850s the railway was extended into the mid west. The case of transportation in the United States and its role in the development presented here is to highlight how transport was needed in advance to open up the country and to exploit resources in the west, and was a prerequisite to the development of the economy as a whole. Therefore in the American case, development required transport.

In developing countries, the relationship between transport and development is easier to predict as the role of transport in economic development is clear in these countries. The development of a country's road network has an important role to play in the process of economic development. The development of transport being a major factor for agricultural development is evident from the Colombian road project known as "pick and shovel" in 1979. The opinions of the community leaders and the farmers themselves indicate the significance of the road network for development of agriculture sector. The improvement of the transport system resulted in a marked increase in production of potatoes from 500 kg per hectare to 1300-1500 kg. Production of peas also increased by 50 per cent and there was a 200 per cent increase in the production of wheat between 1977 and 1979. In addition, farmers also cited a sharp increase in land values from two to ten times at different locations after the start of the road construction programme (Yeser, 1990).

Choudhury (1999) stated that the development of a better road network is a prerequisite in the improvement of Africa's economic performance. With roads accounting for over 80 per cent of all travel and freight movement, the development of a better road network is vital to boosting trade and for increasing access to rural areas. This was also expressed by Beimborn et al. (1999), with highways promoting economic growth by

increasing access to new areas, which in turn may provide access to skilled labour markets and inexpensive land for starting new businesses. Accordingly the increasing accessibility of new areas will make them attractive for development.

In the Kingdom of Saudi Arabia, the position is also similar to some countries where transport development is a prerequisite for economic development. Over the last thirty years road transport has helped to create some degree of agricultural specialization and has created new markets. The provision of transport has led different regions in the country to develop their own products or adopt new ones, for example growing wheat and vegetables in Al-Qassim Region which lies in the middle of the country. In the past, and before using new inputs such as improved seeds, fertilizers and irrigation, every region had to cultivate and consume its own products, in other words they were self-sufficient with limited trade activity beyond each region.

The new transport network has enabled the movement of agricultural provision to remote areas and has also helped to transport crops to markets. In many cases when a road was built to an area, there was a steady growth in production, for example, when the road network was extended in the Al-Qassim region, the estimated production of all cereal in the region increased from about 496,512 tons in 1995 to 692,728 tons in 1999 (MOP, 1995). This was due to the fact that the import of fertilizers and new seeds into the area was now easy and economical. However, before the development of the roads network during the 1960s, such developments were impossible because of the dependence upon camels for transportation. Subsequently, the region has become more involved in internal trade and also exports to the Gulf countries, being connected by the new road network after the first plan development at the beginning of the1970s. The development of transport thus contributed to the development of agriculture, which has

become a major source of income for the population of the area (Aldagheiri, 2004).

2.5 The economic importance of transportation infrastructure

Transport has become an important subject matter for geographers for two main reasons. Firstly, transport is a significant human activity with a strong spatial component. Secondly, it is an important factor influencing the spatial variation of many other social and economic activities (White and Senior, 1983). Transport is the means by which people and commodities are moved from one place to another by a number of physical modes including roads, water, railways, airlines and pipelines. So transport in one form or another is a basic and essential part of the daily rhythm of life throughout the inhabited world (Hoyle, 1988). Based on Mieczkowski (1978: 1), "the transport system may be likened to the blood circulation system in a living organism. Without it the organism dies". Transport is considered an essential feature of all modern economies. In general terms, as an economy grows and develops, it becomes more dependent upon its transport sector (Robinson and Bamford, 1978).

Yeser (1990) stated that transportation was considered for a long time to be the most important factor in regional, economic and social development when it becomes a tradable sector. For example, investment in transportation infrastructure stimulated economic development in North America in the 19th century. Transportation has an important role in increasing production, reducing travel times, increasing employment and improving accessibility. Furthermore, it plays an important role in reducing regional disparities and in improving the competitiveness of regions, by facilitating trade, the movement of labour, and economies of scale. With these factors in place, transportation

infrastructure can become a catalyst for economic diversification which is considered one of the solutions to the resource curse (Aldagheiri and Bradshaw, 2006). However, this view has changed in the past few decades. According to Aldcroft and Freeman (1983), until the 1960s the prevailing view of the role of transport in economic growth was a very positive one, where transport was seen as a leading economic sector in itself, engendering growth. However, after 1960 it emerged that this traditional interpretation of the positive view of transport's role was shaky, at the least, and there was a case not only for seeing transport as playing a permissive role but also for regarding it as a lagging sector.

Relying on Yeser (1990), the permissive view is usually associated with the reciprocal relationship between transport and economic activities, but this relationship is not always a direct one. The provision of adequate transport facilities permits economic and social development, which would not otherwise be possible, but the provision does not determine that development, which depends on an often complex combination, of favourable factors taking place. For example, the extensive iron ore deposits of the Hammersley Ranges (Western Australia) depend on the building of railways to the coast for their exploitation. But exploitation also depended on the demand for ore from the expanding Japanese steel industry. Therefore, transportation may be a necessary but not a sufficient factor for economic development. By contrary, the 'lagging' view comes when transport becomes a non-tradable sector. This view is usually associated with government investment in transport infrastructure such as roads and airports, which require substantial investment and thus the larger and poorer parts of the country gain few benefits from these investments. This investment affects the tradable sectors, such as manufacturing and agriculture, and accordingly the economy will be exposed to the resource curse.

However, arguments of this kind are perhaps controversial. "What seems to be emerging is that there can be no universal rules concerning the relationship between transport and economic growth. It is necessary to recognise that there is scope for positive, permissive and even 'negative' (i.e. transport investment being misdirected investment) viewpoints" (Aldcroft and Freeman, 1983, p: 18). Langton (1979) stated that above all, it must be accepted that "the nature of the relationship may vary over space and through time - from one region and from one country to another, and over the historical continuum. Variability through time is to some extent inevitable, given the 'lumpy' nature of so much transport investment, capacity often being added in fits and starts rather than evenly over the years" (cited in Yeser, 1990, p: 3).

The relationship between transportation infrastructure and economic development has been the focus of increasing analysis, discussion and interest during the past decade (Weiss, 1999; Felloni et al, 1999; Weiss and Figura, 2003). Based on Jiang (2003) the importance of transportation infrastructure to economic growth has been recognized for a long time. There is no doubt that investment in transportation systems (e.g. roads, ports and railways) stimulated economic development in North America in the 19th century. Roads and railroads allowed the United States to expand from states hugging the coast of the Atlantic Ocean to all the land between the Atlantic and Pacific (Francois 2003). In addition, transportation infrastructure has expanded the range over which goods can be marketed. Although there is very little empirical evidence to this effect, it is generally believed that the U.S. government's massive investment in transportation infrastructure development in the 19th century led to the significant growth registered by the country's economy during that period (Gillen, 1996). In general, the previous efforts to explore the relationship between transportation infrastructure and economic

development have been confined almost exclusively to developed countries and have typically dealt with one country at a time (e.g., see Costa, Ellson & Martin, 1987; Aschaeur, 1989, 1990; Eberts, 1990; Duffy-Deno & Eberts, 1991; Eisner, 1991; Garcia-Mila & McGuire, 1992; Munnell, 1992; Evans & Karras, 1994; Garcia-Mila, McGuire & Porter, 1996).

According to Ambe (2000) the relationship between transportation infrastructure and economic development has always occupied a significant place in the development plans of less developed countries (LDCs). Furthermore, the incorporation of transportation in the development plans of these countries dates back to the colonial era. The theoretical argument linking transportation infrastructure and economic development possesses both a logical and an intuitive appeal. This is particularly true in the case of developing countries, such as those of sub-Saharan Africa, where food preservation techniques are crude at best and nonexistent at worst, and where the need to move agricultural and other products from the farm to the market cannot be overemphasized. Thus the availability of dependable transportation facilities connecting rural and urban areas has positive economic implications. Baum and Tolbert (1985) stated that economic growth is impossible without adequate transport. Rural roads connecting isolated areas to markets and sources of supply are essential for converting agriculture from subsistence to a commercial activity.

The economic growth depends on the availability of infrastructure, and in particular on an efficient transport system. But in some areas, like the former communist countries of Eastern Europe, the rate at which these economies develop might be constrained by the poor state of transport. Because, the transport and logistics in general have received little attention (Gramlich, 1994; Sanchez- Robles, 1998). For example, Poland provides

an interesting example of a country which used to have a centrally planned economy. Their industrial plans were based around heavy manufacturing and mining, and there was very little interest in transport. After more than 40 years of neglect, the country was left with an inefficient and badly organised transport industry, and an infrastructure which was in very poor condition. In 1989, the country moved to a free market economy. Also, the increase in trade and the rapid transfer of power in the supply chain from manufacturers to retailers put increasing demands on transport infrastructure. So, without considerable improvement, the defects of the network could make it increasingly difficult to move goods through the supply chain and the benefits of producing and selling in Poland would be offset by the costs of transport (Waters, 1999).

A substantial number of theories and empirical studies shed light on the relationship between economic development and transportation infrastructure, such as highways, distribution facilities and intermodal connectors. This affects four aspects of economic development:

- Production costs
- Industrial location
- Regional productivity
- Costs of inter-regional trade

Generally highways affect most aspects of regional economic development because most economic activities either depend on or use highways in the transport of products. Moreover, highways affect regional productivity by connecting different regions to each other and allowing the exchange of goods and services to occur among them (cited in

Lem, 2002). For example, the highways of Louisiana and Indiana are considered a key component in business efficiency in the level and ease of access they provide to customers, markets, materials and workers. Additionally, they helped spur further growth in the states (TRIP, 2003; TRIP, 2005).

Also, sea and inland ports affect economic development where, a lack of adequate port facilities can be a major deterrent to national and regional economic growth, whilst the provision of modern port services may positively assist development by removing the inhibiting factor of low-level port facilities (Hoyle and Hilling, 1970). Sea and inland ports give regions access to foreign trade and are usually a low-cost means for shipping bulky items to and from distant regions. These efficiencies impact productivity by enhancing the movement of large volumes of goods to distant regions and extending the market reach of industries and regions using the port facilities. In addition, the improvements in port services can increase a region's competitive advantage in attracting businesses from other regions. Like sea and inland ports, airports influence many important aspects of regional economic development and facilitate the fast delivery of important products and services (Lem, 2002).

Moreover, the transportation infrastructure impact is represented by the volume of movement between two places is in fact often in proportion to the quality, speed and cost of transportation facilities available. This relationship easily becomes circular, with improved facilities leading to increased volume of movement and the latter necessitating a further improvement in facilities (Mabogunje, 1980). Thus improved transport infrastructure can, for example, be defined as:

1. The reduction of travel time from a point of origin to a destination;

2. The improved frequency of an existing and already used mode of transportation, for instance expressed in terms of numbers of services each hour;
3. The increased access of a transportation system itself, e.g. provision of buses with greater capacity;
4. The removal of a physical barrier, e.g. providing physical access to a location that was not accessible previously;
5. The reduction of travel cost in the use of a transportation system between two points, whereby people have access to more widespread opportunities than before (cited in Yeser, 1990, p: 77).

In the Kingdom of Saudi Arabia, the position is similar to countries where transport infrastructure development is a prerequisite for economic development. Mining is a key element of the government's plans to diversify the economy under its Seventh five-year plan (2000-2005). In order to enhance the potential of minerals exploitation, the Saudi's government improved its transportation infrastructures. For example, Roads network represents a basic element of the transport system in the Kingdom where it plays a crucial role in facilitating the flow of traffic. The length of the roads network, which satisfies high standards of safety, has expanded to 45.5 thousand kilometres in 2000 compared to only 8 thousand kilometres in 1970. Nearly all towns and cities as well as most of the villages of the Kingdom are now linked by at least two-lane roads (Aldagheiri, 2004).

Also, there is a detailed study on the railway project, which will link the Al-Jalamid and Al-Zabirah mining projects to the Gulf coast, has been drawn up and will be completed in the second half of 2009 by Canada's Canrail, Systra of France and Saudi

Consolidated Engineering Services (Khatib and Alami). The railway will run from Al-Jalamid in the far north to Riyadh, where it will connect to an existing rail link to Dammam. In total, it will stretch more than 1,200 kilometres and pass close to the Al-Zabirah bauxite mine, which is situated near Hail, north of Riyadh (MEED, 2003; MEED, 2004). There are additional plans for a link between Al- Jubail and Dammam on the Arabian Gulf, an east-west land bridge between Jeddah and Dammam and a link to connect proposed mining sites with Al- Jubail, either via the capital Riyadh, or directly (Saudi Railways Organization, 1996).

Regarding ports and shipping, the Kingdom has eight major ports with 183 berths capable of handling 252 million tonnes of cargo a year. The largest in terms of berths are Jeddah Islamic Port with 58 berths and Dmamm Port with 39. Total throughput of these eight ports in 2000, excluding erode oil, was 95.3 million tonnes (Dew, 2003). The volume of cargo handled at these ports reflects the level of development of the economic activity. The volume of cargo handled increased from 1.8 million weight tons in 1970 to 57.2 million weight tons in 1984. However, this volume decreased to 52. 1 million weight tons in 1985 and started to increase again in the following years to reach 88.5 million weight tons in 1999. The substantial increase in the volume of cargo handled is due to industrial exports -via the industrial ports of Jubail and Yanbu'- which increased to 56.5 million weight tons in 1999 (MOP, 2000b).

Generally the transport infrastructure affects most aspects of regional economic development because most economic activities either depend on or use transportation to some extent. Moreover, transportation means affect regional productivity by connecting different regions to each other and allowing the exchange of goods and services to occur among them. Additionally, they are considered key components in business efficiency

for the level and ease of access they provide to customers, markets, materials and workers. Thus, it seems indisputable that the transport sector is a telling indicator of a country's economic development, which will be clear through case study discussed subsequently in Chapter Seven.

CHAPTER THREE

RESEARCH METHODOLOGY AND CONCEPTUAL FRAMEWORK

3.1 Introduction

The main aim of this chapter is to describe and justify the research approach that has been used in this thesis. Additionally, it presents an explanation of the data collection methods that have been used in this research. Jankowicz (2000) states that people undertake research in order to find things out in a systematic way with the aim of increasing their level of knowledge, while Introna and Whitley (1997, p: 32) define methodology as a set of techniques and tools that are used to tackle a particular problem. There are many choices to make when planning a research methodology and there is no "perfect" approach, so many factors need to be considered. This study primarily intends to provide policymakers with specific recommendations regarding the promotion of economic diversification by examining the relationship between the minerals sector and transportation infrastructure in Saudi Arabia.

Nisbet (1997, p: 212) in an attempt to define a useful view to policy-making orientation suggested that "researchers undertake systematic procedures, such as surveys, to enable policymakers to base their decisions on evidence rather than on prejudice or guesswork". Saudi Arabia has focused on economic diversification as a strategy to increase production in the non-oil sectors such as non-oil minerals, in order to reduce dependency on oil exports as a major source of government income. Also, the government has focused on transportation infrastructure as an important element in the exploitation of mineral resources. There are many methods which can be used to measure the relationship between minerals and transportation infrastructure, but

convenient methods need to be developed to determine the reliability and validity of this relationship.

This chapter begins with selection of a research strategy, then focuses on the development of a conceptual framework of model designed to examine the role of transportation infrastructure in the development of the minerals sector in Saudi Arabia. After that, it presents a definition of the variables of the research study and the data requirements. Furthermore, it presents an evaluation of the methods used by the researcher in this study, as data collection techniques, such as, interviews, documentation and observation; each method has its advantages and disadvantages. The final section of this chapter considered data limitations.

3.2 Research design

Based on Yin (1994, p: 19) a research design can be defined as: "...an action plan/or getting from here to there, where here may be defined as the initial set of questions to be answered, and there is some set of conclusions (answers) about these questions". Research design can be considered to be the first part of the empirical research methodology. It begins with a review of the literature, thus looking in-depth at different issues of the research area under investigation. The development of a conceptual model then enables the researcher to present the desired empirical research. According to the needs of an empirical study, the researcher of this thesis has chosen to use a case study strategy through the employment of the qualitative research method.

The case study research strategy focuses on learning about a complex instance through extensive description and contextual analysis (Davey, 1991). Soy (1998) notes that case

study research enables the researcher to understand a complex issue or object and extend experience or strengthen what is already known through previous research. A case study gathers information from a wide angle (Isaac and Michael, 1995). Yin (1989, p: 23) defines 'case study' as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used".

Katherine Hakim (2000) stated that case studies may be used for small projects carried out by a single researcher as well as large and costly projects carried out by many researchers. These large projects could take up to 15 years. She stated that the case study method gives the investigators the whole picture with full meaningful features. Yin (1994, p: 4-5) listed suggestions for a general approach to designing case studies:

- Exploratory case studies, fieldwork, and data collection may be undertaken prior to definition of the research questions and hypotheses. This type of study has been considered as a prelude to types of social research.
- Explanatory cases are suitable for doing causal studies. In very complex and multivariate cases, the analysis can make use of pattern-matching techniques.
- Descriptive cases require the investigator to begin with a descriptive theory, or face the possibility that problems will occur during the project.
- Each of these three approaches can be single or multiple-case studies, where multiple-case studies are replicatory, not sampled cases.

Yin (1994, p: 38) also stated that each case study is one of the following:

- The single case, which is ideally suited for revelatory cases where an observer may have access to a phenomenon that was previously inaccessible. Single-case designs require careful investigation to avoid misrepresentation and to maximize the investigator's access to the evidence.
- The multiple-case, which is used when the researcher can adopt the study through multiple cases (two or more). This method of investigation aims to improve the reliability of generalised results and to approximate more to real life. Each individual case study consists of a "whole" study, in which facts are gathered from various sources and conclusions drawn on those facts.

The choice of the method used for the research is quite complex as each method has its own advantages and disadvantages and each case has its unique characteristics. Many scientists still believe that experiment is the only way of doing explanatory or causal inquiries but, there is no widespread common agreement between the scientists on this as each case has different circumstances and each strategy or method can be used according to these circumstances. There are several advantages when using the case study in comparison with other methods. These advantages according to Denscombe (1998) are as follows:

1. The approach can explore and discover more details and facts, which may not be easily obtained using other approaches;
2. The approach is usually holistic and allows for an in-depth investigation of the processes and relationships and not just the end product or final outcomes;
3. The approach which is used for an investigation usually exists and occurs in its natural setting i.e. it exists before the commencement of the research.

Moreover, Benbasat et al. (1987, p: 371) discussed briefly the main characteristics of case studies, which they summarise as follows:

- Phenomenon is examined in a natural setting;
- Data is collected by multiple means;
- No experimental control or manipulation is involved;
- One or more entities are examined;
- Concentration is on contemporary events;
- The complexity of the unit is studied intensively;
- Changes in site selection and data collection methods could take place as the investigator develops new hypotheses;
- Case studies are more appropriate to the exploration, classification and hypotheses development stages of the knowledge building process; (the investigator should have a receptive attitude towards exploration);
- The results derived rely on the investigative powers of the investigator;
- The set of variables may not be specified by the investigator in advance; and,
- Case research is useful in the study of 'why' and 'how' questions because these deal with operational links to be traced over time rather than with frequency of incidents.

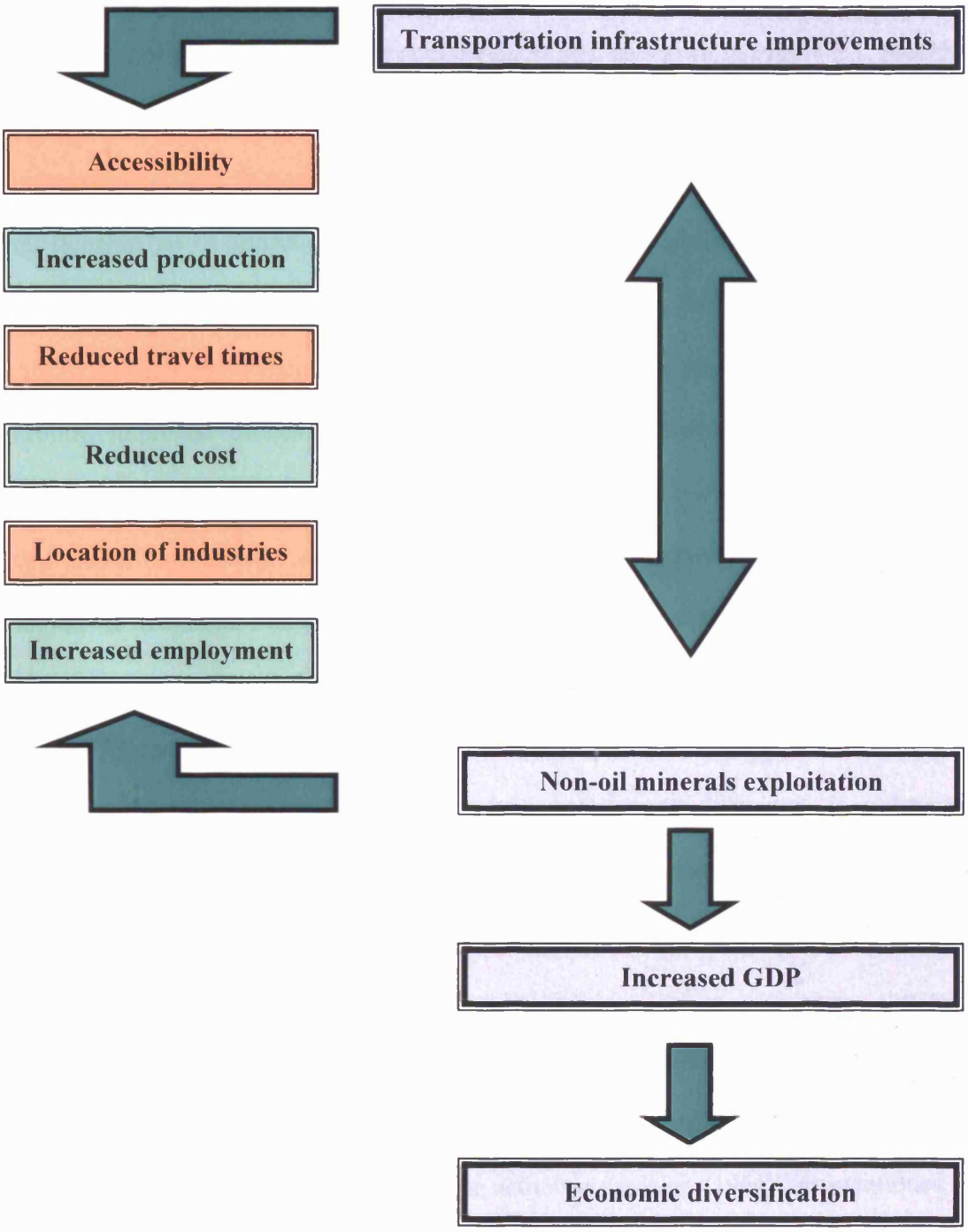
According to the above, in presenting case study definitions of various kinds, protocol, design, advantages and characteristics and the research problem itself, it is better to choose a single case study relevant to the particular projects in the Kingdom of Saudi Arabia, which in this case are the minerals deposits (Al Jalamid phosphates and Az Zubirah bauxite) and the transportation infrastructure (The North-South Railway). The

researcher used multiple sources to investigate the relationship between these projects and the interactions among them, in line with Yin's definition. These projects were selected for the present study for two reasons. Firstly, the Saudi government focused on economic diversification as a strategy to increase production in the non-oil sectors, such as minerals (as mentioned in Chapter Five). Unlike other sectors, the minerals sector is considered one of the most attractive sectors for future investment, where, the two important deposits economically, Al Jalamid phosphates and Az Zubirah bauxite will be nuclei around which a number of industrial projects can be established. Secondly, the North-South Railway has a major potential role to play in the development of the minerals sector.

3.3 The conceptual model

To achieve the aims of this research project a conceptual model has been established to examine the role of transportation infrastructure in the development of the minerals sector in Saudi Arabia in the light of the following objectives: *firstly*, to assess the economic benefits of transportation infrastructure to the minerals; *secondly*, to identify the conditions that may trigger local industrial benefits from improved infrastructure; *thirdly*, to assess the impact of the relationship between transportation infrastructure and minerals development on national economic diversification. Minerals development and transportation infrastructure are closely linked, because minerals exploitation stimulates transportation demand by increasing the number of workers commuting to and from work, the number of employees travelling to and from service areas, and products being shipped from mineral deposits to production factories and for export. Additional demand can then trigger the need for transportation improvements. Transportation improvements do not guarantee increased economic growth.

Figure 3.1: The Conceptual Model



To increase economic growth some additional factors must pre-exist. An improvement needs to decrease transportation costs, make transportation more reliable, increase production, reduce travel times, increase employment and improve accessibility.

Additionally, a proper economic climate and other support services must also exist. With these factors in place, transportation infrastructure improvements can become a catalyst for economic growth. The conceptual model, as shown in Figure 3.1, presents a schematic paradigm showing the relationship between transportation infrastructure improvements and minerals exploitation. From this figure it is apparent that this relationship has an impact on some elements such as accessibility, increased production, reduced travel times, reduced cost, location of industries, and increased employment. Additionally, these elements may affect one another. Based on Banister and Berechman (2000), improved transportation infrastructure affects production and consumption patterns and also leads to a decrease in transport costs and travel times. Furthermore, it can redistribute benefits among economic groups and between regions as well. The impact of additional transport infrastructure in regions that already have good quality transport systems is not the same as where the existing network is sparse or of a poor quality (Rietveld and Nijkamp, 1993). In Saudi Arabia the transportation infrastructure in minerals areas, especially the phosphate and bauxite locations, is quite poor. Therefore, the impact of improvements and investments in transport infrastructure could be quick significant.

The literature indicates that a productive transportation infrastructure, which includes roads, railways, ports, etc., is one of the most important conditions required to increase the productive capacity of most economic activities. Lansing (1966) has mentioned that public policy for transportation is almost certain to be involved in any major effort to increase the productive capacity of an economy. Theoretically, it is believed that no economy has developed to a high level of productivity without heavy investment in transportation infrastructure, nor does it seem likely that any economy will be able to progress without transportation (Baum and Tolbert, 1985; Yeser, 1990). Lem (2002)

stated that the level of productivity in regions that have adequate transportation infrastructure is higher than those with inadequate transportation infrastructure. The reason for this is that transportation infrastructure influences regional productivity through the facilitation of efficient movement of goods and labour used in production. Therefore, an improved transportation infrastructure can enhance the efficiency of goods and labour movement for production. The reduction in time and effort required to produce goods translates directly into increased regional productivity.

According to the Standing Advisory Committee on Trunk Road Assessment (SACTRA) (1999), an improved transportation infrastructure reduces the product transport costs, which then encourages economic performance in a number of ways. Businesses can pass on the benefit of lower production costs to consumers in the form of lower prices, or they can implement further efficiency improvements by reorganizing production and distribution. Moreover, there is another benefit in that reduced production costs leads to regional competition between firms and allows regions to attract industries. "Two principal reasons account for the reduction in transport costs resulting from improved transportation infrastructure. First, improvements in transportation infrastructure reduce the time for moving inputs and consequently reduce the labour hours and costs associated with moving goods. Second, improvements in transportation infrastructure reduce maintenance cost of vehicles involved in goods movement. This reduction in maintenance costs results from the efficient use of goods- moving vehicles and translates into reduced costs for transportation and other factors of production" (Lem, 2002, p: 9).

There are a number of ways that improvements in transportation infrastructure may contribute to the choice of location for industries, for example, a reduction in

transportation costs due to improved transport infrastructure leads firms to concentrate production or distribution operations into a smaller number of facilities. The literature shows that transportation infrastructure has a long tradition in location theory of industrial development and other types of production. In the classical Weberian model, location patterns are determined by transport and factor costs (Weber, 1929). Lösch (1959) emphasized the importance of market size. More recent new economic geography models again emphasize the importance of transport costs along with imperfect competition, market size and economies of scale in explaining the location of industry (Krugman, 1991). Transport infrastructure improvements promote market integration and can change the relative importance of concentrating and dispersing forces and consequently the spatial distribution of economic activity (cited in Holl, 2001, p: 3).

Lynch and DeBenedictis (1995) stated that an effective transportation infrastructure permits the strategic location of industries relative to domestic and export markets through a cost effective transport system. Therefore, an improved transportation infrastructure has a positive impact on industrial location, especially for industries that need to move their products to distant markets as well as receive inputs from distant regions. Moreover, differing transportation costs among regions influence the regional location of production plants, which are not geographically tied to fixed inputs such as in mining industries or in other natural-resource extraction industries (Buurman and Rietveld, 1999; Lem, 2002).

There is no doubt that investments and improvements in transportation infrastructure have an important role in increasing employment, whether in creating new jobs or in facilitating the movement of workers. Furthermore, an exploitation of any economic

activity requires increasing employment, like the exploitation of minerals or other natural resources. Based on Lem (2002) the location of industries in a region contributes to economic development by increasing direct and indirect employment. The increase in the demand for local products and services as a result of the newly established industry provides a stimulus for regional employment growth.

Accessibility benefits arising from transportation infrastructure improvements are considered some of the key elements leading to economic development. This is mainly due to the fact that a well-developed transportation system provides adequate accessibility to the region, which in turn is a necessary condition for the efficient operation of manufacturing, production, labour, markets etc (Ertekin, 2003). According to the Economic Development Research Group (EDRG) (2001), accessibility improvements may create economic opportunities for businesses by expanding the customer markets that they can reach within a reasonable travel time. Local residents benefit from increased access to jobs, just as businesses benefit from a larger available work force. Furthermore, accessibility improvements may create economic opportunities by making it easier for suppliers and producers to reach one another and may facilitate connections amongst transportation modes in the same region.

Accessibility is considered an added value of a location and an important factor of quality of life, while lack of accessibility is undesirable because it is considered partly responsible for lagging economic development (Lopez, 2005). Based on Yeser (1990), the removal of a physical barrier, thus providing physical access to a location that was not previously accessible, is considered improved accessibility. Robinson (1976) suggests that the assessment of accessibility can be expressed in terms of linear distances - kilometres or miles - measured as straight lines between locations or as

journey distances between locations. It can also be considered in terms of time, the way in which most people measure journeys every day, or in terms of cost - pounds or dollars. He also suggested that accessibility could be measured by effect or convenience, or by perceived distance.

3.4 Data requirements

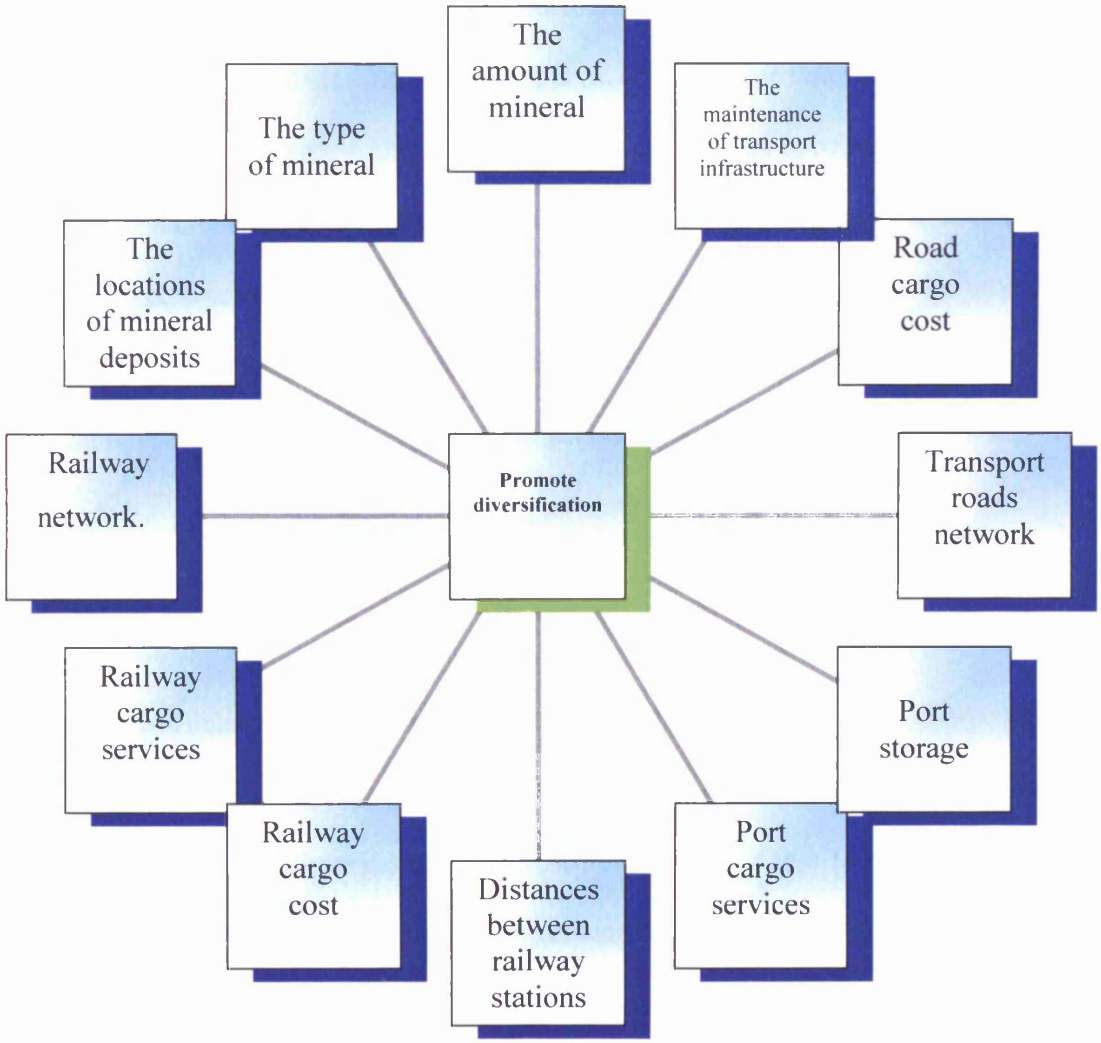
In order to assess the impacts of the role of transportation infrastructure in development of the minerals sector, and thus the impact of minerals on Saudi economy in the study area, various methodologies have been used in this study. These were influenced by several variables related to the nature of this research. It is often very difficult to gather everything related to the subject under investigation, but sometimes it is impossible when the study lies in a developing country such as Saudi Arabia. There are twelve variables that have been selected for the current research. These variables, which are defined below, are proposed as the factors that impact on the relationship between minerals and the transportation infrastructure. They are presented through the research themes below (Figure 3.2).

Data requirements: as mentioned before, this study aims to examine the role of transportation infrastructure in the development of the minerals sector, and thus the impact of minerals on the Saudi economy. This can be achieved by using many sources of data such as documents, interviews and field observations (see section 3.4). A variety of materials and data that pertain to aspects of transportation and minerals that relate to the topic of the research have been covered from the municipalities and some ministries , and are as follows:

- Ministry of Petroleum and Minerals Resources (MPMR);

- Ministry of Transportation (MOT);
- Ministry of Planning (MOP);
- Ministry of Information (MOI);
- Ministry of Finance and National Economy;
- King Abdulaziz City for Science and Technology (KACST);
- Saudi Railways Organization (SRO);
- Saudi Ports Authority (SPA);
- Saudi Geological Survey (SGS); and
- Saudi Arabian Mining Company (Ma'aden).

Figure 3.2: The Research Themes



3.5 Methods of data collection

Generally, research studies are conducted for the purpose of obtaining data that are not available from other sources regarding a specific area of knowledge. Obtaining empirical data for this research has been achieved by using three different techniques: interviews, documentation and observation. The reason for using three methods is to gather as much information as possible about the evaluated project. Interviews provide in-depth investigation, field observation provides information about the tasks and activities performed inside the project environment, and both documentation and archival records provide related documents detail the project activities over the past years. Based on Yin (1994), the various methods of collection data are highly complementary to each other. Benbasat et al. (1987) argue that these multiple sources of evidence aim to obtain a rich set of data surrounding the specific issue of research and capture the contextual complexity. However, the method selected depends on the goals and objectives of the research, the sample of respondents involved, the time set for the completion of the study, and financial considerations. The methods of data collection that have been used in this research are presented in the following subsections.

3.5.1 Interviews

Yin (1994) claims that interviews can be considered one of the most important sources of information of the qualitative method. The interview is the most commonly used qualitative method in organizational research because it is a flexible method, it can be used anywhere, and it can provide the researcher with a great depth of data. It aims to enable the researcher to: (a) see the topic of research from the perspective of the

interviewee; and (b) understand why and how the interviewee comes to have this particular perspective (King, 1994; Mahoney, 1997). The interview is perhaps the most widely used elicitation technique simply because it is what occurs normally when people want to find out information from someone else (Kumar, 1996), while the respondent is largely free to say whatever they like on the broad topic of the interview, with minimal prompting from the researcher (Miller and Crabtree, 1999).

According to Robson, (2002) the advantages of using the interview technique are several. It is very simple, it is low cost, needs less administration time, is confidential, increases return rates, and is easy to score. The interviewer has more control over the interviewing situation and circumstances of answering the questions, and the flexibility of the interview technique allows the interviewer to explain, clarify and modify questions in accordance with the situation whenever it is needed to elicit in-depth information. In addition, it assists the interviewer in obtaining additional information about the situation being studied. On the other hand, there are a number of inherent disadvantages. These include the fact that data are collected from a small number of people, and results cannot be generalized or even be said to be representative. Interviews can also be time-consuming, particularly when potential respondents are spread over a large geographic area. On sensitive issues, interviewees may hesitate to provide the interviewer with in-depth information, such as that regarding personal behaviour. However, the main idea of the interviews is to get good quality information about the current situation which cannot be gathered by using observation or documentation.

The interview should be scheduled in advance and a list of questions should be prepared by the interviewer in an attempt to elicit specific information related to the research

topic. The interviews in this research were commonly one-to-one and face-to-face, they also took place in group settings and the telephone was increasingly used because of the savings in time and resources it permits. The interview method can be a very powerful technique for gathering information because of its flexibility to choose questions, both structured and unstructured, depending on the research problem under investigation. There are three types of interview, according to the degree of flexibility required: fully structured interviews, semi-structured interviews and unstructured interviews.

In this research both unstructured and semi-structured interview techniques were used as much as possible so as to obtain as much information as possible. They are widely used in flexible, qualitative designs (Robson, 2002). King (1994) refers to them as qualitative research interviews. Unstructured interview techniques were used in the first stage of the survey, where no particular people were specified for interview: unstructured discussions with people from various organizations (Ma'aden, MOT, SGS, etc) being used to collect a variety of ideas about aspects of the problem. According to Dixon and Leach (1979), a researcher may benefit from informal or group discussions with a certain number of respondents by using unstructured interview techniques. Unstructured interviews were carried out during coffee breaks, lunches etc. Unstructured interviews were used with all interviewees when they were asked at the end of each interview to add any technical/organizational challenge that had not been reported within the interview. In this case, the interviewees were given time to express technical/organizational challenges facing the project in their organization and in their own terms.

Regarding the semi-structured interview technique as suggested by Mason (2002), semi-structured interviews are a method used for generating data from different sources. He suggested using the term 'generating' instead of 'collecting' data because the researcher can not only collect data, but also encapsulate the much wider range of relationships between researcher, social world, and data which qualitative research spans. About three to six interviews were conducted with senior managers and officials in every ministry or organization. The questions sought to elicit information about the types and locations of minerals, minerals reserves, transportation infrastructure issues (including roads, railways and ports), and financial issues regarding both minerals and transportation projects as well as other topics that the participants felt were relevant. These were the main items of face-to-face and telephone interviews which were used to support analysis of the data.

The interviews were mostly conducted in Arabic but, English was used with some interviewees who did not speak Arabic. The researcher made an advance arrangement by telephoning to set up interview appointments with those who were willing to participate in the interviews. However, some of these interviews took the form of drop-in personal interviews at organizations with which the researcher had contacts. Other participants were interviewed during their attendance at various events (conferences, seminars and symposiums) which the researcher attended. Sometimes the questions asked were not answered, or perhaps not fully understood; at other times it was difficult to obtain access to the most appropriate and most knowledgeable person within a particular organization; occasionally information requested was refused, ostensibly on security grounds, but in reality more probably because the person questioned was unable or unwilling to provide a coherent answer. Despite these problems, however, it

has to be said that in the vast majority of interviews, enquiries were sympathetically received and the responses provided were generous, helpful and informative.

Table 3.1: Interview Respondents

Positions	Organizations
Project Manager, Al Khabra Phosphate	(Ma'aden)
Advisor, Railway and Corporate Projects	(Ma'aden)
Public, Government Affairs Supervisor	(Ma'aden)
Exploration Geologist	(Ma'aden)
Mining Manager, Aluminium Project	(Ma'aden)
Director, Site Development and Infrastructure	(Ma'aden)
Phosphate Project Engineering Director	(Ma'aden)
Government Affairs	(Ma'aden)
Office Manager	(Ma'aden)
Industrial Minerals Director	(Saudi Geological Survey)
Cartography Director	(Saudi Geological Survey)
Mining Development Program	(Saudi Geological Survey)
Exploration Geologist	(Saudi Geological Survey)
Mining Engineer	(Saudi Geological Survey)
Geological Consulted	(Saudi Geological Survey)
Vice-Minister of Maritime Transport	(Ministry of Transport)
Vice-Minister of Roads Transport	(Ministry of Transport)
Public Relations	(Ministry of Transport)
Office Manager	(Ministry of Transport)
Office Manager	(Islamic Jeddah port)
Public Relation Manager	(King Abdul Aziz Port)
Deputy Director General	(King Fahad Industrial Port, Jubail)
Public Relations	(Saudi Ports Authority)
Financial Consulted	(Ministry of Finance-the Public Investment Fund)
Engineering Department	(King Fahd University of Petroleum and Minerals)
Department of Economics	(King Saud University)
Human Resources Director	(Saudi Railways Organization)

The researcher moderated these interviews, especially the face-to.-face interviews, and used the telephone to offer clarification to those in need. Approximately seven conversations over the phone were conducted to offer explanation and clarification. The interviews were carried out in each person's office for two reasons. Firstly, to make it

easy for the respondents and save their time and effort and, secondly, to gain a feeling for the individual's environment and have access to more information. The researcher checked each interview immediately after the interview but away from the interviewee. This was to check that responses were clear and to note some of the ideas which he had not recorded. Moreover, as Benjamin (1981) insists taking care of internal and external factors affecting the responses of participants is very important. Such factors help to promote an interviewee's trust in the interview. The preferred time for these interviews was during the late morning period to minimize business disruption.

Due to the openness of the questions in these interviews, a large amount of data became rather irrelevant to the research theme. Interviewees tended to talk about all aspects of minerals and transport infrastructure projects. Therefore, the researcher used some interactive steps to process interview data. They were:

1. Reading through all interviews;
2. Categorizing the answers of all questions;
3. Drawing conclusions from transferred data and linking them to the research questions.

With regard to data processing, the processing of qualitative data is more difficult than dealing with quantitative data (Dabil, 2005). The difficulty stems from the nature of the interview technique which involves the interviewee talking or writing long statements in response to the interviewer, which then need to be verified. Qualitative data are interpretative, descriptive, holistic and copious and it can be difficult to know where or how to start (Hancock, 1998). Therefore, in order to deal with a large amount of data the researcher requires some sort of categorization to make the data easy to understand and

interpret. The researcher had read through the list of data items and categorised them as major categories and the original, smaller categories as minor categories. For example, the major categories were Al Jalamid phosphates, Az Zubirah bauxite and the North-South Railway; the minor categories were such as quantities and locations of deposits and financial issues. In this way, the categories of data were used to construct a case that the themes are the main findings of the study. Further evidence to support the findings was provided by using direct quotations from respondents, for example the quotations of government representatives such as Dr. Al-Dabbagh and Al-Fadhil. Key quotations were selected to illustrate the meaning of the data (Hancock, 1998).

3.5.2 Documentation

Documentation is a data collection method for gathering relevant documents. Lincoln and Guba (1985) defined a document as any written or recorded material not prepared for the purposes of the evaluation or at the request of the inquirer. "Except for studies of preliterate societies, documentary information is likely to be relevant to every case study topic" (Yin, 1994, p: 81). This is, therefore, another technique used to supplement interview and observation. Documentary information, for example in an institution, can take various forms within an organization and should be treated as a primary source of data collection. There are different types of related documents such as public domain documents (company annual reports, government reports, newspapers, articles, etc) and internal documents (memoranda, minutes of meetings, proposals, plans, etc.).

Documentation may be both an efficient and an effective source of information if suitable adequate data exist and are accessible (Guba and Lincoln, 1981; Barnes, 2001).

Table 3.2: List of Key Documentary Sources

Key Documentation	Sources
Mineral Resources Activities.	Ministry of Petroleum and Mineral Resources.
Atlas of Industrial Minerals in Saudi Arabia.	Ministry of Petroleum and Mineral Resources.
Mineral Resources of Saudi Arabia: not including oil, natural gas, and sulfur.	Ministry of Petroleum and Mineral Resources.
Saudi Arabia Mineral Resources Annual Reports from1980-1985.	Ministry of Petroleum and Mineral Resources.
The developing of Mineral Exploration in The Kingdom.	Ministry of Petroleum and Mineral Resources.
Mining Investment in Saudi Arabia, A brief for the prospective investor.	Ministry of Petroleum and Mineral Resources.
Mineral Information.	Ministry of Petroleum and Mineral Resources.
The Second Development Plan	Ministry of Planning.
The Fourth Development Plan.	Ministry of Planning.
The Fifth Development Plan.	Ministry of Planning.
The Sixth Development Plan.	Ministry of Planning.
The Seventh Development .	Ministry of Planning.
The Eighth Development Plan	Ministry of Planning.
Achievement of the development plans.	Ministry of Planning.
Statistical Yearbook	Ministry of Planning.
Roads and Ports in Saudi Arabia	Ministry of Transportation
The Roads in Saudi Arabia	Ministry of Transportation
Transport and Communication Progress and Achievements	Ministry of Transportation
The developing of roads and transportation in Saudi Arabia	Ministry of Transportation
The ways of development	Ministry of Transportation
Annual report 1981	Saudi Arabian Monetary Agency
Annual report 1985	Saudi Arabian Monetary Agency
Annual report 1987	Saudi Arabian Monetary Agency
The Kingdom of Saudi Arabia Sea Port	Saudi Ports Authority
Annual Statistics for the Saudi Arabia Ports	Saudi Ports Authority
The Annual Report for Saudi Arabia Ports	Saudi Ports Authority
The achievements of Saudi Arabia's Ports	Saudi Ports Authority
The railroad of Saudi Arabia	Saudi Railways Organization
RAILWAYS - Track to the future	Saudi Railways Organization
The Huge Engineering Projects	Saudi Railways Organization
The Railways - Vision and Challenges	Saudi Railways Organization
Ma'aden News Letter from 2001 to 2007	Ma'aden

Secondary documents such as Annual Reports can offer some unique perspectives on the organization. When documents are considered jointly, it may become possible to

gain an holistic perspective of the organization. It must be clearly understood that documents can only be examined with the full consent of the organization concerned. Any confidential documents may not be available to the researcher, thereby concealing some critical information regarding the organization or institution. Obviously this is one of the constraints of this method (Yin, 1994, p.81).

The data used in this research includes numerous official documents and records that were obtained from various government and private sector departments. Needless to say, the Saudi Arabian Mining Company (Ma'aden), the Saudi Geological Survey (SGS) and the Ministry of Finance and National Economy come first, but other departments supplied a great deal of information concerning many aspects of the study. The most important of these data sources were the five National Development Plans (Ministry of Planning), the Statistical Yearbook series, the Private Establishments Census and the International Trade Statistics (Ministry of Finance and National Economy) (se Table 3.2).

3.5.3 Field visit

Observational techniques that use in field visit are methods by which an individual or individuals gather first hand data on projects being studied (Mahoney, 1997). According to Yin (1994) the observations are considered to be another source of evidence in a case study, because field visits to the case study "site" create the opportunity for direct observations. These observations provide researchers with an opportunity to collect data on a wide range of activities, to capture a great variety of interactions, and to openly explore the evaluation topic. These direct observations lead the researcher to develop a holistic perspective, i.e. an understanding of the context within which the project

operates. Furthermore, observational approaches allow the researcher to learn about things the participants or staff that they may be unaware of, or that they are unwilling or unable to discuss in an interview or focus group (Mahoney, 1997). Observation therefore appeared to be a suitable method to be incorporated within the case studies proposed, despite the fact that researcher bias of the observations is a factor to contend with (Lofland and Lofland, 1995).

The nature of this research as a case study is to examine the phenomenon in its natural setting. This means that the researcher should deal with real world events such as unavailability of documents, interruptions during interviews, interviewees being delayed etc., but these events should not stop the researcher from collecting data. Therefore, a fieldwork procedure to observe project activities must be designed to deal with such eventualities. The fieldwork involved observation and investigation carried out during a visit to the study area in order to obtain data on the specific case. The fieldwork took ten weeks starting in the middle of July 2005 and finishing at the end of September 2005. During this period the researcher visited some mineral deposits and the most important visit made was to the Az Zubirah Bauxite and Qiba town where a lot of data was obtained. Moreover, the researcher investigated improvements in some parts of the transportation infrastructure such as the King Abdulaziz Port, Dammam, the King Fahad Industrial Port, Jubail, Jeddah Islamic Port, Jubail Commercial Port, and North-South railway.

As mentioned above the researcher carried out many visits to the minerals deposits and transport infrastructure sites in order to obtain information, as site visits are a good way to obtain first hand and correct information about the research subject (Yin, 1994). These visits gave the researcher the opportunity to meet the people involved in making

the decisions about minerals and transport infrastructure projects in their organisation. The researcher also met workers at the Az Zubirah Bauxite project and obtained first-hand information about the problems they are encountering in this project, as well as information on accommodation and the basic infrastructure on site etc. Furthermore, the researcher met some residents of the town of Qiba in order to obtain some information regarding the development of the town, such as the increase in size and economic activity of the markets, as well as accommodation, filling stations, restaurants etc. The field visit covered most of the ports and the North-South railway. Its purpose was to find specific answers to a large number of questions dealing with the ability of the infrastructure to meet the development of minerals and associated future industry in Saudi Arabia. These visits provided a good understanding and a clear picture about these projects.

3.6 Limitations

Field investigation and official data collection were not easy tasks, due to many obstacles. The major problem was the scarcity of directly relevant literature in the study area, apart from limited pointers included in more general works which were useful as contextual material. Thus the study has been primarily based upon available official documents and records, all of which were treated as raw data, prepared for general administrative or other special purposes without relevance to the comprehensive, spatial point of view of the geographer. Many difficulties were faced in the beginning while trying to obtain the necessary permits for interviews and field visits. Some organizations required long procedures to achieve access, such as obtaining a letter from the head of my department, and agreement from their Minister, vice Minister or chairman, all of which took a long period of time out of the limited time set aside for field work.

There is often a negative attitude towards researchers who seek information from authorized personnel in some governmental and other departments. Unfortunately, this was the case in some situations in various parts of the country; the usual claim of confidentiality and prohibition was the standard answer in many offices, for example, the difficulty which was met with staff in the Public Investment Fund (PIF) of the Ministry of Finance, who had the attitude that they would not release any information about financial issues that concerned railway projects. In this case, personal contacts were used as far as possible to secure information. The confidentiality of information related to many mineral industries was one of the problems that prevented me from obtaining data on production costs in the industrial sector. The data related to the minerals industry was so scarce and so confidential that it was impossible in many cases to obtain even rough estimations.

3.7 Conclusion

This chapter has presented the research methodology that the researcher adapted to build up and identify the research framework. The researcher began by developing a conceptual framework and then selecting a research strategy which a focus of the relationships between the key variables. The case study as a research strategy was discussed; the decision to use it for this research was based mainly on the facts that: (a) this research covers an area of study that has not been greatly studied before, and (b) it allows the researcher to study technical and organizational challenges facing projects in their natural settings. In fact, the case study was decided on as a strategy in order to analyze data from more than one organization and to allow cross checking of the data gathered.

Obtaining empirical data for this research has been achieved by using three different techniques: interviews, documentation and observation. The reason for using three methods is to gather as much information as possible about the evaluated project. It is also to back up by using the triangulation approach, which means that more than one method of information gathering is used. Interviews provide an in-depth investigation, field observation provides information about the tasks and activities performed inside the project environment, and both documentation and archival records provide related documents to show the project activities over the past years. Finally, the obstacles that were faced the researcher during obtaining the data, whether in fieldwork or in interviews, have been explained.

CHAPTER FOUR

ECONOMIC DEVELOPMENT OF SAUDI ARABIA

4.1 Introduction

It is important for the development analyst to recognize the factors which have interacted in the past to produce the current economic and social setting in Saudi Arabia, because it is likely that these factors will heavily influence the course of future developments. To achieve the objectives of any economic development plan, it is important to give a proper weight to the past interrelationships among variables which resulted in the contemporary setting.

There is no doubt that the economy of Saudi Arabia has grown dramatically over the past three decades, after many centuries of low standards of living and fixed patterns of production, characterized by subsistence farming, fishing, some maritime trading amongst the Gulf states and nomadic herding: moving from one place to another with location being determined by the availability of water and pastureland for the herders and their animals. This dramatic transformation of the economy is mainly due to the rapid production and exportation of oil. The Kingdom of Saudi Arabia has the world's largest estimated oil reserves and is also the largest oil exporter, with its proven crude oil reserves approximately a quarter of the world total proven oil reserves.

This chapter presents a general historical review in development economics. Therefore, and to provide the reader with a balanced perspective, it is necessary to divide the economic development of Saudi Arabia into two important periods: the first period is

that before the introduction of Five-Year Plans, which itself divides into two phases: the economy before the discovery of oil and the economy after the discovery of oil. The second period is the economic development after the Five-Year Plans, and this period can also be subdivided as follows:

- The first development plan (1970-1975)
- The second development plan (1975-1980)
- The third development plan (1980-1985)
- The fourth development plan (1985-1990)
- The fifth development plan (1990-1995)
- The sixth development plan (1995-2000)
- The seventh development plan (2000-2005).
- The eighth development plan (2005-2010)

4.2 The economic development before the Five-Year Plans

4.2.1 The economy before the discovery of oil

Before the discovery of oil, Saudi Arabia was one of the poorest countries in the world. Before the 1930s, the region that would later come under the control of the Saudi state was composed of several regions that were dependent on specific resources and differentiated human activities. Additionally, there was no state in the Arabian Peninsula known as Saudi Arabia, but only the provinces of Hijaz and Najd and their dependencies. King Abd Alaziz lbn-Saud, commonly known as Ibn-Saud, the head of these provinces, established his authority throughout the land, imposing a national unity and therefore creating a state called Saudi Arabia. Accordingly, he changed his title

from that of the king of Hijaz and Najd and their dependencies to that of the king of Saudi Arabia. Many activities were in existence before the discovery of oil, including fishing, pearling, agriculture, ship building and commerce. No adequate statistics exist to show the relative importance and magnitude of each of these activities, and therefore only a brief survey of the main economic activities is presented here.

Saudi Arabia was almost barren desert inhabited by nomads, with oases and a few walled towns. Owing to the presence of the Holy places of Makkah and Medina, Saudi Arabia was the focus for huge numbers of pilgrims. It is known historically that the income from these thousands of pilgrims who come every year to the Holy cities, together with their barter trade, constituted the greatest part of the country's economy. So the main source of revenue was charges paid by the pilgrims to Makkah and Madinah. According to Young (1983, p: 499), this constituted about 50 per cent of the total revenue and the government's yearly receipts totalled roughly five hundred thousand dollars. There were also minor sources of revenue such as customs charges which constituted about 37 per cent of the total revenue and the rest of revenue came from the Islamic constitution which is called (the Zakat), whereby wealthy people annually paid two and half percent of their income to the government. Nevertheless, the government faced some financial problems due to the Great Depression in 1929-30, which was accompanied by a fall in the number of pilgrims (the figure dropped from 100,000 in 1929 to 40,000 in 1931). Customs receipts and imports fell accordingly (Alkhelaiwai, 2001).

Regarding agricultural activity, Saudi Arabia has never been known as an agricultural country, nor has this sector been significant throughout its economic history. The majority of people lived at or near subsistence level. Local agricultural activities

consisted mainly of the cultivation of crops, such as dates, domestic vegetables, wheat and barley (Looney, 1982). According to Aboulola (1986) there have been several obstacles to agriculture in Saudi Arabia and these are related to the nature of its soil, water scarcity and harsh climate. Only some limited areas in the north eastern province and the south were cultivated, using periodic rain water which fed some limited oases. Production was limited to serve very small markets and existed essentially on a subsistence level. Local animal organic fertilizers were used on the larger farms.

In the settled areas domestic industries were limited to the production of small tools for skilled craftsmen where there were suitable locations for such activities in the valleys and plains (Johany, 1982). Nomads raised livestock by moving their animals to the limited forage produced by infrequent rains. However, the inability of pastoral nomads to provide for their communities solely on the basis of pastoral activities forced them to create multiple resource systems. Such systems took the form of protection services for merchant caravans and pilgrims.

Trade activities were considered to play a vital role in the Peninsula economy before the discovery of oil. This was encouraged by the strategic and geographical location of the country as a connection point between India in the East, the Mediterranean Arabian Peninsula in the South and Iraq in the north. Moreover, trade activities in the land prospered after King Abdulaziz established strict rules of safety for the caravans. The East India Company established its regional office in Jeddah at the end of the eighteenth century. Trade was limited primarily to camel caravans and the annual influx of pilgrims visiting the holy places in the Hijaz. In the principal cities, such as Jeddah and Makkah, several large merchant families settled permanently and prospered, especially after the development of the Hijaz Railway. These merchants benefited and attracted

numerous families from as far away as the Eastern Province of Arabia, Iran, the Levant and Turkey (Aboulola, 1986).

This simple development continued until the beginning of the 1930s and specifically until 18 September 1932, which was the unification of Saudi Arabia. Based on Mostyn (1983 in Altiriki) the unification of Saudi Arabia marked the beginning of movement towards an integrated national economy. In the early stages of the unification of Saudi Arabia, the only non-traditional economic opportunities for Saudi citizens were linked to employment in the military, provision of services for pilgrims, and some modest contracts and commissions. The little revenue was adequate to allow minimal government functions, but not to undertake economic and social projects (Findlay, 1994). Dramatic change came as a result of the discovery of oil in commercial quantities in 1938. Standard Oil of California, SOCAL, was granted a concession for searching for oil in the eastern province of Saudi Arabia in 1933.

4.2.2 The economy after the discovery of oil

The Saudi Arabian economy is a unique economy with a multi-faceted nature. The economy combines extreme features of both developed and developing economies. It is developed in the sense of having high per capita income, consistent surplus in the balance of payments, consistent and high growth rates, etc. However, the economy also has the features of a developing economy in the low level of skilled manpower, over-dependence on imports for both investment and consumer goods, rural urban migration, etc. This dual structure came into being with the commercial production of oil in 1938. Before assessing the structure and performance of the economy after the discovery of oil, it is necessary to introduce the reader, briefly, to the history of the oil industry in Saudi Arabia.

The oil of the Middle East had been produced in Iran, Bahrain and Iraq for almost 30 years before exploration even began in Saudi Arabia. The first discussions about prospecting for oil in Saudi Arabia took place in 1923 when a New Zealander, Major Frank Holmes, visited King Abdul Aziz and insisted that there had to be oil on the Arabian Peninsula. Major Holmes was an intriguing character in the emerging oil kingdoms of the Middle East. Holmes not only obtained the first oil concession in Saudi Arabia's Eastern Province, he also secured the concession in the area of Kuwait where the super-giant Burgan oilfield was ultimately found. He also had the concession to explore for oil in Bahrain. This trading of concessions, all prompted by the New Zealander, first brought Standard Oil of California (SOCAL) to the Middle East. In the three-and a-half-month period during the first half of 1933 tense negotiations took place between the Saudis and the SOCAL team. As the negotiations advanced, the global economic environment was rapidly unraveling, so it must have taken considerable corporate courage for SOCAL to maintain its pursuit of a risky exploration effort in such a remote part of the world. Despite these economic uncertainties, on May 29 1933, 10 years after Frank Holmes first suggested that oil was to be found beneath the desert sands of the Arabian Peninsula, SOCAL and the Kingdom of Saudi Arabia signed a seemingly unremarkable oil concession. It was the only oil concession ever granted by the kingdom to an outside party (Simmons, 2005).

By this concession SOCAL took exclusive rights to prospect for and produce oil in the entire Eastern Province of the Kingdom of Saudi Arabia. Furthermore, SOCAL also received preferential rights to match any other offers to look for oil beyond the narrow confines on the eastern end of the Eastern Province. It took some time before it became

clear that the initial investment by SOCAL's subsidiary CASOC (California Arabian Standard Oil Company) would yield future profit from oil in commercial quantities.

According to Al-Rasheed (2002), the first drilling for oil began in 1935 and after several disappointments oil, well Dammam No.7 started to produce oil at almost 1,600 barrels per day. Within a few more days the well was producing close to 4,000 barrels a day and would continue to flow for another 44 years until it was finally cemented in 1982 after producing 32.5 million barrels of oil. This well produced more than 1,500 barrels per day in excess of what most oil wells in the USA were producing at the time (Long 1997). In 1938, the valves were turned on to pump oil in commercial quantities and on 1 May 1939, the first tanker with liquid fuel sailed from Ra's Tannura (Vassiliev, 1998).

Since 1939, when the first oil was produced, the Saudi Arabian economy has changed dramatically, but before that the 1933 decision of Saudi Arabia and SOCAL to sign this concession changed forever the nature of the kingdom that Abdul Aziz founded. This planted the seed that grew to become the most important oil producer on earth. However, the Second World War came at a bad time for Saudi Arabia. While oil production was not brought to a complete halt, it was difficult to sustain a high level of extraction given restrictions on further exploration, human resources, drilling and shipment. In 1938 oil extraction started with 0.5 million barrels (see Table 4.1). By 1945 it had increased to 21 .3 million barrels (Vassiliev, 1998). Moreover, the war reduced the number of pilgrims, upon whom state finances were still partially dependent, and the material and skilled personnel needed for further oil exploration and production. Saudi Arabia experienced food shortages and with SOCAL's managers exerting pressure on Washington, the country qualified for the American Lend-Lease

fund as Roosevelt declared the kingdom vital for the defence of the USA in 1943 (Holden and Johns 1981).

Based on Simmons (2005), on the eve of the Second World War Abqaiq was discovered next to the initial Dammam well. It would ultimately be revealed that Abqaiq was a super-giant and this 'miracle' well has become one of the most prolific and most reliable producers of all time. Furthermore, it may be the best oilfield the world has ever known in terms of productivity and the extremely high quality of the crude it produced. There are smaller fields much inferior to Abqaiq in reservoir quality: Abu Hadriya was also discovered in 1940; Qatif in 1948; Ain Dar and Haradh 1949 etc. Ghawar, the King of oilfields, was discovered in 1951 and is considered to be the greatest oil-bearing structure the world has ever known. It covers an area 241 km. long and 35 km. wide. Its superlative qualities cannot be overstated. It is unlikely that any new oilfield will ever rival the bounteous production Ghawar has delivered to Saudi Arabia and the international petroleum markets.

By 1936 the SOCAL Company recognized that because of high production levels, further marketing facilities were required and that these could be supplied by the Texas Company (later renamed Texaco); as a result, Texaco acquired a 50 per cent interest in the operation. The name of the operating company was changed from California Arabian Standard Oil Company (CASOC) to Arabian America Oil Company, or Aramco, in January 1944. With further discoveries of huge oil reserves in 1946, these two recognized that neither of them could cope with the market outlets, or the investment requirements, and hence in 1948 new arrangements were made to distribute the company between four major oil companies.

Table 4.1: Oil Extraction in Saudi Arabia from 1938-1970 (Million Barrels)

Year	Total	Year	Total
1938	0.5	1955	356.6
1939	3.9	1956	366.7
1940	5.1	1957	373.7
1941	4.3	1958	385.2
1942	4.5	1959	421.0
1943	4.9	1960	481.4
1944	7.8	1961	540.8
1945	21.3	1962	599.8
1946	59.9	1963	651.8
1947	89.9	1964	694.3
1948	142.9	1965	804.8
1949	174.0	1966	950.0
1950	199.5	1967	1.023.8
1951	278.0	1968	1.114.0
1952	301.9	1969	1.173.9
1953	308.3	1970	1.386.3
1954	350.8		

Source: The history of Saudi Arabia (Vassiliev, 2000).

Standard oil-company of California took 30 per cent, Texaco 30 per cent, Standard of New Jersey (later renamed Exxon) 30 per cent and Socony-Vacuum (later renamed Mobil Oil Company) 10 per cent (Aboulola, 1986). These four of the original became the sole owners of Aramco until the Saudi government began buying control in the late 1970s (long after control of Aramco totally ceded to the Saudi government, its official name was changed to Saudi Aramco in 1989) (Simmons, 2005).

The attraction of economic prosperity encouraged the government to link Riyadh (the capital of Saudi Arabia) with the economic areas in the east and the holy places in the west. So ARAMCO constructed a railway line from Dammam to Riyadh via Hofuf Harad and Kharj, which was completed by 1952 (Facey, 1992). In 1953, oil extraction reached 308.3 million barrels (Vassiliev 1998). During the last year of the reign of King Abd Alaziz, which was 1953, the Kingdom of Saudi Arabia witnessed considerable

expansion in some of its activities. In addition to the ministries created in the 1930s and 1940s, five ministries were inaugurated in the early 1950s: Interior (1951), Health (1951), Communication (1953), Agriculture and Water (1953) and Education (1953). According to Al-Zirkili (1970) the so-called ministries had 4,653 employees. The majority neither received regular salaries nor kept systematic records of their operations (Vitalis 1999; Abdullah 1990).

In 1957, a Japanese oil consortium led by Mitsubishi approached the Saudi government for exploration rights in the offshore Neutral Zone area with Kuwait. Saudi Arabia awarded Mitsubishi concession rights to explore an area covering 6,200 square kilometres over a period of 40 years. The Arabian Oil Company (AOC) was formed as the main concessionaire in the offshore area. The Saudi government became entitled to 56 per cent of the company's total profits.

In 1962 the Saudi government established the General Petroleum and Mineral Organization (Petromin) which was the first national petroleum company. Petromin's role is to maximize the usefulness of the kingdom's oil, gas and minerals (Al-Farsy, 1982). It is thus engaged in the production, utilization and marketing of the oil and mineral products. Refining, pipelines, storage and power generation all also fall within Petromin's responsibilities.

In 1965, Petromin concluded a concession agreement with two multinational oil corporations: Auxirap of France and Agip of Italy. The Auxirap concession covered an area of 10,000 square miles: two north of Yanbu and one between Jeddah and Jizan. Auxirap was granted an exploration licence for two years subject to renewal for 3 years. An exploitation licence for 30 years was to be given once production reached a

commercial level. A new and important development in this concession was Auxirap's agreement to form a Saudi Arabian oil company with 40 per cent participation for the government. A joint management committee was founded in which nationals were appointed to the board of directors. This gave Saudi Arabia a voice in the company's affairs. In 1970 the Kingdom's oil policy aimed to reduce the major holders' dominant role and increase government participation in the oil industry and former Saudi petroleum minister Mr. Abdallah Teriki played an important part in awarding AOC the offshore oil concession and in the foundation of OPEC and PETROMIN. Such a role was consistent with the government's oil policy.

At the end of the 1960s, world oil demand rose faster than supply. For example, in Europe, industries were changing from coal to oil at a rate faster than predicted; and in the United States, already the world's greatest oil consumer, cheap oil prices boosted demand even more so that the United States had for the first time become a net importer of oil. Moreover, oil consumption was also on the rise throughout the Third World, and there is no doubt that the Arab-Israeli war in 1967 is considered an important factor in the increase in oil prices in that period. By closing the Suez Canal, the war created a tanker shortage. The shift to a sellers' market enabled the producing countries to supplant the oil companies in setting price and production rates and then finally to gain complete ownership over their own oil and gas resources (Long, 1997).

Another important development in the hydrocarbon sector is the gas industry. Most of the gas production in the Kingdom is associated gas produced with oil. In the 1950s and 1960s, Aramco processed only 5 per cent of total gas production and flared the remainder. This small percentage of utilization was used for gas injection to enhance the ultimate recovery ratios of the oil reservoirs. Aramco policy-makers contended that the

low prices for liquefied petroleum products (LPG) and the high cost of transportation made substantial investment in gas development commercially unattractive. In certain circumstances, water injection becomes more attractive than gas injection to enhance the oil fields' ultimate recovery. These factors, along with the low demand for gas products in domestic markets at the time, prevented the growth of the gas industry at that stage. In 1965, PETROMIN and Saudi private investors formed the Saudi Arabian Fertilization Company (SAFCO). PETROMIN took a 40 per cent share in SAFCO, the remainder being owned by the private sector. SAFCO, based in Dammam, used Methane as a feedstock to produce 30,000 mt/y of Urea and 20,000 mt/y of Melamine, commonly used in agriculture and plastic industries. The establishment of SAFCO marked the early stage of gas-based industries in Saudi Arabia (cited in Al-Moammar, 1989).

4.3 The economic development after the Five-Year Plans

Comprehensive planning is a method used by developing countries to allocate resources in a productive way to promote growth and particular structural changes. Planning is a multi-stage process and success in achieving its targets depends heavily upon the proper execution of each stage with no exception. These plans will of course depend on a country's political and economic institutions and aspirations (Hassan, 1987). According to observers, Saudi Arabia has some of the most sophisticated development planning processes of any nation in the developing world (Cordesman, 2003).

Although the five year development plans in Saudi Arabia started at the beginning of the 1970s, the history of development planning in Saudi Arabia goes back to the late 1950s. In 1958, Prime Minister Fisal established an Economic Development Committee

(EDC). The EDC was formed in response to economic difficulties facing the country after the decline in oil revenues and was established to analyze the future prospects of the economy and to create a five year programme for economic development.

Due to a lack of data, efficient personnel and organizational instruments, this committee faced a great number of difficulties in carrying out its task, as this was the first time comprehensive planning had been attempted. As a result, in 1960 King Fisal asked the International Bank for Reconstruction and Development (IBRD) to visit the country to study its economic problems and make recommendations which could help the development of the Kingdom and to suggest the best ways of developing the economic resources. The IBRD mission suggested in its report that the government should begin with a programme of economic development, accelerated yearly. This report also suggested that it was important to create an economic development board to be responsible for planning economic development activities in the public sector (IBRD, 1960).

The government accepted many of the recommendations of the IBRD and a new board for planning was created in 1961. Unfortunately, this failed for the same reasons as the previous committee, EDC: shortage of qualified experts. The Saudi government then requested help from the United Nations (UN). In 1964 the UN sent a mission and invited the Ford Foundation to help in the planning of the Saudi economy. Many recommendations were given to the Saudi government, which led to the establishment, in 1965, of the Central Planning Organization (CPO), which in 1975 became the Ministry of Planning (MOP). The First Development Plan was drawn up by the CPO and the remaining plans were drawn up by the MOP (Al-Nughimshi, 1998).

In the next section the eight economic development plans will be presented, in order to investigate briefly the major characteristics and achievements of each plan, based on the official information released by Ministry of Planning in its development plans books.

4.3.1 The First Development Plan (1970-1975)

At the start of the first development plan period in August 1970, there were several constraints such as severely underdeveloped infrastructure, serious shortages of managerial and technical know- how, insufficient availability of either a skilled or unskilled workforce, and a small but rapidly growing population. El-Mallakh (1982) mentioned that this plan was prepared under financial constraints which faced the country after the Arab-Israeli War in 1967. The plan was therefore cautious but flexible, in order to allow for greater expansion as soon as the financial constraints were overcome, which happened in 1973 when the increase in oil revenue in that year made the government revenue more than expected and eased that financial constraint.

According to the Ministry of Information (MOI) (1976) there were several main objectives for the First Development Plan as follows:

1. Maintenance of the religious and moral values of Islam.
2. Assurance of defence and internal security.
3. Maintenance of a high rate of economic growth through development of economic resources.
4. Reduction of dependence on the export of crude oil.
5. Human resources development through education, training and better health standards.

6. Increased well-being of all groups within a stable society.

7. Development of the necessary physical infrastructure.

The plan objectives were to achieve an average annual growth of the gross domestic product (GDP) of 9.8 per cent compared with 8.5 per cent growth rate before the plan (Sabbab, 1977). During this development plan, the economic situation changed dramatically. The quantity of oil exports expanded substantially, royalty payments and taxes on foreign oil companies increased sharply, and oil-exporting countries, including Saudi Arabia, began setting and raising oil export prices. Saudi revenues per barrel of oil, averaged from total production and oil revenues, increased from $0.22 in 1948 to $1.8 in 1970. By 1973-74, the price had reached $12.38, due to the Arab oil embargo (Nehme, 1994). As result, the higher oil revenues gave the Saudi government the means to make major structural changes in the economy. The total outlay for this first plan was 41.3 billion Saudi Riyals which was divided into a current expenditure of SR 22.9 billion and a project outlay of SR 18.4 billion. The aim of this plan, however, was to promote growth in the gross domestic product (GDP) at an annual growth rate of 9.8 per cent (Hassan, 1987).

According to Table 4.2, the annual rate of growth in real GDP averaged 13.0 per cent which was above the planned rate of 9.8 per cent. This was partly due to the increases in both oil price and production by an average annual rate of 14.8 per cent, which surpassed the target rate of 9.1 per cent. The 10.6 per cent average annual rate of growth in the non-oil sector was in line with the 10.5 per cent target rate. The agricultural, non-oil mining and manufacturing sectors grew, but at rates below the planned rates. For

Table 4.2: Projection and Actual Annual Growth Rate for Gross Domestic Product during the First Development Plan (1970-1975)

Sector	Projection (per cent)	Actual (per cent)
Total GDP	9.8	13.0
Oil Sector	9.1	14.8
Non-oil Sector	10.5	10.6
Government	7.0	7.8
Agriculture	4.6	3.6
Mining	23.3	11.8
Manufacturing	14.0	10.8
Construction	10.4	21.4
Utilities	3.4	13.2
Transport and Communication	12.9	17.0

Source: Saudi Arabia: Recent Economic Developments (1995).

example, the average annual rate of growth in agriculture was 3.6 per cent compared to the 4.6 per cent target rate. Non-oil mining and manufacturing averaged annual rates of 11.8 per cent and 10.8 per cent compared to, respectively, 23.3 per cent and 14.0 per cent target rates. The agriculture, non-oil mining and manufacturing are considered vital sectors in the process of economic diversification. The performance of these non-oil sectors, however, was not encouraging, given the fact that actual government expenditure was almost 2.5 times as large as planned expenditure. The spending on industrial projects was relatively low due to certain recognized constraints such as a skilled labour force. Hence, planners relied heavily on the private sector to promote industry. It is often argued that the growth targets were too optimistic in relation to the initially allocated government expenditure. This argument may seem reasonable due to the lack of necessary and strong physical infrastructure at the outset of the plan period.

The plan concentrated on building the infrastructure needed. The actual average annual growth of construction, transport and communications, and government sectors all

surpassed the planned targets. The construction sector grew at an average annual rate of 21.4 per cent, far above the planned rate of 10.4 per cent. Hassan (1987) stated that the increasing standard of living of the population was the reason behind the boost in this sector. According to Al-Ghamri (1988) it is understandable that the infrastructure projects such as seaports, roads, housing and other public services were necessary. However, Jones (1984) thought that in fact infrastructure projects were over-budgeted and over-planned. He argues that the huge amount of money spent on them should have been spent on the productive industries. He believed the oil bonanza would be short-lived and end before the oil producers realized that the infrastructure would not serve what it was built for, and itself become costly to maintain and heavily increase financial commitments. He believed that the Arab oil producers would soon enter the post-oil era and he asked the question "infrastructure for what?".

This development plan also aimed to develop human resources in order to reduce the country's dependency on expatriates, thus increasing the contribution of the Saudi labour force to economic growth. Based on Al-Nughimshi (1998), quantity and quality elements of manpower problems occurred during the period of this development plan. The vast and rapid economic growth demanded the entry into relevant labour markets of huge armies of employees, but the source population was too small. Not only were there often not enough people capable of implementing development programmes, and not enough qualified personnel to carry out skilled work with adequate efficiency, but also there was a critical need for additional training for employees to be effective.

One conclusion to be derived from such analysis is that, generally, the plan was considered relatively successful since most of the targets were achieved and it was the first sustained attempt in this direction. In spite of this, the first development plan did

not give sufficient emphasis to the most important commodity producing sectors, such as agriculture and industry. However, it achieved relative success in establishing some needed infrastructure in the country.

4.3.2 The Second Development Plan (1975-1980)

In 1975 the Central Planning Organization was reorganized and became the Ministry of Planning. In this same year, the Ministry of Planning submitted the second development plan for the period 1975 – 1980, which started in May 1975. This plan was developed during a period of high oil revenues, which eliminated any financial constraints. In the absence of financial constraints, the second plan was almost nine times larger than the first plan in financial terms; with actual expenditure once again well above planned expenditure. For example, the planned government development expenditure of SR 239.3 billion turned out to be SR 318.4 billion by the end of the plan period (SAMA, 1981). The government allocated substantial sums for infrastructure development. The country faced a problem of the growing needs of the skilled and semi-skilled labour force. Also during this period there was the problem of the ability of the country to absorb all the surplus funds. There was no significant difference between the First and Second Development Plans in their basic objectives. The ultimate goal was to increase employment opportunities, raise the standard of living and welfare of the people, and diversify economic activity, which was the main theme for both plans (MOP, 1975).

According to Ministry of planning (1975) the objectives of the second development plan were determined as follows:

1. Assure the defence and internal security of the Kingdom.
2. Maintenance of a high rate of economic growth by developing economic resources, maximizing earnings from oil and conserving deflatable resources.
3. Reduction of economic dependence on exportation of crude oil (by moving downstream into refining, processing natural gas, petrochemical and ancillary industries, in addition to developing other domestic industries such as fertilizers, steel. and cement).
4. Development of human resources by education, training and raising the standards of health.
5. Increase the well-being of all groups within the society.
6. Development of physical infrastructure to support the achievement of the above goals.

During the second plan period, the 7.0 per cent average annual rate of growth in the overall real GDP was less than the 10.2 per cent planned rate, due to a lower than expected growth in oil production. For example, the oil sector growth averaged an annual rate of 4.6 per cent compared to the 9.7 per cent target rate. The real non-oil GDP, however, grew at an average annual rate of 14.7 per cent, which was above the planned rate of 13.3 per cent. Agriculture, manufacturing, construction, utilities, transport, trade and finance all exceeded their targets (Al-Farsy, 1986). This reflected the urgent need to reduce dependence on oil. Non-oil mining and other services also grew but at less than their projected rates (see Table 4.3).

Table 4.3: Projection and Actual Annual Growth Rate for Gross Domestic Product during the Second Development Plan (1975-1980)

Sector	Projection (per cent)	Actual (per cent)
Total GDP	10.2	7.0
Oil Sector	9.7	4.6
Non-oil Sector	13.3	14.7
Government	12.9	6.5
Agriculture	4.0	6.9
Mining	15.0	9.5
Manufacturing	14.0	15.4
Construction	15.0	15.8
Utilities	15.0	21.9
Transport and Communication	15.0	21.1

Source: Saudi Arabian Monetary Agency (SAMA) (1981).

According to Table 4.3 a further objective of the plan was to achieve high rates of economic growth for all sectors of the economy and to maximize oil revenue in the long term. In other words, the plan aimed to increase the contribution of other sectors to GDP and reduce the dependency on the oil sector which faced decline as the reserves ran out. Based on Aboulola (1986) the second development plan in contrast to the first development plan aimed to diversify the economic base through an emphasis on increasing agricultural and industrial production. Agricultural output would be stimulated through government research and extension services. Also large amounts of capital would be directed towards industrial ventures on natural gas and mineral resources.

With a strong emphasis on diversification of the economic base, the manufacturing sector achieved a growth rate of 15.4 per cent per year, compared to a rate of 10.8 per cent achieved under the first plan. The greatest progress was reported in products serving the construction sector, such as non-metallic mineral products, plastic, rubber,

and fabricated metal. Hassan (1987) stated that the concentration of the industrial programme was based on the development of hydrocarbon based industries which the kingdom would exploit through an established economic advantage; industries essential to national security and regional manufacturing activities appropriate to the development of self sufficiency.

The emphasis on the development of a modern petrochemical sector was based on the construction of two huge industrial estates, one at Jubayl near Dhahran, the other one at Yanbu on the Red Sea. These industrial estates complete with water, electricity, houses, hospitals and modern ports, and provided with both feedstock and energy by twin oil and gas pipelines were completed in 1981. These were then used as bases for a number of enterprises founded and funded by a new state organization, Saudi Basic Industries Corporation (SABIC, founded in 1976). Moreover, in the second development plan there was an important initiative which had a more immediate effect on output. The government founded the Saudi Industrial Development Fund (SIDF) to encourage the development of a private industrial sector through the provision of expertise and long-term credit. Its 1979 report indicates that 330 new enterprises were then under way, while other figures show that, by the 1980s, SIDF initiatives had helped to make the country more or less self-sufficient in building materials (Khatoon, 2005).

The agricultural sector achieved a growth rate of 6.9 per cent per year, compared to a rate of 3.6 per cent achieved under the first plan. Planners relied heavily on the private sector to engage in development activities in agriculture. In addition, their aim was to increase productivity and bring more land into production wherever water was to be found.

There was an initiative in the subsidies given to local agriculturalists by the agricultural bank, where the bank was to provide SR 327.7 million in agricultural loans. This credit facility was for farmers, to help them arrange for seeds, machinery, fertilizers and irrigation equipments. Based on Owen and Pamuk (1999), the agricultural loans were in order to encourage the production of wheat and other cereals in the interests of 'food security'. These were very effective in the sense that they caused the wheat harvest to increase fourfold during the 1970s. The annual wheat production of approximately 4,200 tons was to be increased to 250.000 tons annually by the end of the Second Plan. However, as observers were quick to point out, the costs of production were some five times that of the world price, while the use of modern pumps led to a considerable depletion of the major ground water resources (Al-Farsy, 1986).

The biggest share of the plan's expenditure went to the development of physical infrastructure. Roads, ports and airport construction, development of telecommunications, housing, the establishment of new industries and the building of schools were among the accomplishments in the second plan. For example, the total cumulative length of asphalted roads increased from 2,000 kilometres in 1968 to more than 20,000 in 1979 (Al-Teraiki, 1999). There were municipal programmes that included the construction of drainage and sewerage systems, the commissioning of rubbish collection and disposal systems, the implementation of footpaths and the illumination of streets and roads, as well as the improvement of public transportation and recreation systems.

Among other gigantic projects proposed under the second plan was the expansion and improvement of airport facilities and port facilities at Jeddah and Dammam were also to be expanded. The Jeddah port was to have 20 more berths, with dry-dock facilities. The

Dammam port was to have 16 new berths, with sophisticated cranes to speed loading and unloading of cargo. Additional port facilities were to be constructed at the cities of Jubail and Yanbu. Moreover, the telecommunication system was to be completed and the telephone network was to be upgraded. Citizens should have access to direct dialling facilities from most local areas and to most international cities.

One of the second plan objectives was to develop human resources through education and training. The Saudi labour market was characterized by a shortage of labour. The government therefore depended heavily on foreign skilled labour to implement the first and the second plans. By raising the skill levels of the Saudi workforce, the country could reduce the numbers of foreign workers and secure a productive employee base. Vocational and technical schools were created towards this end. The quality as well as the quantity of manpower is essential to sustain growth and development. The labour force had increased to 2.47 million in 1980, up from 1.75 million at the beginning of the plan. Expenditure on education went up five-fold during the plan and a large proportion of the population was involved in one or another form of education by the end of the second plan (Al-Akeel, 1989).

In summary, one can conclude that the quantum jump in oil revenues at the beginning of this plan allowed the country to be subject to the widespread agent of economic change, replacing the traditional economy with one that depended primarily on state outlay. The government raised the average Saudi citizen's standard of living to one of the highest levels in the world, and established for most of its residents a world class infrastructure and social services. But sustaining real income growth still depended primarily on government expenditure, which was largely facilitated by oil revenues. Therefore the government could not afford to neglect the oil sector, the primary engine of economic

growth. Despite attempts to diversify the economy, developing a self-perpetuating non-oil sector has proved more difficult than earlier Saudi planners had predicted (Vassiliev, 1998).

4.3.3 The Third Development Plan (1980-1985)

The third development plan, submitted in June 1980 for the 1980-1984 period, was far more favourable than the previous two plans. During the early stages of this plan, Saudi Arabia became one of the most powerful financial countries in the world as it became the major oil exporter to the industrial countries. Its duties and responsibilities were increased not only economically but also politically (Hassan, 1987). By 1980 as a consequence of the war between Iran and Iraq, Iran's oil production had fallen to a level of only 1.9 million barrels per day. Iran's collapse brought renewed and even heightened turmoil to the global oil markets and the shocked world oil markets had no place to turn but to Saudi Arabia (Simmons, 2005).

The third plan, therefore, started in a better position than the previous plans because most of the physical constraints on development were greatly reduced due to the efforts of the second plan. The infrastructure system was sufficient and the absorptive capacity of the economy was increased. Manpower was also increased with the influx of foreign workers and rural migration. The total allocation of the third plan was estimated at SR 782 billion. At the end of the plan, actual expenditure reached SR 1207 billion, or 54 per cent increase over the estimated figure. Because major physical constraints had been reduced during the second plan, the priorities shifted from almost exclusive emphasis on infrastructure to diversification of the productive base of the economy. Consequently, agriculture and manufacturing received more emphasis in this plan. The development of

the national labour force through vocational and technical training programmes received increasing attention as well.

As was the case in the first and second plans, the third plan emphasized the will to maintain the religious and moral values of Islam (Cudsi and Dessouki, 1981; Goldziher, 1981). One of the means of doing that, according to the plan, was by promoting the role of individual initiative throughout society, and particularly in the economic life of the nation. The plan even linked the promotion of social values to free enterprise and private ownership. According to Abaalkhail (2003) the era of the third plan was one of the most prosperous in the history of the Saudi Kingdom. Three chief objectives were outlined in the published Third Development Plan report:

1. Structural changes in the economy to conserve the natural resources of oil and gas in order to increase the long-term potential for value-added development (Cooper, 2001). To fix levels of crude oil production to generate sufficient revenue, together with revenue from monetary reserves, to cover the financial requirements for the development plan. Diversification of the economy would continue, with resources in particular being devoted to agriculture, manufacturing and mining. This priority would necessitate a reduced level of investment in developing the physical infrastructure, though some funding would be found for this.

2. Increased participation in development and social welfare whereby all Saudi citizens would be encouraged to make contributions to the development of the nation, and all the necessary resources would be provided to ensure that both individuals and regions achieved their full potential. Society would receive help

to solve the problems associated with rapid economic growth, such as inflation. Subsidies would be reduced, though not at the expense of programmes for protecting lower income groups and improving and expanding social services.

3. Increased economic and administrative efficiency to improve the present and long-term efficiency of the economy itself, the management of the economy and government administration.

The third development plan coincided with a sharp downturn in Saudi oil production. Therefore the performance of the third plan must be evaluated in the light of the tremendous fluctuations in government revenues due to the reduction in oil production since 1982. For example, the annual production of crude oil from 3579.9 million barrels in 1981 fell to 2366.4 in 1982 and to 1158.8 in 1985 (SAMA, 1987). Such instability in the government's earning power translated itself into repeated revisions of the scale of the third plan.

Table 4.4: Projection and Actual Annual Growth Rate for Gross Domestic Product during the Third Development Plan (1980-1985)

Sector	Projection (per cent)	Actual (per cent)
Total GDP	3.3	-1.6
Oil Sector	1.3	-14.4
Non-oil Sector	6.2	6.2
Government	7.2	7.3
Agriculture	5.4	9.5
Mining	9.8	7.3
Manufacturing	18.8	11.7
Construction	-2.5	-2.4
Utilities	29.5	21.2
Transport and Communication	12.9	7.1

Source: Ministry of Plan (MOP) (1985).

From Table 4.4 one can notice that the sharp decline in Saudi oil production resulted in a -14.4 per cent average annual rate of decline in the oil sector during the third plan period. Consequently, the overall GDP declined by an average annual rate of -1.6 per cent compared to the 3.3 per cent planned annual rate of increase. On the other hand, the non-oil sector scored a 6.2 per cent average annual rate of growth. The principal factors behind the continued positive rates of growth in the non-oil sector were the relatively few cutbacks in government expenditure and the continuation of major infrastructure and industrial projects despite declining oil revenues (Al-Teraiki, 1999). This steady increase of the non-oil sector's share in GDP represents an improvement in the diversification of the economy.

Table 4.4 indicates that the manufacturing sector declined by an average annual rate of 11.7 per cent compared to the 18.8 per cent planned annual rate of increase. Based on Al-Ghamri (1988), in this plan about 47 per cent of its total expenditure was allocated for economic development. Thus high priority was given to industrial projects like petro-chemicals, metallurgical industries and refineries and as a result the government supported industrialization programmes such as Sabic with a total of SR25.6 billion, Petromin with a total of SR27.7 billion, and Royal Commission of Aljubail and Yanbu with a total of SR45.7 billion. The Saudi Arabian Basic Industries Corporation (SABIC) was to promote industrialization and also assume the primary role in heavy industry where large capital was involved and where there is usually a long time span before any real profits are realized. The private sector therefore was encouraged to invest in light and medium-sized industries. For example, dairies, soft drinks and bakery products were left to the private sector to promote with the aid of SIDF -The Saudi Industrial Development Fund. The fund was to encourage private sector industries based on available local raw materials and labour-saving techniques (Al-Akeel, 1989). The non-

oil manufacturing sector was considered the most stable activity in this period (Looney, 2004).

In this plan, the agricultural sector made great progress, for it increased at an annual average rate of 9.5 per cent, which is greater than the Plan's target of 5.4 per cent. The agricultural value added in nominal terms doubled during the Plan's period (Al-Obaid, 1987). The objective of this plan was to achieve self-sufficiency in food production mainly for national security reasons. This self-sufficiency had been achieved in some areas, as in wheat production, with annual output increasing from 130,000 to 1.3 million tons during the third plan period (Khatoon, 2005). Furthermore, some of the extra production was donated to neighbouring countries. The Saudi Agricultural Bank provided SR 5 billion in various loans as well as SR 2.5 billion in other subsidies and therefore the private sector was encouraged to develop large-scale agricultural projects (Al-Akeel, 1989).

At the beginning of this plan, the government realized that the country was badly affected by the shortage of technicians, electricians, engineers and many other technical skilled workers. Their response was to invest more to increase both the quality and quantity of labour. An estimated SR 129.6 billion was spent on human resources in the third development plan to achieve this goal, which exceeded the combined total expenditure in the First and Second Development Plans, raising the total number of educational institutions to 11,490 and the total number of students to 1.7 million. By the end of the plan, however, there were only 254 students studying at higher technical institutes. Moreover, there were 4,027 enrolled in secondary technical schools (SAMA, 1985). It seems that vocational training schools (elementary and intermediate school levels) did not meet the need for qualified technicians requested by many private

companies. This led to an increasing number of foreign workers being employed by private enterprises (Al-Nughimshi, 1998). Almashari (1991) stated that the ultimate intention was to eliminate the need for foreign labour by first integrating Saudi and foreign workers, then eventually replacing the latter with the former. Employment policy in the third era, therefore, dictated that when new workers were being taken on, they should wherever possible be drawn from the domestic labour supply. However, these aims were not fully achieved and the expected growth in the domestic employment rate did not materialize (Okuhlik, Gwenn, and Conge, 1997).

In this plan the physical infrastructure did not receive first priority in the government budget as it had in the first and second plans. The proposed expenditure was much less than previous allocations under the second plan. SR 247, 344.3 million was proposed for this sector, which represents approximately 35 per cent of total third plan expenditures, down from 50 per cent of total expenditure under the second plan. This is related to the completion of most of the infrastructure projects.

The third plan, however, was considered successful in so far as the plan achieved most of its objectives. The fall in government revenue, however, affected the performance of the third plan as expenditure decreased during the last three years of the plan. One can conclude that in the third plan more emphasis was given to the producing sectors such as agriculture and industry with less expenditure on physical infrastructure, the aim being to direct oil revenues to new streams and accomplish the strategy of diversification.

4.3.4 The Fourth Development Plan (1985-1990)

The fourth development plan was submitted in March 1985 for the 1985-1990 period, just before the price collapse of 1986. Oil prices would decline significantly from their peak price of over $40 a barrel in 1980-81 and did, in fact, fall to less than $12 a barrel in the winter of 1986 (Morse, 1986; Banafe, 1993; Zanoyan, 1995). Based on Abaalkhail (2003), the price of light oil fluctuated greatly during this plan. Whereas in the first quarter of 1985, the spot market price was $27.68 a barrel, a downward spiral then began and prices reached a low for the five-year period in the fourth quarter of 1988 at $11.52 a barrel. However; prices began to climb again, reaching $28.44 a barrel in the fourth quarter of 1990, according to statistics published by the Ministry of Petroleum. Therefore, this plan had cautious targets and its allocation reflected the need for huge reductions in spending on some projects which were not considered to have first priority in the future national plans.

In the fourth plan period there were some structural changes in the economy of Saudi Arabia. The structural changes were the decline in sectors which were primarily dependent on budget expenditure such as construction, distributive trades, transport and communications. The producing sectors such as manufacturing and agriculture, and the financial and business services sector, would contribute to the economy's diversification. Furthermore, the strategy of the fourth plan was to give greater emphasis than previous plans to the role of the private sector, with the government limiting its economic involvement to regulatory and promotional functions (MOP, 1985).

The basic objectives of the plan were determined as follows:

1) To safeguard Islamic values, duly observing, disseminating and confirming Allah's Shari'ah.

2) To defend the country and to uphold the security and social stability of the Realm.
3) To form productive citizen-workers by providing them with the tributaries conducive thereunto - ensuring their livelihood and rewarding them on the basis of their work.
4) To develop human resources thus ensuring a constant supply of manpower and upgrading and improving its efficiency to serve all sectors.
5) To raise cultural standards to keep pace with the Kingdom's development.
6) To reduce dependence on the production and export of crude oil as the main source of national income.
7) To continue with the real structural changes in the Kingdom's economy through continuous transformation to produce a diversified economic base, with due emphasis on industry and agriculture.
8) To develop mineral resources and to encourage discovery and utilization thereof.
9) To concentrate on qualitative development through improving and further developing the performance of the utilities and facilities already established during the three development plan periods.
10) To complete the infrastructural projects necessary to achieve overall development.
11) To achieve economic and social integration between Arab Gulf Cooperation Council countries (Al Farsy, 1990).

In order to achieve these targets, total government expenditure in the fourth development plan, including non-civilian expenditure, was set at SR 1,000 billion. Of this SR 500 billion was to be devoted to development expenditure. The largest share of development expenditure, 27.1 per cent (SR 135.3 billion), was allocated to human

resources development; economic resources received 26.1 per cent (SR 130.7 billion), health and social services 17.9 per cent (SR 89.7 billion), transport and telecommunications 15.4 per cent (SR 76.9 billion) and municipalities and housing 13.5 per cent (SR 67.4 billion) (Khatoon, 2005). This plan shows that the pattern of public spending is more selective in this plan than in the previous ones.

Table 4.5 indicates that the projected rate of growth of total GDP was estimated to be at around 4.0 per cent, which reflects the planners' intention to achieve a stable growth rate rather than the high growth rates which were attained during the previous plans. The estimated growth of non-oil GDP was 2.9 per cent, while oil GDP was estimated to grow at a rate of 5.6 per cent. The plan for growth of the oil sector was based on increasing the export of refined products while oil price expectation remained the same during the fourth plan (Hassan, 1987). However, the increase in oil production towards the latter end of this period resulted in an average annual growth rate of 5.1 per cent in the oil sector. The overall GDP growing at 1.3 per cent annual rate was well below the planned rate of 4.0 per cent. In addition economic diversification was hindered as the non-oil sector experienced a low rate of growth due to cutbacks in development projects following the sharp decline in oil revenues during the fourth plan. For example, the non-oil sector declined by an average annual rate of -1.1 per cent compared to the 2.9 per cent planned rate of increase (Al-Teraiki, 1999).

The main objective has always been the diversification of the economy. The ultimate objective of reducing dependence on oil translates into the present task of creating a new structural basis for stable future growth. Therefore, the development strategy has taken the realistic course. Instead of turning from crude oil, the objectives have been to maximize the advantages of being the most efficient (in cost terms) and the most

Table 4.5: Projection and Actual Annual Growth Rate for Gross Domestic Product during the Fourth Development Plan (1985-1990)

Sector	Projection (per cent)	Actual (per cent)
Total GDP	4.0	1.3
Oil Sector	5.6	5.1
Non-oil Sector	2.9	-1.1
Government	--	1.7
Agriculture	6.0	13.4
Mining	3.0	-0.9
Manufacturing	15.5	0.5
Construction	-2.8	-7.7
Utilities	5.0	5.9
Transport and Communication	5.0	-0.8

Source: Ministry of Plan (MOP) (1990)

reliable (in terms of quantities of hydrocarbon reserves) among the leading oil producers in the world. Saudi Arabia has 25 per cent of the world's proven oil reserves and vast quantities of associated and non-associated gas. These natural resources make Saudi Arabia a natural location for the production of petro-chemicals. The combination of abundant resources and low costs secures a long-run comparative advantage over other competitors. However, the petrochemical industry was never intended to be a complete substitute for oil as a foreign exchange earner. Even though the demand for petrochemical products is bound to increase, the Saudi's share will only represent a fraction of total world supply (Almashari, 1991). Table 4.5 shows that the manufacturing sector declined by an average annual rate of 0.5 per cent compared to the 15.5 per cent planned annual rate of increase.

The agricultural sector was expected to expand at an average annual rate of 6.0 per cent, which was less than the actual growth rate in the third plan This growth, however, was

based on the assumption of increased productivity in this sector. With the stabilization of wheat production, the production of other crops such as fruits and vegetables was increased. Consequently, in this plan, the agricultural sector made great progress, for it increased at an annual average rate of 13.4 per cent, which is greater than the Plan's target of 6.0 per cent. In this plan, the basic infrastructure (transport and communications municipalities and housing sectors) allocation was lower in contrast to the productive sectors' allocation expenditure. The reasons for this are firstly, conformity with the strategic principle that emphasizes development of the producing sectors; secondly, most of the infrastructure projects had already been completed; and thirdly, it was expected that project costs would be reduced through the implementation of programmes concerned with the modification of construction specifications, reducing the scope of projects and through higher competition in the market (Al-Farsy, 1982).

The fourth plan aimed to reduce the dependence on expatriate labour by increasing the participation of Saudis in the labour market. This was to be done through education and vocational training which would imply a reduction in quantity and an increase in Saudi labour efficiency. During this plan, it was difficult to replace 600,000 out of the 3 million non-Saudi workforce by Saudis, which was the target , when the Saudi workforce in contrast was expected to grow to only 375,000 by 1990 (Presley, 1985). The government encouraged private sector involvement in the country's economic activities and therefore the private sector continued to employ more expatriates than nationals. In addition, this plan also emphasized an increase in female employment as the supply of female labour was increasing (MOP, 1985). This was the first time that the development planning process had emphasized the aims of efficiency and productivity of the workforce as well as opportunities for female employment (Al-Nughimshi, 1998).

The recovery in the world's demand for oil by 1989 and 1990 renewed optimism among the Saudi policy-makers. According to Al-Attas (2001) new plans were made to put the oil and non-oil sectors of the economy on a surer footing. The perceived recovery in international oil consumption and prices provided the government with the opportunity to resume spending to promote economic growth. As a result, two major initiatives became the basis of Saudi economic policy. Firstly, Saudi Arabia unveiled plans to raise crude oil production capacity to between 10.5 million and 11 million barrels per day (Findlay, 1994). Secondly, the government was not willing to continue its expansionist fiscal policies (Askari and Dastmaltschi, 1990).

4.3.5 The Fifth Development Plan (1990-1995)

The fifth development plan for the period of 1990-1995 was formulated in 1990 when the international oil markets were stabilizing and the national economy was showing signs of recovery. The fifth plan was initiated at a time when the physical infrastructure has been largely completed and the processes of economic diversification and of restructuring were well under way. High living standards and a healthy quality of life had been largely secured, while most of the institutional framework for development had been established and the private sector was now ready to absorb more of the tasks which had previously been handled by central government agencies. The circumstances prevailing at the start of the Fifth Plan period indicate that the economy had successfully come through a difficult phase of constraints and contraction, and while gradual positive growth had resumed, a clear forward direction and resurgence of growth had yet to be fully established (MOP, 1990).

At the beginning of this plan, at the end of July 1990, Iraq invaded Kuwait and thus halted the 'mini-boom' in the economy of Saudi Arabia. Within weeks, Iraq's oil exports had been embargoed by the United Nations, which now included not just Iraq's three million barrels per day, but also all of Kuwait's previous oil output. This decision instantly removed over five million barrels a day from the global market (Simmons, 2005). According to Al-Attas (2001) Saudi Arabia's government was obliged to raise oil output to levels unseen since the early 1980s. Saudi Aramco had to respond to a serious crisis without an adequate consideration of its overall production capacity. It quickly became apparent that the country had sufficient capacity to replace the bulk of the 4.5 million to 5 million barrels per day of Iraqi and Kuwaiti oil embargoed by the United Nations (UN). Production increased rapidly to 8.5 million barrels per day, which restored some calm to the international oil market; however, by the end of 1990, oil prices were nearly double those in June 1990 (Al-Yousef, 1998; Morse, 1991).

The objectives for the fifth development plan for the kingdom of Saudi Arabia are defined as follows:

1) To preserve Islamic values, duly observing, promulgating and confirming Allah's Shari'ah (God's Divine Law).
2) To defend the faith and nation, and uphold the security and social stability of the Realm.
3) To form productive citizen workers by providing them with the tributaries conducive thereunto, ensuring their livelihood and rewarding them on the basis of their work.
4) To develop human resources thus ensuring a constant supply of manpower, and upgrading and improving its efficiency to carry out the requirements of national economy.

5) To raise cultural and informational standards to keep pace with the Kingdom's development.
6) To reduce dependence on the production and export of crude oil as the main source of national income.
7) To continue with real structural changes in the Kingdom's economy through continuous transformation to produce a diversified economic base with due emphasis on industry and agriculture.
8) To develop mineral resources and to encourage the discovery and utilization thereof.
9) To concentrate on qualitative development through improving and further developing the performance of the utilities and facilities.
10) To complete the infrastructural projects necessary to achieve overall development.
11) To continue with encouraging the private sector's participation in social and economic development.
12) To achieve balanced development between the different regions of the Kingdom.
13) To achieve economic and social integration between the Arab Gulf Co-operation Council countries (cited in Khatoon, 2005).

The objectives of the fifth plan reinforced the shift in strategy to a blanket programme policy, rather than specific projects. Al-Teraiki (1999) mentioned that the general strategy for this plan was to move the process of economic diversification forward by more aggressively encouraging private sector investment. For example, the government opened the way for the private sector to buy shares in the larger industrial complexes and utilities. In addition, in order to protect domestic private investment, the government began a policy of protectionism by enforcing restrictive tariff and non-tariff

barriers already initiated in the mid-1980s. This policy took place through Gulf Cooperation Council negotiations (GCC) with the European Economic Community (EEC) (Metz, 1993). As mentioned before, such government actions resulted in a mini-boom, however this 'mini-boom' was ended by the Iraqi invasion of Kuwait.

Table 4.6: Projection and Actual Annual Growth Rate for Gross Domestic Product during the Fifth Development Plan (1990-1995)

Sector	Projection (per cent)	Actual (per cent)
Total GDP	3.2	5.3
Oil Sector	2.7	8.9
Non-oil Sector	3.6	1.9
Government	0.8	2.8
Agriculture	7.0	3.1
Mining	4.0	4.9
Manufacturing	7.0	2.2
Construction	3.5	1.5
Utilities	6.9	4.5
Transport and Communication	3.2	1.6

Source: Ministry of Plan (MOP) (1990)

According to Table 4.6, the annual rate of growth in real GDP averaged 5.3 per cent which was above the planned rate of 3.2 per cent. This occurred because of the higher than expected rate of growth in the oil sector, which averaged an annual rate of growth of 8.9 per cent, far above the planned rate of 2.7 per cent. The average annual rate of growth of 1.9 per cent in the non-oil sector was lower than the planned rate of 3.6 per cent. Agricultural, non-oil manufacturing and utilities sectors all experienced growth, but at lower rates than projected. The average annual rate of growth of 3.1 per cent in the agricultural sector was lower than the planned rate of 7.0 per cent. The average annual rate of growth in manufacturing was 2.2 per cent compared to the 7.0 per cent target rate (for more details, see Table 4.6).

Abaalkhail (2003) mentioned that the development of Saudi human resources also continued in this plan, through the evaluation of educational and training programmes modified to conform to Islamic Shari 'ah and societal needs. Attention was given to universities, libraries and industrial safety. The role of women in the workforce was developed according to the Islamic Shari'ah (Esposito, 1982; Ginat, 1982).

In this plan government spending on human resources increased to improve the level of Saudi employment. Human resource development and administration were the only areas that received a steady increase in government expenditure. Moreover, for the first time the problem of national manpower had been mentioned in the development plans, as indicated in the Fifth Development Plan as follows:

"The rapid changes of the past have created numerical imbalances in the labour market between the Saudi and the non-Saudi components of the labour force that pose serious challenges for the fifth plan." (MOP, 1990, p.1 16).

Based on Al-Teraiki (1999) the fiscal crisis which happened during this plan due to Gulf War did not cause economic problems for the private sector because the government's reduction of its budgeted expenditure was slight. Moreover, domestic government spending in support of the war effort was substantially increased, and consequently many Saudi companies benefited from war-related contracts. Accordingly, the mini-boom that was interrupted by the Iraqi invasion of Kuwait was once again revived. This revival was further enhanced by:

(a) the long-term US commitment to the protection of Saudi Arabia which restored private sector confidence in the economy,

(b) the Saudi government's regional policy changes to further encourage the existing manufacturing firms, and

(c) government subsidies for the lower- and middle-income Saudis to increase their disposable income (Metz, 1993).

4.3.6 The Sixth Development Plan (1995-2000)

The sixth development plan started on July 1995 and covered the period 1995-2000. The first three plans took a project approach to planning to satisfy the need for infrastructure development. Accordingly, the individual projects within each sector were first identified and then government expenditure was allocated to each sector with the aim to complete these projects. However, the sixth development plan took a different approach, which was a programme approach aimed at developing sectoral programmes rather than individual projects. In contrast to the project approach, the programme approach to planning concentrates on the overall structure of development rather than its component parts (Presley, 1996). The sixth development plan called for further economic diversification through encouraging private sector participation in agriculture, manufacturing, development of mineral resources, completion of infrastructure projects and achievement of balanced growth in all regions of the country. Concerning balanced growth, this plan pointed out that: "Despite great efforts to provide various services throughout the regions in a relatively balanced manner, there are some disparities between urban and rural areas because of the nature of short and long term development. The Sixth Development Plan will give a higher priority to regional planning in order to effect greater balance in the development of the regions" (MOP, 1995, p. 374). Furthermore, the plan also emphasized the development of human

resources to meet the economy's needs and to reduce dependence on the foreign labour force (MOP, 1995; Presley, 1997).

The objectives for the sixth development plan for the kingdom of Saudi Arabia were defined as follows:

1. To safeguard Islamic values by duly observing, disseminating and confirming Allah's Sharia (God's Divine Law).
2. To defend the Faith and the Nation and to uphold the security and social stability of the Kingdom.
3. To form the productive national citizen through providing him with the appropriate means and sources of income, and ascertaining his reward on the basis of his work.
4. To develop human resources and continually ensure an increasing supply of manpower; upgrading its efficiency sufficiently to meet the requirements of the national economy, and replacing non-Saudi manpower with Saudis.
5. To achieve balanced growth throughout all regions of the Kingdom.
6. To continue encouraging private sector participation in socio-economic development.
7. To reduce dependence on the production and export of crude oil as the main source of national income.
8. To continue restructuring the Kingdom's economy through continuing diversification of the economic base.
9. To develop mineral resources and to encourage discovery and utilization thereof.

10. To concentrate on qualitative development of already existing utilities and facilities by improving their level of performance.
11. To complete infrastructure projects necessary to achieve overall development.
12. To promote scientific activity and to raise cultural and information standards to keep pace with the Kingdom's development.
13. To achieve economic and social integration among the Gulf Cooperation Council (GCC) countries, and to support economic cooperation with Arab, Islamic and other friendly nations (MOP, 1995).

With the emphasis on efficiency and cost effectiveness, the plan had recognized the need for a change in the distribution of government spending between capital and consumption expenditure. That was, in order to achieve the above targets, the plan increased government capital spending while reducing government consumption expenditure. Also, in order to reach the above targets, it was essential for both the private and public sectors to finance the necessary investment. Over the duration of the plan, the total investment requirement was estimated to be SR 472 billion. The sixth development plan expected that SR 212.7 billion of the total investment requirement (nearly 45 per cent) would come from the private sector (Presley, 1996). As indicated by Ministry of Planning (1995) most of the public sector investment financing, however, was allocated for petro-chemicals, petroleum refining, and electricity and water, with little contribution in construction, trade, restaurants and hotels and financial services. The plan expected private sector involvement in financing most of the investment requirement for the latter sectors (Al-Teraiki, 1999).

In 1999, during this plan, crude oil prices tripled. The rapid rise in world oil prices of about $20 a barrel in 1999 was preceded by a fall of 40 per cent in 1998. The sudden

price spike was caused by an unexpectedly quick recovery by the East Asian economies, which increased the world's overall demand for oil; a rise in sport-utility vehicles on America's roads; and the slow recovery of Russia's oil industry from the decade of chaos after the Soviet collapse, which limited oil supplies. But one of the main reasons for skyrocketing oil prices was a series of decisions taken by Saudi Arabia, the world's largest oil exporter. Although Saudi oil policy during the past 25 years had generally helped to prevent price spikes and to hold prices down when big increases occurred, as prices rose during 1999 Saudi oil production fell by more than a million barrels per day (Anderson, 2000; Gause, 2000; Jaffe and Manning, 2000; Matt, 2002).

Table 4.7: Projection and Actual Annual Growth Rate for Gross Domestic Product during the Sixth Development Plan (1995-2000)

Sector	Projection (per cent)	Actual (per cent)
Total GDP	4.5	3.8
Oil Sector	15.6	12.9
Non-oil Sector	30.1	24.9
Government	7.5	6.6
Agriculture	3.0	2.6
Mining	9.0	--
Manufacturing	3.9	3.1
Construction	3.9	3.2
Utilities	3.7	2.7
Transport and Communication	2.8	2.5

Source: Ministry of Plan (MOP) (2000).

From the Table 4.7 one can notice the decline in Saudi oil production resulted in a 12.9 per cent average annual rate of decline in the oil sector during this plan period. Therefore, the overall GDP declined by an average annual rate of 3.8 percent compared to the 4.5 percent planned annual rate of increase. Also, the non-oil sectors declined by

an average annual rate of 24.9 per cent compared to the 30.1 per cent planned annual rate of increase.

During the sixth development plan, the private sector became more independent of government expenditures and showed resilience against adverse international economic and financial conditions. The emphasis on the role of the private sector in this plan can be explained by:

(a) the need for economic diversification to lessen the current heavy dependency on the oil sector in economic development;
(b) the need to reduce the vulnerability of the domestic economy to external economic shocks reflected in particular in the fluctuation in oil prices and revenues; and
(c) the need to increase gross domestic investment by fueling additional private sector investment to the gross domestic investment including the foreign private sector investment (Khatoon, 2005).

Significant progress was also made on Saudi-ization and in creating job opportunities for the growing Saudi labor force. The rapid advances of education, training, health and social services sectors continued, as funding for priority sectors was provided, despite the strained revenue situation towards the end of the plan (Yavas, 1999; MOP, 2000a).

4.3.7 The Seventh Development Plan (2000-2005)

The seventh development plan was approved by the Council of Ministers in September 2000, and covered the period of 2000-2005. The start of this plan coincided with the Kingdom's centenary and also coincides with the start of the twenty-first century, the

beginning of the third millennium. This new era is likely to bring about a host of changes and create many challenges at the local, regional, and international levels. The key developments that faced the economy of Saudi Arabia in this plan included an accelerated pace of scientific and technological advancement, the drive toward privatization, regional trading blocs, and the Kingdom's imminent accession to the World Trade Organization, all of which required serious efforts to enable the Saudi economy to successfully meet the challenges of globalization (MOP, 2000a).

At the domestic level, continued rapid population growth brings increased demand for government services and growing pressure on infrastructure and on education, training and health services, along with a growing number of new entrants to the labour market. Accordingly, the government initiated privatization programme has been a forward step in this direction with the aim of expanding the scope of private sector participation and enhancing its leading role in the development process. Furthermore, the Kingdom enjoys the benefit of an advanced system of infrastructure facilities and other economic services which enhance the level of economic activity and boost its efficiency.

The objectives for the seventh development plan for the kingdom of Saudi Arabia are defined as follows:

1. To safeguard Islamic values by duly observing and endeavouring to confirm and disseminate Allah's Sharia (God's Divine Law).
2. To defend the Faith and the Nation; to uphold the security and social stability of the Kingdom; and to deepen the values of national loyalty and belonging.
3. To improve the services provided to Hajj and Umrah performers so as to facilitate easy performance of religious rites and support economic activity.

4. To provide an appropriate range of services to enable the individual citizen to become more productive and capable of a positive contribution, and to expand the provision of basic services to citizens in education, health and other services along with diversifying the means of financing and managing such services.
5. To develop human resources and continually ensure an increasing supply of manpower; upgrading its efficiency through training to meet the requirements of the national economy, and replacing non-Saudi manpower with Saudis.
6. To promote cultural and informational activities to keep pace with the Kingdom's development.
7. To continue to achieve balanced growth throughout all regions of the Kingdom, and increase their contribution to national development.
8. To enhance the private sector's participation in socio-economic development.
9. To prepare the national economy to adjust in a more flexible and efficient manner to economic changes and international developments.
10. To reduce dependence on the production and export of crude oil as the main source of national income, and to increase the value added to crude oil prior to exporting.
11. To diversify the sources of national income and to expand the production base of services, industry and agriculture.
12. To develop mineral resources and to encourage discovery and utilization thereof.
13. To complete infrastructure projects necessary to achieve overall development, to maintain them and improve their performance and methods of finance.
14. To keep abreast of developments in science, technology and information technology, and to encourage research, development and technology assimilation.

15. To continue to protect the environment against pollution and develop appropriate systems; and to preserve natural resources and conserve wildlife.
16. To promote integration among the Gulf Cooperation Council (GCC) countries and to strengthen the Kingdom's relations with Arab, Islamic and friendly countries (cited in the seventh development plan, 2000).

Table 4.8: Projection and Actual Annual Growth Rate for Gross Domestic Product during the Seventh Development Plan (2000-2005) (Million Barrels)

Sector	Projection (per cent)	Actual (per cent)
Total GDP	3.16	3.4
Oil Sector	2.9	2.8
Non-oil Sector	2.4	2.5
Government	1.9	1.8
Agriculture	5.7	5.3
Mining	0.4	0.4
Manufacturing	10.4	11.1
Construction	6.5	6.6
Utilities	7.6	8.0
Transport and Communication	4.6	5.1

Source: Ministry of Plan (MOP), 2000.

As shown in Table 4.8, the annual rate of growth in real GDP averaged 3.4 per cent which was lower than the planned rate of 3.16 per cent. Within the strategy of diversifying the economic base and developing an efficient and competitive private sector, the seventh development plan aims at realizing structural changes in the national economy through oil sector averaged 2.5 per cent which was above the planned rate of 2.4 per cent, while the increasing the non-oil sector's share of GDP, whereby the annual rate of growth in the non-average annual rate of growth of 2.8 per cent in the oil sector was lower than the planned rate of 2.9 per cent.

With respect to the agricultural sector, the average annual rate of growth was 5.3 per cent. This relatively lower target rate reflects the problems with limited water resources. In the other word, the agricultural sector has migrated towards products which conform to the Kingdom's water resources in order to achieve sustainable long-term development. Hence, agricultural subsidies will be rationalized, resulting in further positive developments in the production pattern of this sector which is expected to shift from large scale crop production using substantial volumes of scarce water resources towards high value added crops using modern irrigation methods, such as drop irrigation and greenhouse crops, with due emphasis on the role of research and agricultural extension in raising productivity and quality levels (Presley, 1997).

The average annual rate of growth of the manufacturing sector including petro-chemical industries is 11.1 per cent, which was above the planned rate of 10.4 per cent. The diversification already achieved in this sector is impressive, reflected in deepening linkages between Saudi industries. Production of many consumer goods, including agro-related products and building materials, have now largely replaced imports. Several manufacturing products have significant potential for export, particularly to regional markets. Furthermore, adoption of the economic diversification strategy aimed at exporting industrial products and attracting foreign investments is a favourable factor that gives manufacturing industries a unique position in the future (MOP, 2000a).

The mining sector has been one of the fastest growing sectors during the seventh development plan. The granting of concessionary permits has already started for prospecting of precious metals in several mining sites, with several metallic mining sites having proven their investment potential. This reflects the effectiveness of steps to

streamline the investment code to encourage private investors to invest in minerals manufacturing and exporting.

The demand for transportation and telecommunications services has led to an increase in the average annual rate of growth from 4.6 per cent to 5.1 per cent. The transport sector generally enjoys sufficient capacity, which reduces the pressure to invest in the construction of new facilities and makes it possible to direct resources towards improvement and maintenance of existing facilities. This plan witnessed an increase in the total length of the paved road network to 51,800 km and the rural road network to 111,000 km (Aldagheiri, 2004). In the telecommunications sector, revolutionary technological advances and rapidly increasing demand for the sector's services will justify the need for substantial investments in this sector using modern technologies (MOP, 2000a).

4.3.8 The Eighth Development Plan (2005-2010)

The eighth development plan was approved by the Council of Ministers in September 2005, and covers the period of 2005-2010. Cited in Khaled AL-Gosaibi (Minister of Economy and Planning) (MOP, 2005, p: 1) this plan places emphasis on several priorities such as: Upgrading of the quality of life and providing job opportunities to all Saudi citizens; expansion of education, training, health and social services, both quantitatively and qualitatively; expansion in applied and technological sciences; and the furtherance of initiatives and creativity in all spheres. In addition, the Plan lays stress on keeping pace with the fast momentum of global economic and technological developments, diversification of the economic base as well as improving productivity and boosting the competitiveness of the national economy.

The plan gives considerable attention to promising areas, such as strategic and manufacturing industries, particularly energy-intensive industries, the natural gas industry, mining, tourism and information technology. The private sector's contribution to broad based socio-economic development is another area of focus of the eighth development plan. Moreover, the plan underscores the fact that efforts will continue to forge ahead with the implementation of economic reforms, along with support to the private sector and strengthening of the Kingdom's economic stability. The Plan calls for continued efforts to maintain a prudent balance in the state budget and a sustainable balance of payments equilibrium, and to keep inflation at its current low levels.

The objectives for the eighth development plan for the kingdom of Saudi Arabia are defined as follows:

1. To safeguard Islamic teachings and values, enhance national unity, uphold security and social stability and deepen the Arab and Islamic identity of the Kingdom.
2. To raise the standard of living, improve the quality of life and provide job opportunities to citizens, by accelerating the development process, increasing the rates of economic growth, and ensuring enhancement of the quantity and quality of education, health and social services.
3. To develop human resources, upgrade their efficiency and increase the supply of manpower to meet the requirements of the national economy.
4. To diversify the economic base with due emphasis on promising areas such as manufacturing industries, particularly industries that make intensive use

of energy, and its derivatives, as well as mining, tourism and information technology industries.

5. To improve productivity of the national economy, enhance its competitiveness and prepare it to adjust in a more flexible and efficient manner to economic changes and developments at the national, regional and international levels.
6. To enhance private sector's participation in economic and social development.
7. To achieve balanced throughout all regions of the Kingdom and reduce the development gap between them.
8. To develop the science and technology system, pay attention to informatics, support and encourage scientific research and technology development, with a view to enhancing the efficiency of the Saudi economy, and keeping abreast of the knowledge economy.
9. To conserve and develop water resources and ensure their rational utilization.
10. To protect the environment and develop suitable systems in the context of sustainable development.
11. To continue to strengthen and promote the Kingdom's relations with Arab, Islamic and friendly countries (cited in the eighth development plan, 2005).

Table 4.9: The Key Strands of the Development Plans and their Relationship to the Resource Curse Thesis

National Plan	Key Strands of Plans	Relationship to Resource Curse Thesis
First (1970-1975)	- Due to the Arab oil embargo, the oil revenues increased and gave the Saudi government the means to make major structural changes in the economy. However, the performance of non-oil sectors was not encouraging.	- To shield economies from resource curse, mineral-rich countries have long been advised to invest windfalls in economic diversification away from oil sector (Weinthal and Luong, 2006).
Second (1975-1980)	- The economic diversification was constrained by persistent over-valuation of the real exchange rate. - The biggest share of the plan's expenditure went to the development of transportation infrastructure.	- Over-valuation of the national currency means 'Dutch disease'. - The excessive spending on transportation infrastructure as a non-tradable sector led to contraction in the tradable sectors which ultimately leads to the resource curse.
Third (1980-1985)	- More emphasis was given to the producing sectors such as agriculture, mining and industry with less expenditure on physical infrastructure. - The vocational training schools did not meet the need for qualified technicians requested by many private companies.	- Government policies can turn abundant natural resources into an unambiguous blessing through regulatory and fiscal transparency, reduction of bureaucracy and the abolition of corruption (Korhonen, 2004). - Inadequate expenditure on training and education can lead to resource curse (Gylfason, 2001a).
Fourth (1985-1990)	- The emphasis was on the petrochemical industry which is based on the development of hydrocarbon.	- The diversification in the oil sector lead to the economic problems and is associated with the resource curse.
Fifth (1990-1995)	- Economic diversification through private sector investment.	- To forge a viable diversification and competitive enhancement programme, an attractive climate for private sector investment must be created (Aysan et al., 2007).
Sixth (1995-2000)	- The emphasis was on the role of the private sector. It became more independent of government expenditure and showed resilience against adverse international economic and financial conditions.	- To avoid the resource curse resource revenues should be used as a guarantee for foreign and local investments (Mane, 2005).
Seventh (2000-2005)	- The government initiated privatization programme has been a forward step in this direction with the aim of expanding the scope of private sector participation and enhancing its leading role in the development process.	- Privatization is considered to be a strategy for combating the resource curse, especially for new producers of mineral wealth (Weinthal and Luong, 2006).

4.4 Conclusion

This chapter has presented a general overview of the Saudi Arabian economic development strategy. Despite the discovery of oil on 29 May 1933, the Saudi Arabian economy remained very limited up to 1970 when the Kingdom announced its First Five-Year Plan. The plan laid the foundations for the country's future economic development and diversification, given the limited resources available at that time. While oil revenues since 1970 have effectively replaced the old Saudi economy with a new economy, they have also made the country vulnerable to oil price fluctuations, particularly during the Arab-Israeli War of 1973, the Iranian Revolution of 1979, and the Iraqi attack on Kuwait in 1990. In addition, the fourth oil shock, which happened recently in 1999, demonstrates that this kind of shock can also occur in peaceful times, in the absence of any unusual political tension. Therefore, one can note some characteristics of the Saudi economy that include the dependence of the GDP and budget on oil revenues, a lack of economic diversification, a high level of bureaucracy and lack of regulatory and fiscal transparency that have led to problems associated with the resource curse. To shield economies from shocks caused by market volatility, mineral-rich countries have long been advised to invest windfalls in economic diversification (Weinthal and Luong, 2006).

During the 1970s and in the early 1980s, the authorities tried to consolidate the massive inflow of oil revenues to build the infrastructure and raise the living standard of Saudi citizens. The actual average annual growth in construction, transport and communications, and government sectors all surpassed the planned targets. However, the government failed to spend oil revenues wisely and this necessitated a review of policies on spending priorities. The Saudi government failed to promote a highly

productive manufacturing sector (which is regarded as a principal source of technological progress) to replace the reduction in export earnings following a decline in export prices. Therefore, the failure of this strategy led to economic problems and is associated with the resource curse.

The authorities embarked on a series of political and economic reforms in order to improve domestic economic conditions. The results of these reforms were impressive by the end of third plan, which was considered one of the most successful plans in the history of the Saudi Kingdom, as it achieved most of its objectives. As mentioned in Table 4.9, more emphasis was given to the producing sectors such as agriculture, mining and industry with less expenditure on physical infrastructure. The progress that has been made in human resources development and workforce training during the fifth plan is a direct result of oil revenue. These reforms can turn abundant natural resources into an unambiguous blessing rather than a curse.

The fiscal crisis which occurred during the fifth development plan due to the Gulf War did not cause economic problems for the private sector because the government's reduction of its budgeted expenditure was slight. Moreover, domestic government spending in support of the war effort was substantially increased, and consequently many Saudi companies benefited from war-related contracts. In the sixth development plan the Saudi government called for further economic diversification through encouraging private sector participation in agriculture, manufacturing, development of mineral resources, completion of infrastructure projects and achievement of balanced growth in all regions of the country. From Table 4.9 it can be seen that during the fifth and sixth development plans the Saudi government enabled the private sector to assume its proper role in the economic diversification process, through creating an attractive

climate for local and foreign investments. The literature suggests that improvement of the investment climate through improving bureaucratic performance and predictability is vital for averting resource curse,. Also, deregulation removes bureaucratic forms of rent-seeking and replaces them with private sector competition (World Bank, 2003; UNDP, 2006).

One of the key developments that faced the economy of Saudi Arabia in the seventh development plan was the drive toward privatization, which is considered to be a good strategy for combating the resource curse through better management of enterprises and reduced opportunities for diversion of revenues to "off-budget" priorities (Boardman and Vining, 1989; Ascher 1999). The mining sector has been one of the fastest growing sectors during this plan. The granting of concessionary permits has already started for the prospecting of precious metals at several mining sites, with several metallic mining sites having proven their investment potential. This reflects the effectiveness of steps taken to streamline the investment code to encourage state-owned companies and private investors to invest in minerals manufacturing and exporting.

CHAPTER FIVE

THE MINERALS SECTOR IN SAUDI ARABIA

5.1 Introduction

The previous chapter has shown that Saudi Arabia is largely considered to be a single-commodity economy, in that the oil sector is the most important pillar of the national economy, while the non-oil sectors have relatively weak roles. The government, having realized the risks of this dependency, has taken delineated action to make the best use of the huge oil-revenues to develop all sectors of the economy through the planning process. Considerable attention has been paid to the minerals sector and various policies and programmes have been undertaken to increase its productivity.

This chapter provides the background to the Saudi Arabian mineral sector and its industrial base. Specifically, the chapter presents an overview of the main known mineral resources and production in Saudi Arabia as well as the structure of the industry. In addition, the minerals sector and its role in the Saudi Arabian economy is examined. Finally, the chapter identifies the problems and constraints that face the minerals sector in Saudi Arabia and provides an assessment of the effects of government policies and planning efforts in the minerals sector, particularly during the period of the development plans which started in 1970.

However, before examining the minerals sector of Saudi Arabia, it is necessary to presents a general overview of the geological structure in Saudi Arabia which is divided into two main terrains. The first is the Arabian shield area in the west, adjacent to the

Red Sea and covering one-third of the country. The second is the area where sedimentary rocks dip toward the Arabian Gulf, called the Phanerozoic Cover or Arabian platform.

5.2 The geological structure of Saudi Arabia

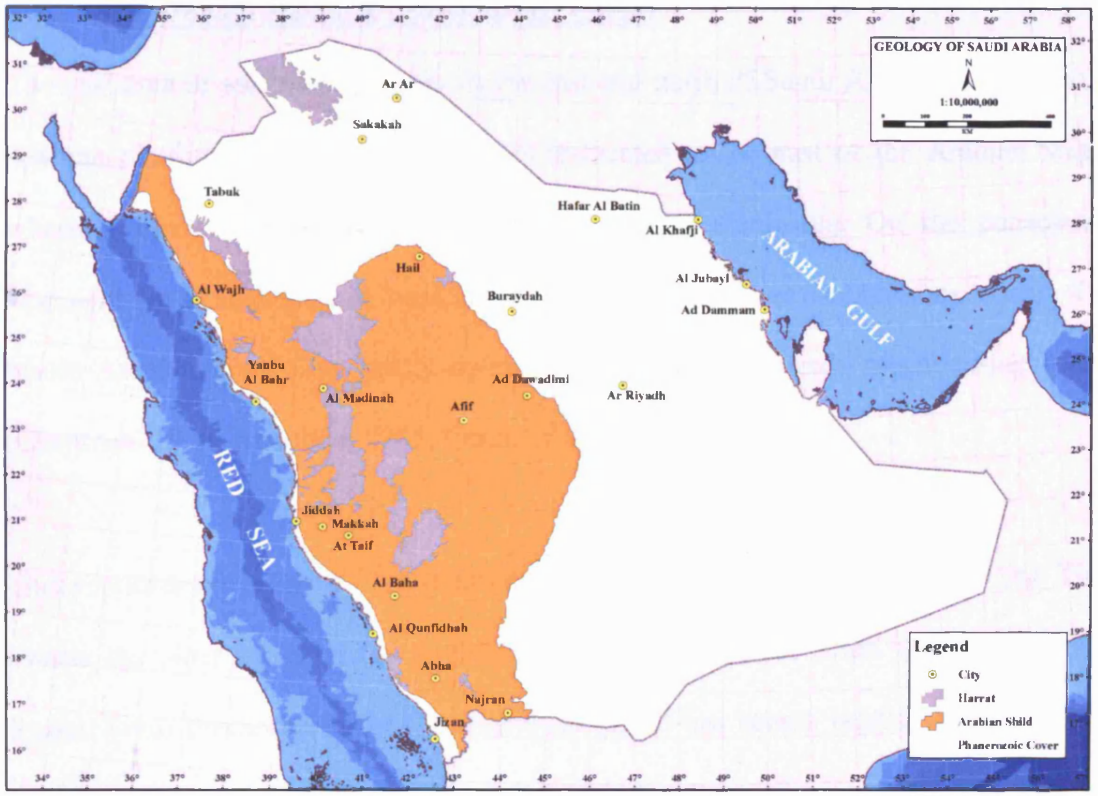
The geological structure of Saudi Arabia is customarily divided from the geological point of view into two major geological units: the first is the Arabian Shield area in the west, adjacent to the Red Sea and covering one-third of the country and the second is the area where sedimentary rocks dip toward the Arabian Gulf, called the Arabian Platform or Phanerozoic Cover (see map 5.1). Saudi Arabian mineral deposits are located in both terrains. The metallic deposits, such as gold, copper, zinc and iron, are mainly associated with the rocks of the Arabian Shield. The phosphate, bauxite, dolomite and gypsum deposits are located further to the east, in the Phanerozoic Cover.

5.2.1 *The Arabian Shield*

The Arabian Shield is separated by the Red Sea rift from its former partner, the Nubian Shield of Egypt and Sudan. The Arabian-Nubian Shield is itself part of the much larger African Shield that constitutes the core of continental Africa. The Arabian shield forms the central Najd, Al-Hejaz and Asir, the Yemen-Aden Plateau and the Southern Arabian Shield (Burdon, 1973; Alwelaie, 1985; Genna et al., 2001a). The exposed Arabian Shield is a trapezoidal-shaped area of about 575,000 km^2 in Saudi Arabia (plus smaller areas in Yemen and Jordan) that forms the western fifth of the Arabian Peninsula. It is bounded to the west by the Red Sea rift valley and its coastal plain (Tihama), and to the north and east by Phanerozoic sedimentary rocks of the overlying Arabian platform. Including extensions in the northwest and southeast, the Shield is about 1,800 km long

and has a maximum width of 700 km. Approximately 81,000 km^2 of the Shield within the Kingdom is overlain by Cenozoic basaltic lava fields (*Harrats*) (DMMR, 2000).

Map 5.1: The Geological Structure of Saudi Arabia



Source: Saudi Geological Survey (SGS) 2007

The Arabian shield has a large variety of metallic and non-metallic mineral resources that range in size and value occurrences of limited potential to deposits large enough to sustain profitable exploitation. Most metallic minerals are located in the Proterozoic rocks of the Arabian Shield exposed in the western part of the Kingdom. Industrial minerals, particularly construction materials, are also located in the Arabian Shield, but are more common in the Phanerozoic sedimentary rocks that flank the Shield in the eastern and northern parts of the Kingdom and underly the Red Sea coastal plain. The Arabian shield, which forms a geologic and metallogenic province, has been the site of

ancient cultural and mining activities that are dated prior to the beginning of Islam (Ma'aden, 2004).

5.2.2 *The Arabian Platform (Phanerozoic Cover)*

The vast area of sedimentary rocks in the east and north of Saudi Arabia constitutes the Arabian platform. The Arabian platform is located to the east of the Arabian Shield where it forms roughly two thirds of the Arabian Peninsula. On the peneplaned basement lie a sequence of continental and shallow -water sedimentary rocks. The whole Arabian Shelf dips gently away from the Shield towards neighbouring basins (Chapman, 1978; Alwelaie, 1985; Genna et al., 2001b).

These rocks are less than 570 million years old and belong to the Phanerozoic Era. They overlie the older rocks of the Arabian Shield and hence are often termed the Cover Rocks. Since Precambrian time, the Arabian Shield has been a relatively stable block. On its eroded surface was deposited the thick sequence of continental and shallow-marine sediments that now dip at low angles into the Mediterranean, Arabian Gulf and Rub' al- Khali sedimentary basins. The Arabian platform is divided into a number of distinct structural units: the Interior Homocline, the Interior Platform and several basins (Powers et al., 1966). The Phanerozoic cover rocks in the Arabian platform contain the well-known oil and gas fields, in addition to some important mineral deposits, especially industrial minerals which are more common in the Phanerozoic sedimentary rocks such as phosphate and bauxite (DMMR, 1995).

5.3 Mineral resources

The natural resources of the Kingdom of Saudi Arabia are highly diverse, both in terms of their variety and their location throughout the country. Dabbagh, the President and CEO of Ma'aden Company, said in an interview "The Arabian Shield rock formation in the west of the Kingdom is a little smaller than the Canadian Shield, and we are optimistic that it contains a similar amount of riches" (2004b, p: 11). The Saudi Arabian soil has a large variety of metallic and non-metallic mineral resources that range in size and value occurrences of limited potential to deposits large enough to sustain profitable exploitation. This section examines minerals important to the economy of the Kingdom of Saudi Arabia.

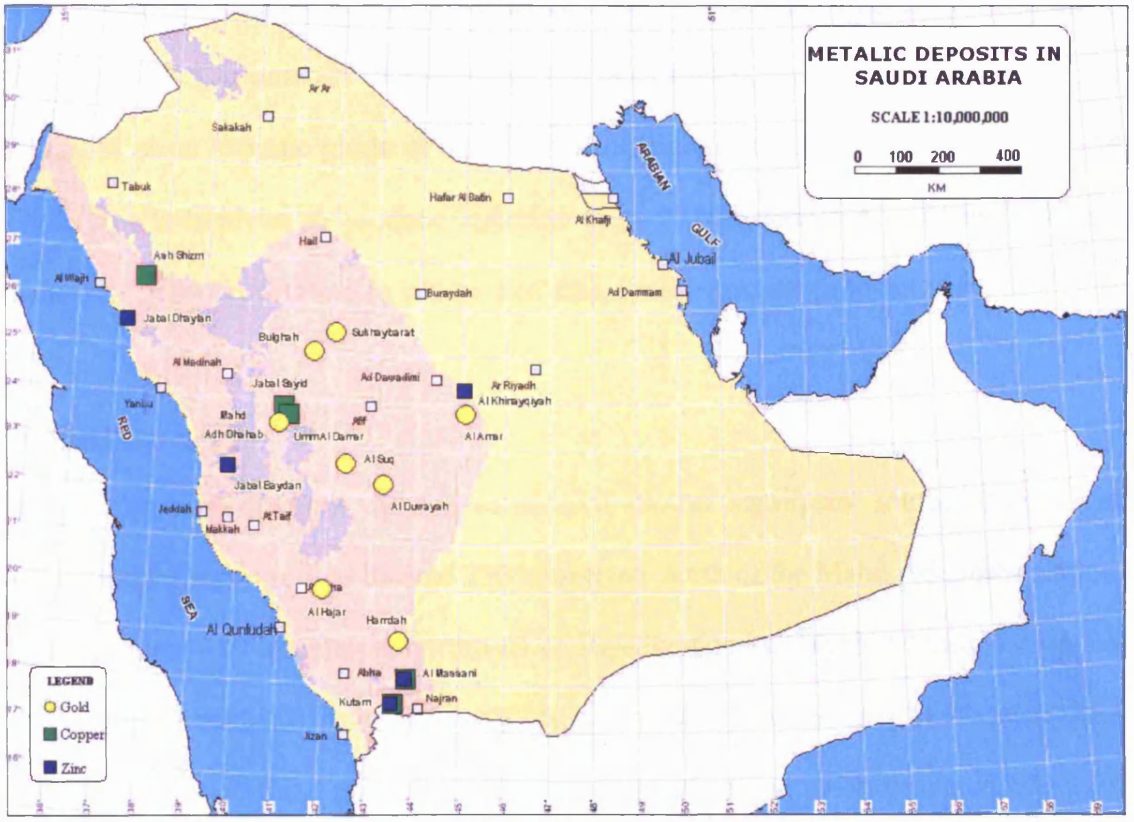
5.3.1 *Metallic minerals*

Gold:

Saudi Arabia is considered the kingdom of gold mining, because this activity has a long history in the Arabian Peninsula. The earliest traces of activity have been dated to 2100 BC and by 1000 BC gold was being extracted on the site of the present-day Mahd Ad Dahab Mine (Ma'aden, 2002a). The total world gold production in 2003 exceeded 2,500 tones. The leading producers were Africa with 17.3 per cent, followed by Australia with 10.6 per cent, the USA with 10.2 per cent, China with 7.9 per cent, Russia with 6.9 per cent, Peru with 6.6 per cent and Canada with 5.4 per cent (DMMR, 2004). Based on the estimate of the U.S.-Saudi Arabian Business Council (USABC) (2005), the Kingdom of Saudi Arabia has close to 20 million tons of gold ore. A significant part of the 2,000 tons local market is covered by local gold production. Additionally, there are exports to the Indian, European, and American markets. An historical review of minerals development in Saudi Arabia is introduced in the next section.

The private sector is involved in all mining operations except in gold mining. Here, the government-owned company, Ma'aden, is the only company authorized to engage in gold mining in Saudi Arabia. The gold is primarily extracted by Ma'aden from two gold mines, Mahd Ad Dhahab and Sukhaybarat. Several commercially significant gold deposits have also been discovered in the Arabian Shield (see map 5.2) and in addition, there is potential to develop other gold mines such as Al-Hajar and Al-Amar.

Map 5.2: Metallic Minerals in Saudi Arabia



Source: Saudi Geological Survey (SGS)

Mahd Ad Dahab Mine:

Mahd Ad Dhahab is considered one of the most significant gold mines in Saudi Arabia. This mine is located in the western region of Saudi Arabia on the Arabian shield, approximately 270 kilometers northeast of Jeddah (Michalski and Mobbs, 1998). The

U.S.-Saudi Arabian Business Council (2005) stated that commercial production at this mine started in 1988. In 1997 this mine processed nearly 200,000 metric tons of ore averaging 24.41 grams per tone (g/t) gold and 131.24 g/t silver. Gold production, including more than 0.5 tons recovered from heap leaching, was nearly 4.32 tons as bullion and more than 1.0 tons in concentrate for a total of 5.32 tons compared with 4.88 tons in 1996 (Michalski, 1997).

According to Rogers (2003), the Mahd Ad Dhahab mine produced 12,527 ounces of gold in the first quarter of 2003 at a net cash cost of $269 per ounce. In this mine to date, over 47.5 kilometers of tunnelling has been mined, and 2.7 million tons of ore extracted at an average grade of 21.89 g/t gold. Based on Al-Attas (2004), Mahd Ad Dhahab will continue to produce approximately 90,000 ounces of gold and 300,000 ounces of silver, in addition to copper and zinc, for the next seven to ten years.

Sukhaybarat Mine:

The Sukhaybarat open-pit mine is considered another significant source of gold and silver in the Kingdom. It is located 250 kilometers north of the Mahd Ad-Dhahab mine, approximately 480 kilometers northwest of Riyadh. The Sukhaybirat Mine is operated by the Saudi Company for Precious Metals, Ltd. (SCPM) a subsidiary of Ma'aden. This mine started in 1991 and produced 2.75 metric tons of gold in 1998 compared with 1.94 tons in 1997 and 2.65 tons in 1996 (Northern Miner, 1997). Based on Ma'aden, heap-leach operations ended in 2003, while the carbon in-leach facilities remained in operation until 2006. Production at this mine has been reduced to 22,000 ounces since 2003, due to the low grade of ore available for treatment (USABC, 2005).

In 1998 the Dahab Co. Ltd., a Saudi Arabian-French joint venture, opened a gold refinery at Jeddah with a capacity of 110 tons/year for gold and 20 tons/year for silver. The Saudi private sector holds 51 per cent of the company, while the French concern, Thomson CSF, holds the remaining 49 per cent. It refines local scrap plus bullion from Mahd Ad Dhahab and Sukhaybarat gold mines (Al-Attas, 2001).

Al-Amar Mine:

A third deposit, Al-Amar, 220 kilometers southwest of Riyadh, is being developed through underground mining. The operation of this mine began in late 2000 and the mine has significant resources of gold, silver, zinc and copper (Mobbs, 2000). Ma'aden signed a contract agreement in 2003 with a Canadian company S.N.C. as a services consultant for the Al-Amar Mine Project, located near AI-Goeaaeh town in the Riyadh Region. This contract will prepare the mine engineering details, ore concentration, filtration, technical details and management of construction. The construction is expected to be completed at the end of 2005 with the commercial start-up of the project at the beginning of 2006. Dabbagh (2004a) explains that Al-Amar Project is one of Ma'aden's promising projects and a significant step in developing the mining industry in the Kingdom. Annually the facility is expected to process 200,000 tons of gold ore; the average annual production is estimated throughout the mine age at 1,100 tons of copper, 54,000 ounces of gold, 84,000 ounces of silver and 6,500 tons of zinc.

Al-Hajar Mine:

The Al Hajar deposit is located in the Asir region in the south west of the Kingdom, about 60 kilometers west of Bishah. The feasibility study for this mine, which was completed in 1996, concluded that the project was economically viable and recommended its development. The construction of the Al-Hajar Project was completed

by 2001. This mine produces gold and silver from a near surface oxidized deposit, with recovery rates of 80 per cent for gold and 30 per cent for silver (Ma'aden, 2001). According to Ma'aden, the Al-Hajar reserves stand at 3.5 million tons grading 3.28 g/t of gold and 38 g/t of silver. This mine has an annual production of 35,000 ounces of gold and 180,000 ounces of silver.

Bulghah Mine:

The Bulghah deposit is one of a number of gold prospects surrounding the Sukhaybarat Mine that will enable the plant to continue even after the Sukhaybarat resources are exhausted (see map 5.2). Based on Ma'aden, the construction of the Bulghah Mine began in March 2001 and operations started in October 2002. Gold production in the initial 3-4 years was expected to be significantly higher than the estimated 81,700 ounce average due to higher grades of ore that will be treated. The ore will be crushed, screened and stacked at an annual rate of approximately 4-4.5 million tons. The mine production in 2003 was scheduled at 7.7 million tons, of which 4.2 million is ore. Gold production is estimated at 130,000 ounces at a recovery rate of 75 per cent (Collenete and Grainger, 1994).

The company has several other gold projects that may be developed at a later date at Al Sup, Sbabah and Hamdah. In the meantime exploration is ongoing. Finally, Sbayban and Jabal Samran are also being explored for their gold potential and silver copper and zinc by product credits. Exploration work on the Ad-Duwayhi project in the Makkah region has also revealed significant gold deposits in the Kingdom.

Copper:

Saudi Arabia is home to significant deposits of copper which are estimated at over 60 million metric tons. The copper deposits occur within the Proterozoic Arabian Shield (see map 5.2). Copper mineralization is widespread in the Arabian Shield and many ancient workings and smelting sites testify to an extensive copper mining industry. The heyday of the ancient mining industry was in pre-Islamic and Abbasid times. In 2003 the total world copper production exceeded 361,000 tons, a significant improvement from 2002's 135,000 tons production surplus. The leading producers were Chile, with 35 per cent of world total followed by the US with 8 per cent, Indonesia with 8 per cent and Australia with 6 per cent (DMMR, 2004).

Until 1998, Saudi Arabian copper was a by-product of gold mining at Mahd Ad Dhahab. After that, the Deputy Ministry for Mineral Resources (DMMR) invited private investors to bid on an exploration licence to explore for copper. Japanese government agencies have also been awarded licences to explore for copper in the western region of the country (Michaiski, 1997).

The Alujain Corp. of Saudi Arabia has placed a hold on its plans to develop a large copper deposit at Jabal Sayid in the Arabian Shield, located approximately 150 kilometers from Al Madinah. It is hosted in a geological environment consisting of lavas, about 40 kilometers north of Madh Ad Dahab mine. The deposit was defined at 80 Mt grading 1.5 per cent copper and believed to contain 20 million tons of copper ore. In addition a new copper smelter and refinery plant started up in 1998. The plant, located in the second largest industrial city on the Red Sea, Yanbu, produces 150,000 tones/year of copper cathode (Al-Attas, 2004; Nehlig et al, 1999).

The Al-Masane polymetallic sulphide deposit stretches over an area of 20-by-35 kilometers and has significant reserves of zinc, copper, gold, and silver. The deposit has reserves of 7.2 million tons, grading 5.3 per cent zinc, 1.4 per cent, copper, 1.2 grams/ton gold, and 40.2 grams/ton silver. The Al-Masane deposit, licensed to the Arabian Shield for Mining Industries Company (ASMIC) holds a mining licence for the Al-Masane deposit. In 1998, the company solicited and received bids from the Saudi government for the development of an underground mine for the Al-Masane deposits and the construction of a processing plant (Michalski, 1997).

Relying on DMMR (2004), the Kutam deposit is located in the Asir Mountains 60 kilometers west of Najran and the results of several studies indicated the possibility of an economic ore body being established, but the relatively low grade and size of the deposit mitigate against further exploration. The Jabal Ash Shizm prospects are approximately 115 kilometers east of Al Wajh and drilling to date has been insufficient to demonstrate continuity of the mineralization. The irregularity and small size of the mineralization as currently known show the deposit is uneconomic, but potential exists for further exploration in the area. The Umm Ad Damar prospects lie 30 kilometers northeast of Mahd Ad Dahab and 20 kilometers southeast of Jabal Sayid. Resources of 1 Mt at 2 per cent copper have been estimated at the South Prospect, but the possibilities for increasing these are considered limited.

Zinc:

Saudi Arabia's annual production of zinc is around 3,000 tons. The majority of zinc occurrences in Saudi Arabia are hosted by low-grade volcanic sedimentary rocks in the Neoproterozoic volcanic-arc terrain of the Arabian Shield (see map 5.2). Zinc is considered the fourth most common metal in use, after iron, aluminum and copper.

Zinc is a metal used primarily in galvanizing steel to prevent corrosion. Zinc alloys have been known for many centuries, however the identification of pure zinc is generally credited to a German in 1746.

The total world production of zinc in 2002 was 8.8 Mt, total metal production was 9.6 Mt and total metal consumption was 9.2 Mt. A large proportion of the world production of zinc is mined with lead or copper, gold, silver, cadmium, sulphur and germanium as important by-products. Of the total world mined zinc production approximately two thirds comes from China, Australia, Canada, USA and Peru. Australia (1.9 Mt/y) and Peru (1.4 Mt/y) are by far the largest net exporters of zinc concentrates, followed by Ireland, Sweden and Mexico (DMMR, 2004).

Zinc occurrences in Saudi Arabia are widespread, but at present the only zinc produced in Saudi Arabia is a by-product (amounting to approximately 3,000 tons of zinc per year) of gold mining at Mahd Adh Dhahab. Although the production of zinc in Saudi Arabia is small, the local market has a significant demand for zinc (estimated to be 27,706 tones in 2003). Therefore, the Saudi Geological Survey (SGS) considers zinc exploration to be one of its priorities.

The Khnaiguiyah deposit is considered one of the most promising zinc deposits in the Kingdom. The deposit is located about 170 kilometers west-southwest of Riyadh, and comprises four carbonized fracture zones enveloped by strongly folded volcanic sedimentary rocks. The DMMR conducted a prefeasibility study on this site and established reserves of 1.9 million tons of minerals, grading 15.26 percent zinc and 0.89 percent copper, mineable underground, or 3.2 million tons at 12.17 percent zinc and

0.81 percent copper, possibly mineable by open pit. At a production rate of 500 tons/day, the life of the Khnaiguiyah mine is assessed at 11 years (USABC, 2005).

At Al Masane, which is located approximately 80 km northwest of Najran, concordant lenses of polymetallic massive sulphides deposit occur in three main zones (Al Houra, Sa'adah and Moyeath) hosted by a thick sequence of predominantly volcanic rocks. According to Mobbs and Michalski (1998) the mining licence for the Al-Masane polymetallic deposit in southwestern Saudi Arabia was held by the Arabian Shield Co. for Mining Industries, which was a joint venture of Arabian Shield Development Co. of the United States and Al Mashreq Co. for Mining Investments of Saudi Arabia. The Al Masane deposit, in southwestern Saudi Arabia, contains demonstrated reserves of 7.2 Mt averaging 5.33 per cent zinc, 1.44 per cent copper, 1.2 g/t gold, and 43 g/t silver. Output was anticipated to be 58,000 t/yr of zinc concentrates containing 54 per cent zinc and 34,900 t/yr of copper concentrates containing 25 per cent copper.

Zinc mineralization at Kutam, which is located about 60 kilometers west of Najran, occurs in irregular schistose zones largely confined to the footwall of the Kutam fault. Although small in size and of relatively low grade, one estimate is 3.8 Mt at 2.1 per cent copper and 0.9 per cent zinc. At Jabal Baydan, approximately 100 kilometers north-northeast of Jeddah, massive sulphide lenses, reported as 10-40 per cent zinc and 1-5 per cent copper, occur associated with black graphitic shale; the estimated tonnage is 0.6 Mt. Carbonate hosted zinc-lead mineralization is present along the Red Sea coast at Jabal Dhaylan, approximately 50 kilometers north of Umm Lajj. A preliminary estimate of 500,000 tons with a combined zinc-lead grade of 7.7 per cent has been made (DMMR, 2004).

5.3.2 *Non-metallic minerals (Industrial minerals)*

Phosphate:

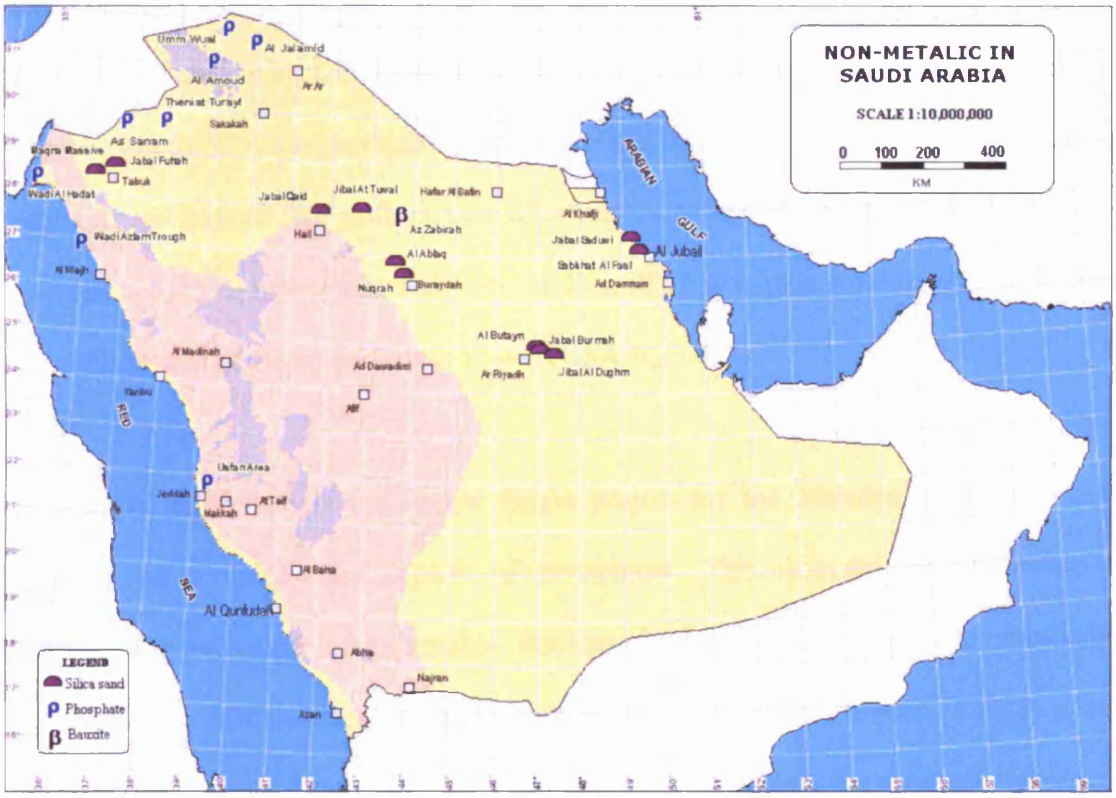
Saudi Arabia is home to some of the largest phosphate deposits in the world. These deposits are located mostly in the north and north-western regions in a belt stretching across the entire northern section of the Kingdom (see map 5.3). The phosphate rock is hosted in a sedimentary sequence of Paleocene to Eocene age that extends to the north into Iraq and Syria and west into Jordan. The phosphate reserves are part of a shelf sequence of rocks that marks the edge of the Tethys Sea, an ocean in past geological time that is now occupied by the Mediterranean and the countries surrounding its shores. It is the largest and most extensive phosphate province in the world (Ma'aden, 2004).

According to Ma'aden's President, Dabbagh (2004b), the Kingdom's phosphate is estimated at 3.1 billion tons, of which 1.6 billion tons is an estimated reserve, with 1.5 billion tons as a mineable resource. In addition to the Al-Jalamid Mine Project, there is an estimated 313 million tons of phosphate ore reserve extending for an area of 18 km^2. Spencer (1999) stated that with private sector investment, Saudi Arabia can exploit the produced phosphate locally to consolidate its position as third ranked exporter of fertilizers in the world. Also, DMMR anticipates that the country will capture 16 per cent of the world phosphate market. Identified future markets for phosphate include China, India, Japan, Pakistan, and Iran.

Regarding the annual worldwide production of phosphate rock, there has been a significant decline in output from the peak of 159 Mt in 1988 through a low of 120 Mt in 1993. This decline in rock use was largely a result of the wholesale down-scaling in

fertilizer use in the countries of the former Soviet Union (FSU). The annual production was 138 Mt in 1997, 145 Mt in 1998, 141 Mt in 1999, 139 Mt in 2000, and 148.1 Mt in 2002. For many years the U.S.A. has been the main producer, but largely due to depletion of reserves in Florida and environmental restrictions, production has fallen from 45 Mt in 1997 to 39.7 Mt in 2000. Other major producers in 2000 were China with 26 Mt, Morocco with 21 Mt, Russia with 11 Mt, Tunisia with 8 Mt and Jordan with 6 Mt (DMMR, 2004).

Map 5.3: Non-Metallic Minerals in Saudi Arabia



Source: Saudi Geological Survey (SGS)

Phosphate accumulations in Saudi Arabia are known in four regions: Sirhan-Turayf, the coastal Red Sea, the central and eastern Regions. Deposits with economic potential have been established in the Sirhan-Turayf region that extends into Jordan, southern Iraq and Syria but in the others further work is not justified. Sedimentary phosphorite was first

identified in Saudi Arabia in 1965 in the Turayf area during drilling for water wells by ARAMCO close to the Tapline, about 70 kilometers to the east of Turayf city. In the same year, reconnaissance mapping led to another discovery of a phosphate bed in the Thaniyat–Turayf area, 250 kilometers southwest of Turayf. In 1988, the Sannam deposit was discovered by the US Geological Survey (USGS) and (DMMR). Furthermore, continued exploration works indicate prospects for other resources in Widyan Ar-Rushaydah, Amud and Al-Fihah areas (DMMR, 1999).

Al Jalamid phosphates are considered to be the best explored and largest deposit in the Kingdom, and are located about 120 kilometers east-southeast of Turayf city. Since the discovery of the deposit in 1984, DMMR's work has advanced from the exploration phase to a feasibility study which was completed in late 1992. The Al-Jalamid deposit is estimated to contain 313 million tons of mineable resource. Ma'aden expects the Al-Jalamid deposit to have an annual yield of 11 million tons/year for 27 years, including 4.5 million tons of phosphate concentrates (USABC, 2005).

Al Jalamid phosphate is the largest single project for the Ma'aden planners and is centered on a world-class deposit of phosphates. This resource could become a significant new source of exportable fertilizer in the form of dominium phosphate (DAP), which contains double the nutrient value of unprocessed rock. This is a big project which would require the establishment of infrastructure for mining, processing and transport. Ma'aden estimates that the deposits within its exploration programmes will lead to the establishment of a phosphate industry and a number of downstream industries in the Kingdom. Ma'aden views the phosphate resources of Al-Jalamid as a nucleus around which a number of industrial projects can be established.

Another resource prospect for phosphate mining in the Kingdom is the Umm Wu'al area, situated around 70 kilometers west of the Al-Jalamid deposit. This deposit was under extensive exploration indicating promising techno-economical potential with estimated reserves of about 208 million tons of phosphate deposits. Ma'aden, through international qualified consultants, has conducted the ore reserve evaluation and ore beneficiation and processing tests on both lab and pilot scales with objectives to assess the proven reserves, confirm the ore amenability to beneficiation and chemical processing and optimize its industrial flow sheets. The findings of these studies will be included in a feasibility study and utilized to identify local or foreign joint venture partners to develop this site.

Relying on the Saudi Geological Survey (SGS), the Sanam phosphate beds correlate with the Thaniyat member of the Jalamid Formation and consist of two units. The area has not yet been explored in detail, but a resource study in 1999 showed a demonstrated resource of 23 Mt averaging 16.91 per cent. A particular attraction of Sanam is its relative proximity to the Red Sea, 250 kilometers, in contrast to the 1,000 kilometers distance from Al Jalamid to the Arabian Gulf. Thaniyat phosphate occurs at several levels in the Thaniyat Member at the base of the Jalamid Formation. Part of the Thaniyat area was explored under licence by Granges International Mining in 1977-81. Al Amud phosphate beds of the Arqah Phosphorite Member in the Al Amud area are largely covered by basalt and have been explored by only 27 drill holes. In the Quraymiz Area there are two thin and low-grade phosphorite bed outcrops in an escarpment for about 20 kilometers in the Quraymiz area. Six drill holes show no development of phosphorite beds to the north. Moreover, there are several areas in the Kingdom such as the Red Sea region (Maqna massif, Azlam trough and Usfan Area), Central region and Eastern region (for more details see Chapter Seven).

Bauxite:

Saudi Arabia has significant bauxite deposits. Bauxite was first discovered in Saudi Arabia in 1970 at Az Zubirah, which lies about 180 kilometers north of Buraidah and about 470 kilometers northwest of Riyadh (see map 5.3). Based on Michalski (1997) the deposit was part of a Cretaceous paleolaterite that outcropped in three main zones covering a distance of 105 kilometers between Al Qassim and Hail provinces with a thickness of 3 metres and a proven reserve of 150 million tons. This reserve is the only known bauxite deposit in the Middle East. Bauxite is used in the production of alumina, the main feed stock for the aluminum industry (Smith, 2003). The Az Zubirah deposit is economically important as the only known deposit of bauxite in the region with the potential to supply an aluminum industry in the Gulf Cooperation Council (GCC) countries.

The deposit has been intensively explored and tested and a resource estimation and prefeasibility study were conducted by the DMMR during the Fifth Development Plan. Test work has shown that the bauxite is amenable to the Bayer Process of alumina production. The total reserves would allow open-pit mining at an annual rate of 2.5 Mt initially, for at least 20 years. At the end of Fifth Development Plan, the DMMR issued an international invitation to tender for the development of the deposit (DMMR, 1995).

The Saudi Arabian Mining Company (Ma'aden) obtained the Bauxite exploration licence in May 2001 after competition against a number of international firms, which released by the Ministry of Petroleum and Mineral Resources (DMMR). During 2002 a pre-feasibility study was carried out by Ma'aden to determine the configuration for this project. The study indicated that the project should not be limited to the construction of

an aluminum refinery, but must aim to develop an integrated industry. The plan involves the construction of a 3.3 million ton/year bauxite mine, a 620,000 ton/year aluminum smelter, and a 1.4 million ton/year alumina refinery. According to Ma'aden, investment in the bauxite project, including the alumina refinery plant and the aluminum smelter, will reach $3.2 billion (USABC, 2005).

The world capacity of Bauxite is approximately 135 Mt., 75 per cent of Bauxite is produced by two dozen countries: Australia 36 per cent, Guinea 13 per cent, Jamaica 10 per cent and Brazil 10 per cent. The rest of production is from India, Kazakhstan, Russia, Suriname and others (Donald, 1994; Harben, 1999). The principal sources of non metallurgical-grade bauxite are limited to only a handful of countries; abrasive grade is produced in Australia, China, Guinea and Guyana, and refractory grade in Brazil, China and Guyana (Sehnke, 1995). Total reported world reserves of bauxite are sufficient to meet cumulative world primary aluminum metal demand well into the 21st century. Although bauxite reserves are unevenly distributed throughout the world, with approximately 90 per cent located in about a dozen countries, the sheer magnitude of these reserves (25 billion metric tons) is sufficient to ensure a readily accessible supply for the future (Plunkert, 1999).

Silica Sand:

Saudi Arabia is considered a home to vast resources of silica sand and sandstone, but few of the deposits can be used as sources of industrial silica without recourse to some form of beneficiation. Silica sand is the result of repeated winnowing and reworking of sediments by waves, streams or wind that removes almost all minerals except stable quartz. Consolidation of such sands forms the high silica sandstone that is commercial value. Quartzite is the highly indurate form of sandstone cemented by secondary silica.

According to the Directorate General of Mineral Resources (DGMR) (1994), the sandstone-dominated detrital sequences make up several of the Phanerozoic units flanking the Arabian Shield. Deposits of eolian sand are widespread and form the major sand seas of Al Rub' al Khali, Al Nafud and Ad Dahna. Quartz veins and pegmatites are present in the Arabian Shield but in small quantities. Of particular economic interest are the high-silica sandstones of Paleozoic age in northern Saudi Arabia, certain Mesozoic sandstones east of Riyadh, some Tertiary units near the Gulf coast and silicified sandstone (quartzite) east of Riyadh and near Jizan. High-silica sandstone in the Riyadh area is used in the manufacture of container glass and fibreglass.

Exploration for high-grade silica sand in Saudi Arabia has focused on slightly indurate, well-sorted, quartz-rich sandstone formations in the Phanerozoic sedimentary succession of the Arabian Platform in the central and northern parts of the country. Such formations outcrop close to urban and industrial centres in Riyadh, Al Qassim, Tabuk, Al Jawf and Ha'il, and require only a minimum of processing such as screening, washing and magnetic separation to meet most industrial specifications (DGMR, 1993). Relying on DMMR (2004), the major resources of silica sand include the Riyadh area, which has several zones of white, glass-grade silica sand, and the Jabal Burmah and Ad Dughm areas.

Jabal Burmah has silica sand reserves of about 75 million tons with the Ad Dughm area having the highest potential for glass sand with approximately 100 million tons. A recent marketing study showed that at least 120,000 t of silica sand produced annually from the Ad Dughm area east of Riyadh are used in the glass and ceramics industry; the demand is expected to increase to more than 500,000 t. Sandstone in the Al Kharj area is chemically of glass grade and could be upgraded, with screening to adjust the grain

size also necessary. The silica sand could also be used for calcium-silicate bricks, as foundry sand, and as an aggregate in decorative white concrete. Al Butayn has high-grade silica sand which is located about 60 kilometres northeast of Riyadh industrial city. Here field investigations and exploratory drilling undertaken in 1991 led to the discovery of enormous resources of high-grade silica sand. The deposit consists of white to off-white friable sandstone. Resources are estimated at 660 Mt and the sand is suitable for the manufacture of glass, ceramics, and other products.

The Al Qassim area has eight localities of high-silica sandstones which are known as the Saq Sandstone, the upper part of the Al Qassim Formation. These are about 50 to 80 kilometres northwest and southwest, respectively, of Buraidah. For example, at Al Bukayriyah, the white sandstone has a grain size suitable for glass making, but would require upgrading. In the Al Ablaq and An Nuqrah areas, resources are very large but a combination of grain size sorting and beneficiation would be required to obtain high-grade glass sand.

In the Tabuk area very large resources of glass-grade quartz sandstone have been indicated in the Wadi al Hadat and Jabal Fuhah areas. Conventional beneficiation would upgrade the sand to a high purity product suitable for many grades of glass. At Al Jawf, high grade silica sandstone occurs south and west of Al Jawf near Al Lajjuh and Mulayh, the physical and chemical properties of which are favourable for glassmaking. The glass-grade sandstone in Hail area is available at Jabal Qa'id and Jibal at Tuwal and requires minor beneficiation. The dunes of An Nafud in this area provide inexhaustible supplies of well-sorted, fine to medium-grained sand, although the relatively low silica and high iron oxide content would require beneficiation to produce glass-grade material.

Although in most cases the sandstone and dune sand of Al Jubayl-Dammam area do not have the characteristics of high-silica sand, high-silica sandstone does occur in the Jabal Saduwi area, and represents a potential source of foundry sand. Eolian sand is heavily exploited for construction purposes, and at Sabkhah al Fasl the sand is suitable for up-grading. Near Dammam, in the Dawhat az Zalum, Ad Diriyah, An Nabiyah and Ghunum areas, dune sands occur which would require beneficiation for glassmaking, but are suitable for cellular concrete and after size correction, for calcium-silicate bricks (cited in DMMR, 2004).

Silica world production figures are difficult to obtain because of the fragmented nature of the industry and the multiple uses for high-silica sands. In 2003 the world production of industrial (silica) sand and gravel was about 110,000 Mt. For many years the U.S.A. has been the main producer of silica sand (27,500 Mt). Other major producers are Slovenia with 12,000 Mt, Austria with 8,600 Mt, Germany with 8,500 Mt, France with 6,500 Mt, Spain with 6,500 Mt Australia with 4,500 Mt and the rest of the production comes from other countries (Zagan, 2004).

5.4 The development of the mineral sector

This section presents the historical background to the minerals sector in Saudi Arabia. Mining has a long history in the Arabian Peninsula where it has been carried out for 4,000 years. The earliest traces of activity have been dated to 2100 BC. The Arabian Shield, which forms a geologic and metallogenic province, has been the site of ancient cultural activity. Around 1000 BC mining was underway at the Madh Ad Dahab mine, a date confirmed by carbon dating of smelting charcoal. Some historians believe that it may have been King Solomon's mine. Evidence of ancient mining traditions includes

old inscriptions and numerous scattered ruins of mining sites and their associated villages along ancient caravan routes. By the time of the early Islamic period (AD 750-1258), mining in Arabia was flourishing, and the archaeological evidence includes gold coins dating from this period (DMMR, 2000).

Historically, however, the age of Ummayad and Abbasid Caliphates is considered to be the 'golden age' of mining which marked the flowering of Arab culture, science and empire through the Middle East, North Africa and the Iberian peninsula. Between 750 AD and 1150 AD over 1,000 mines and workings were developed in the Arabian Shield with gold, silver and copper the principal metals sought. Gold from Arabia was transported to Baghdad along the famous Darb Zubaydah, the pilgrims' highway to Makkah. But mining activity declined during the centuries, mirroring a slump in the fortunes of the ruling caliphs, reaching a low in the early 20th century. In the 1930s, however, gold was again mined at Mahd Ad Dahab, using equipment which enabled deeper reserves to be reached. It is estimated that more than one million ounces of gold have been extracted from Mahd Ad Dahab during the past 3,000 years (Ma'aden, 2002a; Ma'aden, 2004).

Minerals development in Saudi Arabia is divided into two important periods: the first period is pre-national planning (Before 1970) and the second period is post-national planning (After 1970).

5.4.1 *Pre-national planning (Before 1970)*

Mineral exploration in the kingdom began in the early 1930s when many ancient mines were re-discovered, foremost amongst these being the ancient gold mine of Mahd Ad

Dahab. In 1931 the late King Abdul Aziz commissioned the American geologist K.S. Twitchell to investigate the occurrence of oil and minerals in the Kingdom. Twitchell's work confirmed the existence of oil in the Eastern Province and of gold in the Hijaz Region which is located in the Arabian shield. The Bureau of Mines and Public Works was established in 1933 under the Ministry of Finance to oversee mining operations in the Kingdom. In 1935 an agreement was signed between the government and a British-American consortium - the Saudi Arabian Mining Syndicate (SAMS) - to operate the ancient gold mine of Mahd Ad Dhahab. In an effort to streamline the operations of foreign companies in the Kingdom, late that year the government established the Bureau of Mines as a liaison office between the Ministry of Finance, SAMS and other international companies holding mining concessions in the Kingdom (DMMR, 2000).

The foundation for systematic mineral exploration was laid in 1949 when an aerial survey of the Kingdom was completed. This survey was followed by a co-operative mapping project in 1955 between the Kingdom, the US State Department and ARAMCO. Geologic maps of Saudi Arabia were published at a scale of 1:500,000 and geological and geographic maps of the Arabian Peninsula at 1:2,000,000. In 1952 the Directorate General for Oil and Minerals was established under the Ministry of Finance to monitor oil and mineral production and to safeguard the government's interest in the sector. In 1960, the Directorate General for Oil and Minerals was transferred to the Ministry of Petroleum and Mineral Resources. An independent directorate, the Directorate General of Mineral Resources (DGMR), under the Ministry of Petroleum and Mineral Resources, was established in 1962 to administer a systematic geological mapping and mineral exploration programme. This led to the discovery of several commodities, including copper, zinc, gold, silver, iron, bauxite and phosphate deposits, and sources of ornamental stone and industrial minerals of varied economic importance.

The DGMR became the present-day Deputy Ministry for Mineral Resources (DMMR) in 1994 (Trevelyan, 1997). In 1999, the Saudi Geological Survey (SGS) was created, totalling most of DMMR's activities.

Nevertheless, the search for minerals remained sporadic and was limited to the location and examination of ancient mine sites. This work by the small staff of the DGMR showed that considerable mineral potential might exist, and emphasized the need for a broad, long term approach to mineral development. Consequently, in accordance with the Saudi Arabian plan for economic development, in which the discovery of minerals other than petroleum was stressed, the help of the Japanese and United States Geological Surveys was invited. A small team of Japanese geologists were seconded to the DGMR to undertake detailed examinations of a number of mineral prospects, and the USGS Geological Mission was established in 1963 under the terms of a three year contract to undertake joint investigation of mineral resources in western and central Saudi Arabia. In 1965, at the request of the Saudi Arabian government, the Bureau de Recherches Geologiques et Minieres of France (BRGM) began a mineral investigation programme in the northern part of the Arabian Shield. These developments marked the beginning of systematic mineral exploration in the Kingdom. In ensuing Sectional Plans, the work of both Missions has continued to follow the broad objectives originally defined, through a series of Extension Agreements to the original contracts. The two Missions are self- contained and autonomous under the Office of the Deputy Minister for Mineral Resources, but each Mission provides some central services to the DMMR. The technical work programmes of the Missions are initiated and supervised by a team of professional staff in accordance with a plan formulated by the DMMR (DGMR, 1971; Babhair, 2002).

5.4.2 *Post-national planning (After 1970)*

This section presents the seven development plans, in order to investigate briefly the major characteristics and achievements of each plan, based on the official information released by Ministry of Petroleum and Mineral Resources.

Late in 1969, the Directorate General of Mineral Resources was required to prepare an overall plan of operations for the next five years. The first development plan started in September 1970 as part of the overall national Five Years Plan. During the period of ***the First and Second Development Plans (1970-1980)***, the Directorate General of Mineral Resources continued its dual programme of basic geological and geophysical work and of specific mineral investigation. The greater part of this programme was carried out by the two geological missions: the United States Geological Survey Field Party and the Bureau de Recherches Geologiques et Minieres through contracts financed from the budget of the Ministry of Petroleum and Mineral Resources. A small team of geologists and other technical personnel from the Geological Survey of Japan was also engaged on a mineral exploration project (DGMR, 1971).

Furthermore, the opportunity was taken to introduce within the framework of these plans a general reorganization of the functions and performance of the technical departments of the Directorate General. About the same time the Centre of Applied Geology was established in Jeddah as a joint project financed by the United Nations Special Fund and the Saudi Government. The majority of Saudi geologists working in the Directorate General who had not already received postgraduate training were enrolled in a two and a half year course at the Centre to equip them to take a productive part in the programme of the Directorate General.

Although the Directorate General has about thirty Saudi graduate geologists, the majority of these are taking postgraduate courses at the Centre of Applied Geology in Jeddah or at overseas universities. With the aid of several senior geologists, the Directorate General has nevertheless started its own programme of geological mapping and minerals exploration; these activities will be expanded as Saudi geologists return from postgraduate training, and dependence on the geological missions will diminish. Research programmes were continued by the Mining Geology Department of Imperial College of Science and Technology, London, and the Department of Earth Sciences, University of Leeds, under the direction of Profession G. R. Davis and Professor I. G. Gass respectively, with small teams of postgraduate students. Most of the core drilling required under the Directorate General's programme was undertaken by the Arabian Drilling Company under contract, although the USGS also maintains a small drilling unit (DMMR, 1981).

Progress in the mineral resources sector during ***the Third Development Plan (1980-1985)*** was more practical than the first and second development plans. Under this plan, the Deputy Ministry for Mineral Resources was entrusted with the responsibility for extensive programmes of mineral exploration and development, basic geology, geophysics, geochemistry and for the provision of technical services supporting these activities. Sound progress was made during this plan, with particular emphasis being given to the exploration for gold, zinc and the granitophile minerals, such as tin, tungsten, niobium, tantalum and the rare-earth elements. Underground exploration at the Jabal Sayid copper deposit was started, and substantial drilling programmes were carried out in the Sirhan-Turayf phosphate and the Az Zabirah bauxite deposit (DMMR, 1984).

Geological mapping of the Arabian Shield at 1:100,000 scale was well advanced, with more than 80 percent of the fieldwork now finished. An unusually large amount of airborne geophysical work was undertaken; radiometric surveys were flown over 11 areas on the shield, and a combined magnetic and radiometric project was started over the Phanerozoic rocks east of the shield. Work towards the establishment of mines at the Mahd Adh Dhahab gold deposit, at Al Masane zinc-copper-gold-silver deposit and at Nuqrah silver-zinc-copper-gold deposit was continued by mining companies working under exploration licences (DMMR, 1982). In addition, the Deputy Ministry itself examined the Wadi Sawawin iron ore deposit as a possible domestic source of ore for the new iron and steel industry and contracted with British Steel Corporation (Overseas Services) to carry out all work necessary for a full feasibility study (DMMR, 1981). By the end of the Third Plan, mapping at 1:100,000 and 1:250,000 scales had been completed over the whole Arabian Shield, comprising an area of 650,000 km^2. Responding to the need for geological maps to assist mineral exploration in the Phanerozoic Cover Rocks, a 1:250,000 scale mapping programme was started by the Deputy Ministry for Mineral Resources. At the end of the Third Plan seven maps had been published and another four were being prepared (DMMR, 1985).

As part of the Government's overall diversification policies, major emphasis was to be given to developing the mineral sector during ***the Fourth Development Plan (1985-1990)*** period and beyond. Although non-oil mineral resources were far less significant than oil mineral resources, their development had the potential to contribute to the economic diversification of the Saudi economy. Exploration and development of non-hydrocarbon mineral resources has, therefore, been a consistent objective of the government throughout successive Development Plans. The fifth basic strategic

principle states in this respect: "Developing economically promising natural resources, such as the exploration of mineral and sea resources, the mapping of their location, their further development and utilization, and the processing of available natural gas to the maximum extent possible" (MOP, 1990, p: 183).

Therefore, one of the major objectives of the fourth development plan was to encourage the discovery, development and utilization of mineral resources. This was transformed into a set of detailed policies for the mineral resources and mining sector as follows:

- surveying and recording the geology of Saudi Arabia as a basis for mineral exploration and other applications in agriculture, industry and construction;
- prospecting for all types of mineral resources;
- exploring mineral occurrences for exploitable ore, applying modern technological and theoretical concepts;
- investigating and assessing infrastructure and economic cost conditions which affect mining development;
- encouraging the development of mining support services and downstream processing industries;
- evaluating mineral deposits and conducting prefeasibility studies;
- providing information services to the private sector;
- promoting the formation of joint-venture companies to invest in mineral projects;
- advising the community on the practical significance of geohazards and application of construction materials;
- training Saudi nationals in the practical application of geosciences and mining engineering (MOP, 1985).

Moreover, in line with the plan strategy, the main impetus for development was expected from the private sector, in joint ventures with either foreign companies or Petromin. With the revision of the mining code, the Government intended to create an environment conducive to investment and there was a positive response from the private sector.

In this plan the shift from basic geological research towards mineral exploration and mining development was increased. Emphasis was on direct support to the national industry and economy rather than scientific work. Some activities were organized in this plan to implement the policies of this plan. The Mineral Exploration Programme was the core of DMMR's activities. The range of target commodities included both those with export potential and those which could promote national industrial and agricultural development. The prime targets were gold, silver, copper and zinc. Tin-tungsten deposits were also given priority. Increasing effort was directed towards the Phanerozoic Cover areas, where important commodities had already been discovered.

A programme for Exploration Geochemistry, Geophysics and Drilling provided the specialized facilities that were required in mineral exploration. Support programmes were concerned with the provision of services such as laboratories, specialist equipment, publications, storage and transportation facilities. In addition, DMMR's Management and Administration Programme was concerned with the overall planning and management of DMMR's activities and of the other operating units (such as foreign missions). An intensified training scheme for Saudi geoscientists, technicians and administrative staff at all levels was included in this programme (MOP, 1985).

The highlight of ***the Fifth Development Plan (1990-1995)*** was the directive of the Custodian of the two holy mosques (King Fahad), which with the strategic principles, constituted an attempt in the fifth development plan period to overcome the administrative and legal complications that constrained private sector participation in the minerals sector and included issuance of the regulations governing mining activity, as well as mining concessions. The Saudi mining industry was in its infancy and lacked the necessary expertise, so every possible effort had to be made to promote the participation of specialized international foreign companies in investment in the Kingdom to facilitate the transfer of technical knowledge. Also, the mining and tax laws were modified and a business-like approach adopted with a view to keeping abreast of on-going progress in this field (MOP, 1985).

In the early stages of this plan, the Council of Ministers provided guidelines for the DMMR to promote the development of the mining sector. The DMMR was instructed to publicize those deposits likely to prove exploitable and to invite experienced mining companies to submit applications for exploration licences and for mining leases as appropriate, to be issued under the provisions of the Mining Code. The Zarghat magnesite was the first deposit to be publicized and was later licensed to Petromin. The growth of the minerals sector during this plan expanded because of the recovery in domestic construction, as well as continuing substitution of imports of foreign construction materials with locally produced materials.

The DMMR continued to implement its wide-ranging mineral exploration programme with increased emphasis on exploration for near-surface gold mineralization. There was testwork on the Wadi Sawawin iron ore deposit which was undertaken following the signing of a contract in late 1990 between the DMMR and British Steel Consultants Ltd

to provide a report on the technical feasibility of the project. Late in 1991, the DMMR discovered huge resources of silica sand at Al Butayn near Riyadh, some of which would be utilized in two new glass plants under construction in the area. Furthermore, this plan was marked by the completion of the economic assessments of the Az Zabirah bauxite, Wadi Sawawin iron ore, Al Jalamid phosphate and Khnaiguiyah zinc deposits, and by the issue of the Mining Regulations. A Mining Lease was granted for the development of the Al Masane polymetallic sulfide deposit in the southwest of the Kingdom. An airborne thematic imaging survey was made of 74,000 km^2 of part of the Red Sea coastal plain and parts of the Arabian Shield.

At the end of this plan, the opportunities for world-scale mining projects in the Kingdom were made available to foreign investors with the publicizing of the Az Zabirah bauxite, Wadi Sawawin iron ore and Al Jalamid phosphate deposits, following the completion of technical and economic assessment studies. Companies specializing in the mining and processing of such ores were invited to submit proposals for the exploitation of the deposits. As a means of encouraging interest in the Kingdom's mineral potential, the DMMR published the Mineral Resources of Saudi Arabia. Also, an important publication issued by the DMMR was the Atlas of Industrial Minerals. Mining investment seminars were held in the Kingdom, the United States of America and Canada (DMMR, 1995).

The mineral activity in Saudi Arabia in ***the Sixth Development Plan (1995-2000)*** was expected to grow at a target rate of 9.1 per cent annually, thereby targeting it as the fastest-growing sector of the economy. The Saudi government has increasingly viewed the private sector as an engine of growth for the mining sector. The government's focus

in this plan had been on building the legal and institutional infrastructure to encourage the private sector to invest in this promising sector.

According to Babhair (2002), in August 1997 the Council established the basic rules for the transfer of public assets to the private sector, including:

- increasing the share of the private sector in GDP;
- expanding the scope of public participation in projects;
- encouraging local and foreign investment;
- increasing job opportunities and employment for the national workforce;
- providing services to citizens and investors at the appropriate time and cost;
- raising the competitiveness of the economy;
- rationalizing public spending and easing the burden on the state budget by giving the private sector a chance to provide some services; and
- increasing state revenues from partnership projects.

The DMMR continued to provide geophysical support services and conduct environmental geohazard and seismic monitoring programmes, as well as maintaining responsibility for technical support services provided by the Mineralogy-Petrology Laboratory, the Chemical Laboratory, the Remote Sensing Centre, and the Technical Reports Unit. Several TDY personnel from the United States visited the Mission to provide programme assistance and training, including first-stage implementation of a Mission GIS program. In addition, DMMR established an elaborate information infrastructure for the mining sector with a technical library of at least 4,000 reports, studies and maps, and a variety of mining databases. The DMMR also had a comprehensive website, offering geological data on Saudi Arabia, reports and maps, and

a listing of investment opportunities (USABC, 2005). During this plan the strengthening of the human resources potential was a particular focus with training and formal classroom exercises. Fieldwork included the joint completion of exploration, drilling and mapping programmes and training of Saudi staff in the laboratory and in the computer centre.

From these developments, in April 1997 the Saudi government established the state-owned Saudi Arabian Mining Company (Ma'aden), which consolidated all mining projects in which the government was involved. This company is a 100 per cent Saudi governmental holding company with an initial capital of more than $ 1 billion, reporting directly to Ministry of Petroleum and Mineral Resources, and the Minister himself is the chairman of the board. This well capitalized company is part of the Saudi Government's national planning objective to diversify the income of the Kingdom into the non-hydrocarbon sectors.

Ma'aden is proactive for the entry of private sector companies into resource projects. It does not have monopoly rights, and operates on a commercial basis under the mining code as applied to all mining companies in the Kingdom, either independently or in joint ventures with Saudi or foreign companies. Shares in the company will be offered for public subscription, either partially or wholly, once the company starts operating profitably. Ma'aden has taken over Petromin's interests at the Mahd Ad Dahab gold mine and in the Saudi Company for Precious Metals gold mine at Sukhaybarat. Ma'aden presently has three operating gold mines and three projects under consideration for gold and magnesite. The company's significant priority is the development of phosphate in the Northern Region with integrated fertilizer operations on the Gulf Coast. These, together with the potential for an integrated bauxite-alumina facility, will permit the

KSA to realize its potential as a world-class source of minerals and downstream products. In May 2004, the Saudi Government approved the initial steps to privatize Ma'aden. According to the Supreme Economic Council, the privatization of Ma'aden will take place in phases. Once privatization is complete, Ma'aden will have four strategic units specializing in basic metals, phosphates, bauxite, and aluminum and industrial minerals (USABC, 2005).

In a second development, on 25 October 1999, the Saudi Geological Survey (SGS) was established as an independent entity by Royal Decree and attached to the Ministry of Petroleum and Mineral Resources. The role of SGS is similar to those of most geological surveys worldwide and includes: geological research, geochemical, geophysical and hydro geological surveys. It uses the most advanced methods in research and exploration for mineral resources. Moreover, it presents pre-feasibility studies of promising ore deposits to assist the mining industry and offers consultancy services relating to its activities to government and private agencies.

The SGS has the right to cooperate with companies, corporations, universities, centres of scientific research and any other entities performing similar work: definition of water resources and water storage, including the types and quantities that could be extracted together with assessments of their potential use in different applications, in cooperation with the Ministry of Agriculture and Water; study of geological aspects of environmental issues and determination of the best methods for remediation of the harmful effects of mining and geological activities on the environment; study and research to observe volcanic and seismic activities that may occur in the Kingdom, monitoring floods resulting from rain and storm waters and preparation of inventory

maps for all levels of risk for all types of disasters; training of Saudis inside the Kingdom and abroad (DMMR, 2000).

Although to date the minerals sector has made a limited contribution to the Saudi Arabian economy, the government believes that it can contribute significantly and, hence, is trying to enhance its role in the economy. Minerals have been highlighted in ***the Seventh Development Plan (2000-2005)***, and there are big ambitions for the part they can play in the future prosperity of the country. In the Seventh Development Plan the annual growth rate for the non-oil mineral sector was set at 8.34 per cent a year and was expected to grow at a target rate higher than any other sector of the economy. Integral to the attainment of this rate of growth will be two factors; the proposed new Mining Code and the Saudi Arabian Mining Company (Ma'aden). The Deputy Ministry for Mineral Resources (DMMR) is the sole supervisory agency for the application of the Mining Code, which lays down all the premises for mineral operations in the Kingdom.

Al-Attas (2004) stated that, during the past two decades the large-scale expansion of domestic mineral-based industry has resulted in a steep rise in production. For example, eight cement factories finished their planned expansion and increased their capacities by 40 per cent in 2002. The output expansions of iron and steel and fertiliser production have been based on imports of their raw materials such as iron ore, coking steel scrap, phosphoric acid and potassium chloride. In 2002, the total mineral-based industry was more than 351 factories with a total cost over $8 billion. To date, over 30 minerals have already been identified in the Kingdom of Saudi Arabia, with at least 15 industrial minerals that could become commercially viable. The DMMR has identified 1,273 sites of precious metals, and 1,171 sites of non-precious metals.

The Saudi Government is in the last stages of approving a new mining code. The code currently in effect grants local and foreign investors significant incentives. These incentives are included in a draft of a new mineral policy and a new mining and investment code that are in the final stages of governmental approval. Under the new mining code, investors enjoy many incentives such as:

- Duty-free import of mining equipment;
- Exploration licences guaranteeing the exclusive right to explore within the licence area, and the exclusive right to obtain a mining lease;
- Exploration rights for a period of 5 years (renewable for an additional four years) and mining lease for 30 years (renewable for another 20 years) together with 5 years of exemptions from taxation;
- Full management control and repatriation of profits and capital;
- Choice of selecting local partnership or of operating as a wholly Foreign Owned Enterprise.

There are many other attractive features in investing in Saudi mining sector such as:

- The infrastructure of the country is well developed and modern. All big cities and small towns are connected by roads and highways and have necessary utility services;
- Most known deposits are situated in the vicinity of developed areas;
- Many explored mineral deposits are untapped and available for development and exploitation;
- A local manufacturing industry is well established and prosperous, creating domestic demand for high-grade industrial raw materials;

- The manufacturing sector in the neighbouring GCC countries has shown significant growth over the last two decades, and therefore can be considered potential consumers of Saudi raw materials;
- Existing industries in Saudi Arabia often rely on imported raw materials, even though many of these minerals are locally available. Domestic materials could effectively replace such imports if a long-term supply, consistency and quality assurance can be guaranteed (cited in Alfi and Zagan, 2004).

These incentives have contributed to making investment in the Saudi mining sector highly lucrative, and have boosted interest in the sector among local and foreign investors. For example, the number of valid building material permits and quarrying leases doubled in seven years and reached more than 841 in 2002 (Al-Attas, 2004).

5.5 Conclusion

The territory of the Kingdom contains abundant minerals and metals, as well as hydrocarbon mineral resources. Although non-oil mineral resources are far less significant than the latter, their development has the potential to contribute to the economic diversification of the Saudi economy. Exploration and development of non-hydrocarbon mineral resources has, therefore, been a consistent objective of the government throughout successive Development Plans.

This has been achieved through considerable government effort during previous Development Plans, and a sizeable number of mineral deposits have been explored. Within the context of these endeavours, enormous knowledge of the Kingdom's geology and mineral potential has been gained, and as a result, a data base has been established

that has helped to identify a number of mineral projects and deposits that give a sound basis for the development of the Kingdom's mining industry. The respective roles of the government and the private sector are determined by the Mining Code, which confirms that the government will continue to play an important administrative and regulatory role, but the driving force for the development of mining activities will be provided by private enterprise.

Saudi Arabia has strategic minerals such as phosphate and bauxite, as well as industrial raw materials that can be used in the domestic, regional and overseas markets after processing. The diversified geological terrain, strong economy and strategic location of Saudi Arabia in the GCC countries are among the most fundamental features attracting investment in mineral industry.

CHAPTER SIX

THE TRANSPORTATION SYSTEM IN SAUDI ARABIA

6.1 Introduction

In Chapter Five the minerals sector development was discussed; this development led to a high demand for transportation infrastructure, the provision of which has become a necessity. In practice, the number of roads and ports increased to satisfy this demand. In this chapter, the physical development of transportation infrastructure in connecting the regions and cities is considered. This chapter presents the history of the evolution of the three most important infrastructural systems, namely the road network, the railway network and sea ports in the Kingdom of Saudi Arabia.

According to Norton (1984), the historical review of the evolution of the transport network relies on an examination of the interaction between the development of the transport system and economic development. In the broadest sense it includes factors such as population growth and human activities which have an impact on the landscape, influencing the evolution of transportation, and where the road network plays a significant role in facilitating all activities related to economic development. The road network is made up of single roads which link together two or more points, or centres, of movement. It may therefore be regarded as a set of inter-connected roadways along which movement takes place. Different modes of transportation form prominent landscape features and indeed roads, railway tracks, waterways and electricity structures form imposing features on the landscape and in well-populated, industrial and urban

areas there is usually a dense pattern of transportation lines (Robinson and Bamford, 1978).

The information presented in this chapter has been derived from reviews of both published and unpublished literature, including some official reports such as maps of the roads and ports from the Ministry of Transportation (MOT), the Ministry of Planning (MOP), the Saudi Railways Organization (SRO) and the Saudi Ports Authority (SPA).

6.2 Roads network

Development of the road transport network plays an important role in the economic development of a country and, therefore the kilometres-age of paved roads existing in a country is often used as an index to assess the extent of its development. According to MOT (1971) the proper development of a road network not only reduces the cost of transportation both in terms of money and time but also helps in the integration of various regions within the country and better understanding of the neighbouring countries on an international level. Roads contribute to the development of a country by bringing in direct benefits from their role in the development of activities such as agriculture, industry, commerce and mining and by bringing in indirect benefits from the enhancement in the value of property and the change it sets in the way of life and thinking of its people. It is therefore no wonder that all developed countries complete networks of roads and other transportation infrastructure and in the same way developing countries are making huge investments in developing and improving their transportation systems, including road networks.

In the vast Kingdom of Saudi Arabia, where the main population centres are not only scattered all over the country, but are also separated by deserts, sand dunes, valleys and mountains, fast and reliable means of transportation become all the more important and essential. The principal aim of road construction in Saudi Arabia is to connect major urban centres with surrounding villages and towns, thereby opening up the entire nation to development and enabling improvements in the quality of life by providing citizens with the ability to commute or move from place to place. Road construction has been a significant feature in the Kingdom's development, and has dictated patterns of traffic movement. Most development projects, whether for public services, religious purposes, agriculture or industry, have required the construction of new roads (MOT, 1985).

Various authors have researched and written about the road networks of Saudi Arabia. Saudi Arabia has been subjected to investigation and study in several Ph.D. theses and papers particularly focusing on transportation. For example, Abdo (1969) examined the development of transport and road transport in Saudi Arabia. He also drew an historical picture of inland transport and described the pattern of caravan routes before and after the advent of Islam in the Arabian Peninsula. Mecci (1979) studied and described in parts of his dissertation the effects of modern pilgrimage on transport in the city of Madinah.

Makki (1988) investigated the problems of urban transportation in Makkah, giving a broad description of the pattern of roads and streets of the city of Makkah in his thesis. The impact of socio-economic change on Saudi urban transportation, particularly in the Eastern Region of Saudi Arabia, with special reference to the urban transportation of women, particularly by those in employment, has been examined and discussed by Amer Al-Metair (1987). Furthermore, Al-Rakeiba (1991) examined the movement and

transport of pilgrims in the Hajj Region in Saudi Arabia and applied some of the tools of road network analysis.

There are more recent studies in transport geography in Saudi Arabia. The first one is a thesis which aimed to study the road network as one of the main pillars of development in the Eastern Region of Saudi Arabia, examined and discussed by Najah Al-Qaraawi (1996). The second is a research project which examined the road transport network in Riyadh region, discussed by Alforih (2001). The third is an analysis of the efficiency of the road transport network in the Al-Qassim region, examined by Aldagheiri (2004). All used the analysis of the road network in their theses and applied several methods for this analysis, such as connectivity, accessibility, density etc.

It is helpful to subdivide the expansion of the modern road network from 1938 until the present day into two stages. The first stage is prior to the initial development plan from 1938 to 1970 (pre-1970) and the second following the initiation of the plan (post-1970). The two stages, pre-national planning and post-national planning, relate to the historical circumstances of the economic, political and social demands of the region. The activity during the second stage greatly exceeds that during the first owing to the existence of coordinated plans, high investment and concentration of effort.

6.2.1 Pre-national planning

This stage covers the period between the discovery of oil in 1936 and the first development plan in 1970, and starts with the formation of the first modern road in Saudi Arabia, which was built in 1938. The road, 73 kilometres in length, was built by Egypt with funding support received from the *Wagfs* of the Holy Mosques (Al Sayyad,

1956). It connected the city of Jeddah with the holy places in Makkah and was primarily intended to serve the pilgrims arriving at the seaport of Jeddah (see Map 6.1). Relying on Al-Rakeiba (1991) there were some reasons for the Hajj region attracting modern roads before other parts of the Kingdom, as follows:

a) The region includes two holy cities of Makkah and Madinah, which are visited annually by large numbers of pilgrims. Development of transportation was an obvious requirement to facilitate the movement of pilgrims between Makkah, Madinah and the port of Jeddah, particularly since the Hijaz railway was destroyed in the First World War (Abdo, 1989).

b) The economic position of the Saudi government at that time was poor. This situation permitted no development and, as has been stated above, the road which was built in the region was financed by non-Saudis, as all Muslim governments felt responsible for the holy cities and the development of the Hajj facilities.

c) On the other hand, the economic situation of the Hajj region in general, and its main cities in particular, was relatively better than the other areas of Saudi Arabia as a result of the Hajj revenue, which constituted about 50 per cent of the government's total revenue. This led to the Hajj region enjoying greater economic and social progress.

In the 1950s the Arabian-American Oil Company (Aramco) built the first asphalted road in the Eastern Region, where oil was discovered in 1936 and first produced in 1938.

This road was 55 kilometers long, and linked Dammam and Ras-Tannurah (see Map 6.1).

Map 6.1: Roads Network Pre-national planning

Source: Ministry of Transport (MOT) 1970.

Although the Ministry of Communications was established in 1952, it was not until a year later that it assumed total responsibility for the nation's roads (Abd Arhman, 2001). Before the establishment of the Ministry there were only 239 kilometres of paved roads in the Kingdom (IRF, 1986). The Ministry of Communications is responsible for the construction of the entire network of highways in the Kingdom, including all agricultural and feeder roads. Based on Assad Abdo (1969), the construction of the Madinah-Makkah road (424 kilometres in length), which was started in 1951 and completed in 1955, was the first instance of investment by the government of Saudi Arabia in roads. Consequently, in 1955 there were only two separate modern road

networks: the first one in the Hijaz, Western Region, linking the holy places (a total of about 527 kilometres) and the second in the Eastern Region which connected the oil-fields with the main ports and cities (a total of about 400 kilometres).

In 1953, Riyadh was chosen as the government capital, and the need arose to link the capital with the economic areas in the east and the holy places in the west. The position of Riyadh, which is closer to the east than the west, and the attraction of economic prosperity, encouraged the government to link Riyadh with Dammam, first by railway which was completed by 1952, and then by road, which was completed in 1961. The new road also linked Riyadh with the main agricultural areas. The project to link Riyadh with the western part of the Kingdom started in 1961 and the road, 810 kilometres in length, linking the capital with the holy places, was completed in 1965. This enabled travel from the Gulf area to the holy places along an east-west axis (Al-Rakeiba, 1991).

Subsequent expansion of the asphalted roads has diverged from the east-west axis, both northwards and southwards. The Makkah-Madinah road was extended to reach as far north as Tabuk (111 kilometres), and to the border with Jordan (see Map 6.1). The Tapline Road (300 kilometres), which followed the oil pipeline, starts in the east and extends northwest, parallel to the Kuwaiti, Iraqi and Jordanian borders and Saudi Arabia. However, in the pre-1970 period, the total length of paved road completed did not exceed 8,000 kilometres, 20 per cent of which was built by Aramco (MOT, 1986).

6.2.2 Post-national planning

Over a period of three decades the Kingdom of Saudi Arabia has constructed a modern network of roads. This network has become a symbol of the modernization of the

country and a national landmark, and is an integral part of government plans for both the public and private sectors of the Kingdom. The experience which has been gained in constructing this network and the upgrading of the nation's ability to undertake large highway construction projects under very difficult conditions, has given the Kingdom significant expertise in modern highway construction. In conjunction with the Kingdom's five-year plans, the Ministry of Transportation prepared its own comprehensive plan, which was known as the Five-Year Road Programme. The Post-Development Plans stages started in 1970 and have continued until the present time. In the year 1969 the Ministry of Transportation prepared a comprehensive five year plan for the development and maintenance of transportation infrastructure, including the road network. The advantage of preparing periodic plans is that expenditure over a period of years is estimated in advance, so that allocations can be indicated for each development activity. Thus it becomes possible to fix priorities in advance with the result that the development of the whole country can be carried out in a coordinated manner, with well defined objectives and targets.

The objectives of the Five-Year Road Programme were therefore designed to:

1. Promote the growth of other sectors while minimizing the overall cost of transportation required for their projected economic and social activity.

2. Promote national integration and regional economic growth. It was expected that on the completion of this plan all cities with populations of 10,000 or more would be connected with the main road either directly or by link roads.

3. Meet the expected growth in traffic at a minimum cost. This involved balancing the cost of maintaining the roads against the wear and tear on the vehicles using it plus the excessive time and cost of travel (MOT, 1971, p: 33).

During the First Development Plan (1970 to 1975), 3,221 kilometres of new roads were constructed and 908 kilometres of existing roads were reconstructed (MOP, 1975). The most important road at this stage was the road on the coastal plain beside the Red Sea, which is about 1800 kilometres in length and extends from a northerly extreme on the Saudi-Jordanian border to a southerly extreme on the Saudi-Yemeni border. Although the main and secondary roads programme was sizeable in this development plan, public interest necessitated launching the Feeder Rural Roads Programme in order to connect villages and towns with the primary network. As Saudi Arabia is a vast country with numerous scattered small villages, it was initially decided to consider connecting the villages which were within 50 kilometres on either side of the main roads. Therefore, the programme of construction in this development plan completed 4,338 kilometres of rural and feeder roads. A maintenance programme for paved roads was also introduced during this period.

In the Second Development Plan (1975 to 1980), 11,399 kilometres of paved main roads and 10,053 kilometres of rural roads were constructed (MOP, 1985). There were numerous geographical challenges to creating a comprehensive road system in Saudi Arabia such as the climate, the burning hot deserts and high mountain ranges which were each to pose different but equally challenging problems for contractors. In the south west of the Kingdom, where mountain ranges soar to 3,000 metres, a series of projects, involving the construction of magnificent viaducts, has been undertaken so that even the more inaccessible parts of the Kingdom in this region can be reached by road.

Additionally, a 555 kilometre carriageway from Taif towards the southerly crossing of the mountain ranges of the Hejaz and Asser at Dahran Aljanob was built in this development plan.

During the Third Development Plan (1980 to 1985), the massive increase in traffic that ensued from the Kingdom's industrial and agricultural development necessitated the upgrading of many inter-city roads to expressways in various parts of the Kingdom, such as Jeddah-Makkah (70 kilometres), Riyadh-Dammam (388 kilometres), Riyadh-Sedir-Qassim (353 kilometres) and Makkah-Madinah (424 kilometres) bringing the total road network to 25,000 kilometres of paved roads and 20,000 kilometres of agricultural roads (MOP, 1985). It is important to note here that the actual pace of road construction during this period surpassed the targets proposed in 1980 for all types of roads and the Ministry of Transportation spent $12.24 billion on this construction, linking all cities and towns to the road network. (IRF, 1986). By the end of the third development plan, the Kingdom's physical transportation infrastructure was largely in place, so the focus of longer term development in the transport sector was on improving the operating efficiency of the system.

Table 6.1: The Total Length of Roads in the Development Plans (Kilometre)

Development Plans	First	Second	Third	Fourth	Fifth	Sixth	Seventh
Paved Road	3221	11399	25000	33000	37322	45000	51800
Rural Road	4338	10053	20000	48500	80669	106300	111000
Total	7559	21452	45000	81500	117991	151300	162800

Mainly as a result of the huge infrastructure investment during the Third Development Plan, this was followed by a period of consolidation in the Fourth Development Plan

(1985 to 1990), where the road construction programme focused on secondary and feeder roads, as well as on links to new and expanding agricultural areas. Secondary and feeder roads provide access to remote areas and connect village clusters. The total length of roads increased in this period to 81,500 kilometres, categorized as expressways and divided highways (3,500 kilometres), primary and feeder roads (26,500 kilometres), paved agricultural roads (3,000 kilometres) and agricultural roads (48,500 kilometres) (MOP, 1990). The most important road constructed in this stage was the motorway, which opened in 1985 between Dammam, Riyadh and Jeddah and was about 1,275 kilometres long. The Fourth Development Plan began in earnest with the planned shift in emphasis from road construction to maintenance. The growing need for ordinary and preventive maintenance resulted not only from the expansion of the main road network, but also from the damage caused to roads by overloading of trucks at a time when the demand for trucking services exceeded the supply capacity of the industry. In response to this problem, weight load limitations were enforced more strictly towards the end of the Third Plan period, by operating weighing stations at strategic points of the road network. Hence, this plan was initiated on completion of the Third Development Plan's projects and focused on increased efficiency of operations and maintenance.

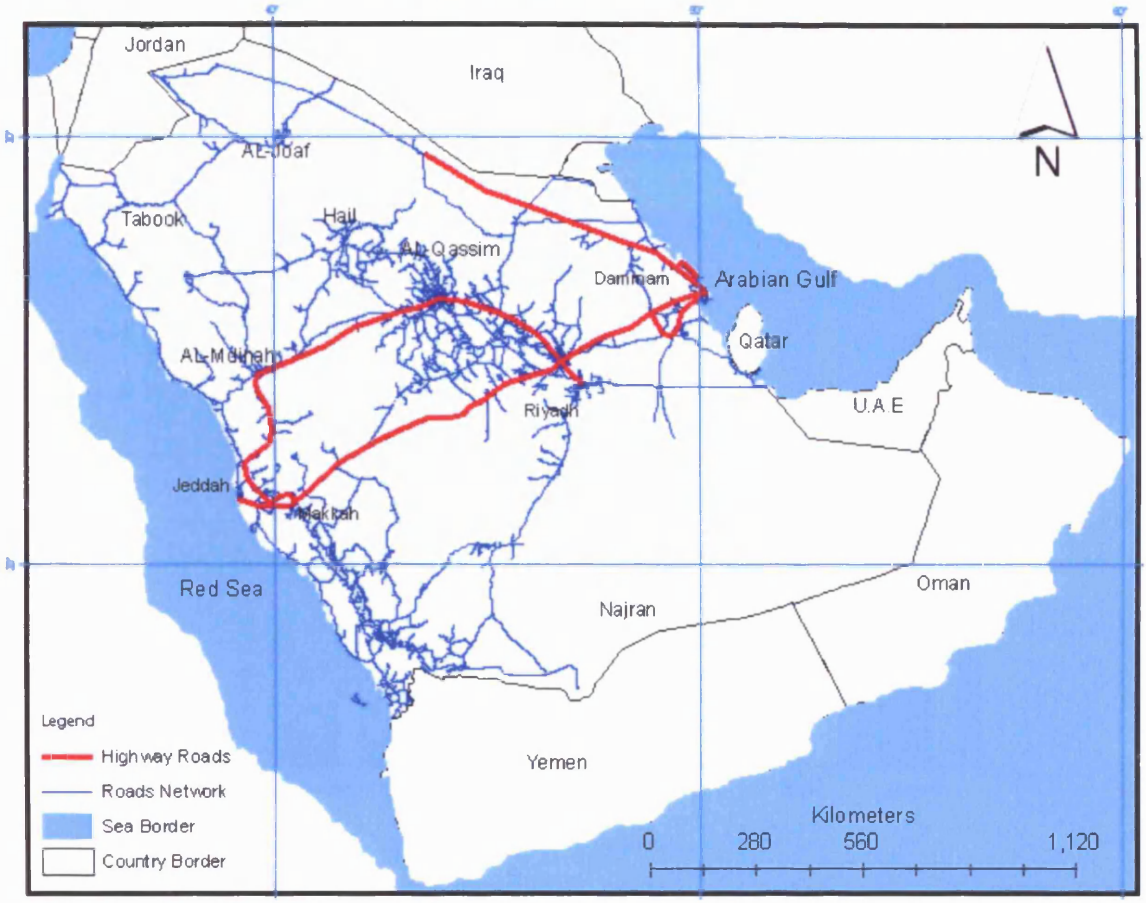
During the Fifth Development Plan (1990 to 1995), a total length of 4,322 kilometres of main paved roads was built and 32,169 kilometres of rural roads (MOP, 1997). According to Abalkhai (1992), the transport sector, and specifically the Ministry of Transportation, received $2,585 billion from the government for the operation and maintenance of roadways and other projects at this stage. By 1991 the country boasted an excellent system of expressways and paved roads that linked all the populated areas of the kingdom. Highways constituted the backbone of the Saudi transportation system

with about 100,000 kilometres of roads, 35,000 kilometres of which were paved. Some of the more important inter-city highways were; Dammam-Abu Hadriya- Ras-Tannurah Highway (257 kilometres), Khaybar-Al-Ola Highway (175 kilometres) and Taif-Abha-Jizan Highway (750 kilometres).

In the Sixth Development Plan (1995-2000), the road network played a crucial role in facilitating the flow of traffic. The length of the paved road network, built to high safety standards, reached 45,500 kilometres in 2000 compared to only 8,000 kilometres in 1970. In addition, the total length of the rural road network serving the rural and agricultural areas had expanded to 106,300 kilometres in 2000 compared to only 3,500 kilometres in 1970 (MOP, 2000a). As a result, the majority of the towns and cities and most of the villages of the Kingdom were linked by at least two-lane roads. In the context of improving efficiency and maintaining roads, the ordinary and preventive maintenance tasks carried out by the Ministry of Transportations covered about 37,000 kilometres of paved roads and bridges. The development of the roads network and improved efficiency led to a decline in traffic accidents from 167,300 in 1996 to 153,700 in 1998, or 8 per cent. The important issue in the Sixth Development Plan was encouraging the private sector to participate effectively in the provision of transport services, which constituted one of the significant directions of development strategy in the Kingdom (MOP, 2000c).

During the Seventh Development Plan (2000-2005), the total length of the paved road network increased to 51,800 kilometres and the rural road network increased to 111,000 kilometres (see Map 6.2) (MOT, 2003). The most important road is the 810 kilometres highway completed between Al-Qassim, Madinah, Yanbu, Rabigh and Thuwal.

Map 6.2: Roads Network in Saudi Arabia

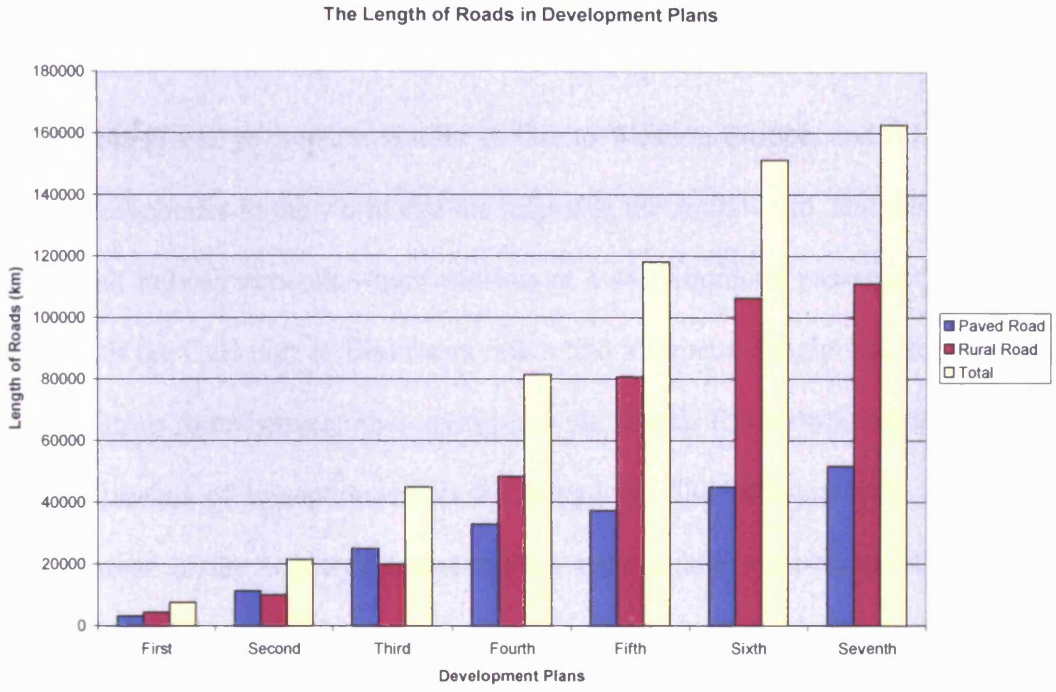


Source: Ministry of Transport (MOT) 2006.

In addition a second highway started during this period between Al-Qassim and Hail, and still under construction, is expected to be completed in the Eighth Development Plan period. There were major objectives in the Seventh Development Plan such as an improvement of the standard of operational efficiency and a reduction in dependence on government funding, together with an increase in private sector participation in the management and operation of transport facilities. Additionally, one of its objectives was to achieve a balance between the adequate expansion of domestic and international transport networks and the expected growth in demand and traffic on the one hand,

whilst taking into account safety aspects and reducing adverse environmental impacts on the other.

Figure 6.1: The Length of Roads in the Development Plans



Currently, Saudi Arabia is served by more than 165,000 kilometres of roads, about one-third of which are paved and the rest, improved earth (see Figure 6.1). The considerable achievements described above are the result of various studies and programmes undertaken in co-ordination with a number of ministries and government agencies with regard to the perceived need for roads in the region. The overall objective was to connect all settlements in the Kingdom with the principal urban areas, thereby opening up channels for the government to provide necessary services for the entire population. Putting the Kingdom's road network in place has been one of the fundamental aims of the government in order to meet the basic requirements of national development. Without a functional and modern road network, national development on the scale

achieved would not have been possible, as the existence of an adequate network of roads is a basic necessity for the economic and social progress of any developing country.

6.3 Railways

Saudi Arabia is a large country, similar in size to Western Europe, and it is among the 25 largest economies in the world and the largest in the Arab world. But the country has a very small railway network which consists of a 449 kilometre passenger line linking Riyadh with the Gulf port of Dammam, and a 556 kilometre freight line which takes a more circuitous route between these two cities via Harad. The railways remain the least developed means of transportation in the Kingdom. The railways have been only a minor element in the country's transportation system, and were re-established in the early 1950s after a four-decade hiatus. The Ottoman Turks built the first railroad on the peninsula, the Hejaz Railway linking Damascus with Madinah. Parts of this railroad were destroyed in World War I, and the line was abandoned, especially that in Saudi Arabia. This section presents three stages of development for the railway network: firstly, the Hejaz Railway (old network); secondly, the existing railway network and finally, the expansion projects for the railway network.

6.3.1 The Hejaz Railway

The Hejaz Railway is considered to be the first railway in the Arabian Peninsula and ran between Damascus and Madinah. It was proposed to continue the railway to Makkah, but this section was never constructed. The construction of this railway started in 1900 and the railway reached Madinah in 1908. The construction, maintenance and security

of this railway all presented enormous difficulties, and was mainly undertaken by 5,000 Turkish soldiers. Additionally, variations in the terrain itself made construction difficult, as the ground was very soft and sandy in places and rock solid in others. Water scarcity was the norm, but occasional torrential rainstorms caused flash floods, washing away bridges and banks and causing the railway to collapse (Landau, 1971; Al-Degn, 1985; Ziadh, 2000).

Ostensibly, this railway was built to facilitate pilgrimages to the Muslims' holy places in Arabia but in fact also to strengthen Ottoman control over the most distant provinces of the empire. On 1 September 1908 the railway was officially opened, and was transporting 30,000 pilgrims a year by 1912. Business boomed, and by 1914 the annual load had soared to 300,000 passengers. Not only were pilgrims transported to Madinah, but the Turkish army began to use the railway as its chief mode of transport for troops and supplies. During the First World War this railway was severely damaged.

There was no direct intention to destroy the railway at this time; the main aim was simply to cripple it in order to impede the advance of the Turkish army. From the First World War until recent time, several attempts were made to revive this railway, but the scheme proved too difficult and too expensive. In addition, the expansion in road transport and air traffic in the 1970s and 1980s led to the cessation of these attempts (Ochsenwald, 1980; Tourret, 1989).

6.3.2 The Existing Railway Network

Information from the Saudi Railway Organization (SRO) indicates that the idea of constructing a railway line in Saudi Arabia after the Hejaz Railway was first introduced

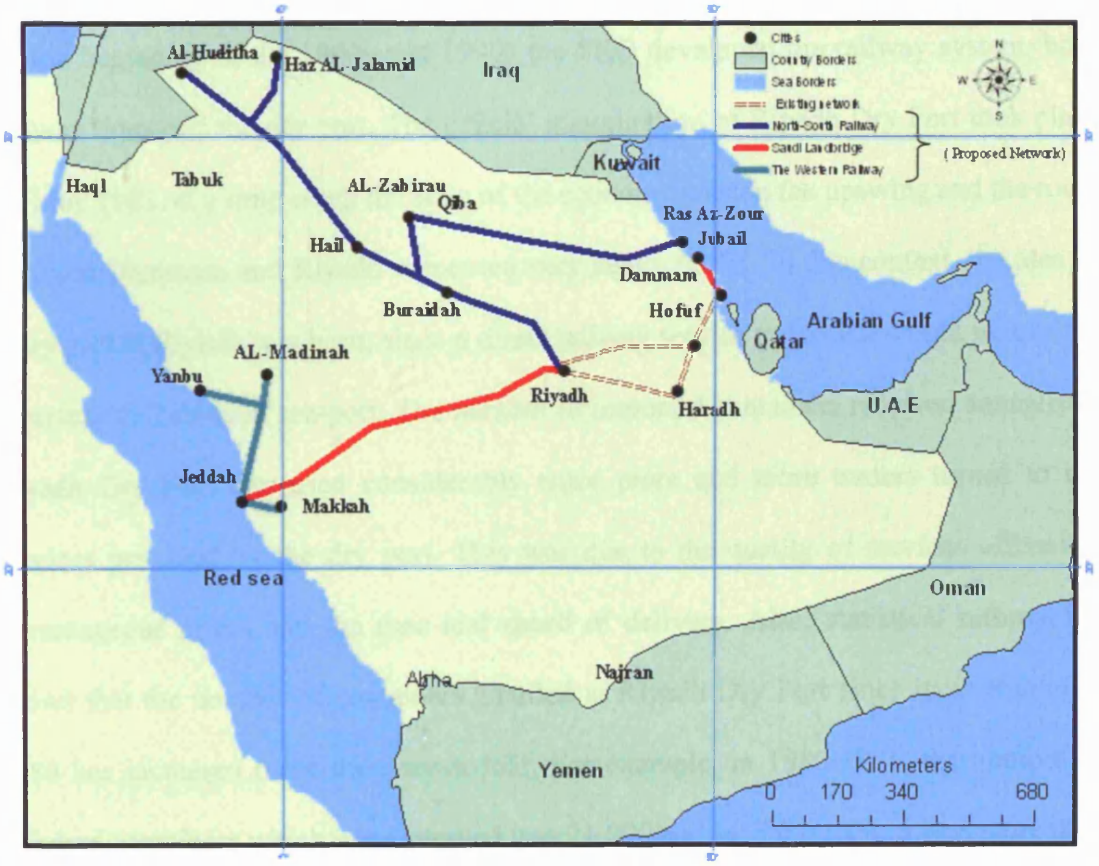
in the mid-forties, when the need was felt for a port on the eastern sea-shore of the Kingdom to handle goods dispatched to the Aramco Petroleum Company. Such goods had to be conveyed inland from the port to the warehouses of Dhahran. This idea was presented to the late King Abdel Aziz Al Saud, who gave his assent to the project and instructed that the line should extend up to Riyadh, because Riyadh had been chosen as the government capital, and the need arose to link the capital with the economic areas in the east and the holy places in the west. Also, the position of Riyadh, which is closer to the east than the west, and the attraction of economic prosperity, encouraged the government to link Riyadh with Dammam by railway (Aldagheiri, 2004).

Based on SRO (2000) the construction work commenced in October 1947, and in October 1951 the railway line was officially inaugurated by the late King Abdel Aziz Al Saud. At first, Aramco ran the railway line but it was subsequently entrusted to the Ministry of Finance, at which time it was known as the Railway Department. The government later created the railway authority as a public corporation organization having a legal status with rights and duties just as a natural person. The name of this organization was the Saudi Government Railroad Organization (SRO). The SRO is responsible for rail transport in the Kingdom and is an autonomous agency headed by a President who is responsible for the policies and the day-to-day activities of the railways. He is supported by a Vice President. The SRO is controlled by a Board of Directors and chaired by the Minister of Transportation. There have been several development projects undertaken by the SRO, some of which are as follows:

- Construction of a direct railway line from Dammam to Riyadh - with a total length of 499 kilometres.

- Construction of 3 modern passenger stations in Dammam, Hofuf and Riyadh.
- Establishment of a fully-equipped central maintenance workshop at Dammam.
- Construction, inauguration and operation of a dry port in Riyadh, which may be regarded as one of the most important achievements of the corporation. The availability of this service in Riyadh has greatly facilitated import of goods from abroad and clearance by customs directly to the importers in Riyadh (see Map 6.3) (SRO, 1999).

Map 6.3: Existing and Expansion Railways Network in Saudi Arabia



Source: Saudi Railways Organization (SRO) 2007

Although the railway had a significant effect on the transport of goods and passengers between Riyadh and Dammam, the connection of Dammam with Riyadh by paved road in 1961 led to a considerable decline in goods and passengers carried by rail. In 1960 for example, the amount of goods transported from Dammam to Riyadh was 721,000 tonnes, but by 1961 this had already decreased to 671,000 tonnes, i.e. about 7.5 per cent fall. In 1962 this had decreased further to 650,000 tonnes. The number of passengers was also affected, decreasing from 98,000 in 1960 to 27,000 in 1962, a fall of 72.5 per cent. In addition, by the early 1970's, the railway system had reached an unsatisfactory position owing to, firstly, the decay of the infrastructure, secondly, the age and inefficiency of the rolling stock and thirdly, income and expenditure were out of balance and operating efficiency was continuously declining (Al Metair, 1987).

At the beginning of the 1980s and 1990s the SRO developed the railway system: both railway lines and the dry port. The official inauguration of Riyadh Dry Port took place on May 1981, at a time when the state of the economy was on the upswing and the route between Dammam and Riyadh witnessed very heavy traffic. In this context, the idea of a dry port at Riyadh was born, since a direct railway service to Riyadh would relieve the pressure on Dammam sea-port. The number of imported containers received annually at Riyadh Dry Port increased considerably since more and more traders turned to the services provided by the dry port. This was due to the quality of services offered at advantageous prices and the ease and speed of delivery. Also, statistical information shows that the number of containers handled at Riyadh Dry Port since its inception in 1980 has increased more than seven-fold. For example, in 1980-1981, the number of standard containers which were handled was 21,000 and in 2003-2004, it was more than 141,405.

According to the SRO's website the dry port has some significant benefits such as;

- In handling and transporting cargos, whether in the form of containers, motor-cars, equipment or general merchandise, the dry port offers to its customers a speedy and efficient service.
- The port can efficiently handle containers of different sizes and volumes, whether wholly or partly loaded.
- The port authority is subject to liability for the safety of all kinds of goods consigned on its trains, including containers, motor-vehicles, equipment and general goods, from the time they are loaded on the train at Dammam, and until they are received by their owners at Riyadh.
- The dry port at Riyadh has an advanced combination of specialized facilities, such as warehouses – cranes and other lifting gear devices – various types of equipment – shadings – sufficient open space – etc. These facilities enable the Port to handle more than 200,000 standard containers per year.
- Goods earmarked for export are received by the Port authority for dispatch to the sea port at Dammam. The Port authority is committed to follow-up the consignment until it is loaded on board the ship within the agreed period of time.
- As noted previously, one of the benefits for traders is the speed and efficiency of handling of consignments at very competitive prices.

6.3.3 The Expansion Projects

As is known all over the world, railway networks are effective in moving large volumes of bulk commodities over long distances and according to regular schedules and when compared to other means of transport can often be cheaper. Furthermore, they are safe and efficient in use of fuel and are responsible for less environmental pollution than

some other forms of transport. The Saudi Arabia government has long had an ambition to expand its rather modest railway, which currently links Riyadh via two railway lines to the port of Dammam. There are three big projects planned by which the dream finally looks set to become a reality. The Supreme Economic Council has approved the implementation plans for three railway projects, which will be under the direction of the Saudi Railways Organization.

The three railway projects are:

1. The Saudi Landbridge: this will involve building a new 950 kilometres line from the capital, Riyadh, west to the Red Sea port of Jeddah, and a 115 kilometre line from Dammam north along the Gulf coast to Jubail; the existing Riyadh-Dammam railway will also be upgraded.
2. The Western Railway: 750 kilometres of new lines from Jeddah southeast to Makkah, and northeast to Madinah and Yanbu, and
3. The North-South Railway: a 1300 kilometre mineral railway running north from Riyadh to Hazm Al-Jalamid.

The Saudi Landbridge:

This section starts by quoting Dr Jobarah Al-Suraisry, Saudi Arabia's Minister of Transport and chairman of SRO: "The time is right to bring the many advantages of rail transport to Saudi Arabia and this can only be achieved by extending the rail network to the main centres of population and industry. The landbridge project represents the cornerstone of our expansion plan. It will be one the largest BOT (build, operate, transfer) projects ever undertaken in the Middle East and is a key initiative in the

railway expansion programme approved by the Kingdom's Supreme Economic Council" (Briginshaw, 2005, p: 1). Therefore, the Saudi Landbridge will transform the existing rail network in the Kingdom of Saudi Arabia into a world-class freight and passenger rail link across the country. It will have the capability to move large quantities of cargo over long distances at competitive rates and will offer safe and comfortable overland passenger transport. In addition, it will transform the Kingdom's existing network into one of the world's most important strategic freight links connecting the port cities of Jeddah, Dammam and Jubail via Riyadh's inland dry port. The delivery time for containers tracked between Dammam and Jeddah will be less than 48 hours compared to up to eight days journey by sea around Ras al Mandab from the Red Sea to the Arabian Gulf (Khmash, 2005; Jackson, 2005).

The Saudi Landbridge will connect the port cities of Jeddah, Dammam and Jubail and will pass through the capital city Riyadh and serve its dry port (see Map 6.3). The project will involve:

1) Construction of 950 kilometres of new line between Riyadh and Jeddah.
2) Construction of 115 kilometres of new line between Dammam and Jubail.
3) Upgrade of the existing railway link between Riyadh and Dammam, including connection to the new Riyadh-Jeddah and Dammam-Jubail lines.
4) The integration of the new lines with the upgraded existing railway and with the ports at Jeddah, Dammam and Jubail and Riyadh Dry Port (and the expansion, operation and management of the Dry Port).
5) The operation of freight transport on the new and existing lines (including procuring additional rolling stock) and (until the award of a separate passenger concession) passenger transport on the existing lines.

6) The maintenance of the new and existing lines (Hughes, 2004; SRO, 2004).

The Saudi Arabia government granted concessions to the private sector for the construction and operation of the Saudi Landbridge via a Build Operate Transfer (BOT) contract. This is considered to be one of the largest BOT schemes ever undertaken in the region.

The Western Railway:

There is a huge demand for travel between Jeddah and Makkah (about 80 kilometres) and Jeddah and Madinah (about 420 kilometres). Makkah, with a population of 1.6 million, is within commuting distance of Jeddah. Of the 16 million people that travel between the two cities a year, 7 million are commuters. Another 5 million are visitors, 2 million are Hajj pilgrims, and 2.5 million are Ramadan visitors. Madinah has nearly 1 million inhabitants and has 3 million visitors a year (Briginshaw, 2006). Therefore, the purpose of the western railway project is to cater to the requirements of passengers, predominantly religious pilgrims and commuters, wishing to travel between Makkah, Jeddah and Madinah. In order to meet these requirements, the Government of KSA plans to develop a new railway infrastructure consisting of a high-speed line linking the three cities with six new stations. Moreover, the project will provide a safe, fast, reliable and comfortable mode of transport for Umrah visitors and Hajj Pilgrims traveling to Makkah and Madinah via Jeddah. This project will involve:

1) Construction of a new line between Jeddah and Makkah.
2) Construction of a new line between Jeddah and Madinah.
3) Construction of a spur from the Jeddah-Madinah line to Yanbu (see Map 6.3).

According to the SRO (2005), the proposed western railway network will transport millions of passengers every year on state-of-the-art high speed railway infrastructure. At first, it is expected about 20 million travellers per year will travel by train between Jeddah and Makkah, but this number is expected to grow to 30 million by 2020. The traffic between Jeddah and Madinah is estimated at 3 million in year one, increasing to 4.5 million by 2030. The KSA will grant concessions to the private sector for the construction and operation of the MMRL via a Design, Build, Operate and Transfer (DBOT) contract.

The stations for this line will be located in strategic locations in each of the cities: Makkah, Jeddah and Madinah. There will also be a connection to the city of Rabigh to serve daily commuters to the King Abdullah Economic City. The stations will be located as follows:

1. Jeddah City Centre: a station will be a part of the Municipality development plan for a multimodal transport station near Jeddah's old airport.
2. Jeddah International Airport: a station in the new airport for the convenience of travellers from the airport into the city centre, Makkah and Madinah avoiding heavy road traffic. A second station in the Hajj terminal for Hajj and Umrah performers during high season.
3. On the outskirts of Makkah to serve daily commuters traveling to universities and businesses.
4. Close to the Haram, about four hundred metres from the Haramto to help Umrah performers to complete their mission and leave the city to continue other business.

5. Madinah station will be located about three kilometres from the Prophet's Mosque (Masjid Alnabawi).
6. Rabigh station will be located near the city to serve employees and businessmen expected to travel to and from the newly developing King Abdullah Economic City.

The North-South Railway:

The reason for building the north-south railway can be shown from an interview with the President of Saudi Railways Organization Dr Al-Yahya, who said "In the past it was the government's strategy to expand highways and roads. But things have changed. The Saudi demography and the size of the economy have changed, and diversification has become government policy. All these developments have dictated a fresh look at the railway sector" (Cited in SRO's official website, 2003). The North-South railway project was conceived to serve two major ore bodies located in the north of the Kingdom. These now form the core traffic for a new network extending north of Riyadh. This line would also support projected industrial development in Saudi Arabia north of Riyadh, particularly around the urban centres of Buraidah, Majma'h, and Hail (see Map 6.3).

Saudi Arabia is home to some of the largest phosphate deposits in the world, so this project is a major investment in infrastructure by the Saudi Arabia government and will conclude with the construction of 1,800 kilometres of standard gauge single railway track including the existing railway network. Its primary objective will be to connect bauxite and phosphate mines at Az Zubairah and Al Jalamid to processing facilities located at the Arabian Gulf port of Ras Azur. Ras Azur is located approximately 200

kilometres to the north of Dammam. In addition to mineral traffic, the North-South railway project will serve passengers and freight traffic from Riyadh to Al-Hudaitha. The railroad network will run from Al-Hudaitha near the border with Jordan and continue all the way to Riyadh via Al-Jouf, Al-Zabira (Hail), Qassim and Sudair. A railroad spur will connect Hazm Al-Jalamid and Al-Zubairah (Hail) to Ras Az-Zour (southeastern part) along the railroad to Jubail (for more details see the case study in Chapter Seven).

6.4 Ports

The Kingdom of Saudi Arabia is considered to be the world's main oil exporting country. The Saudi government, therefore, has to have efficient, fully equipped ports that are capable of functioning effectively. According to the Saudi Ports Authority (SPA) (2000), the demands of commerce encouraged the early development of roadsteads, precursors to ports and harbours, which soon became hubs of social and trading activity. Indeed, until the advent of air travel, the ports of Saudi Arabia represented the only practicable channels of physical interchange between the Kingdom and the outside world. Following the discovery of oil in the 1930s, investment in ports and terminals capable of handling ocean-going tankers has been crucial to the country's wellbeing. The Saudi ports used to be managed by different bodies with different rules, regulations and tariffs for each port. But in 1976 the Saudi Government created an independent Ports Authority to improve and develop all Saudi Ports and to run them in the most advanced and effective ways, in a unified manner. For example, between 1974 and 1976 ships calling at Jeddah had to wait up to six months before discharge. The queues of ships for berths were up to 200 in Jeddah and up to 125 in Dammam. Success in the elimination of such delays was achieved by the establishment of an autonomous

Saudi Ports Authority (MOP, 1991). Now the Saudi Ports have become major contributors to Saudi economy and a link between the national and international economy.

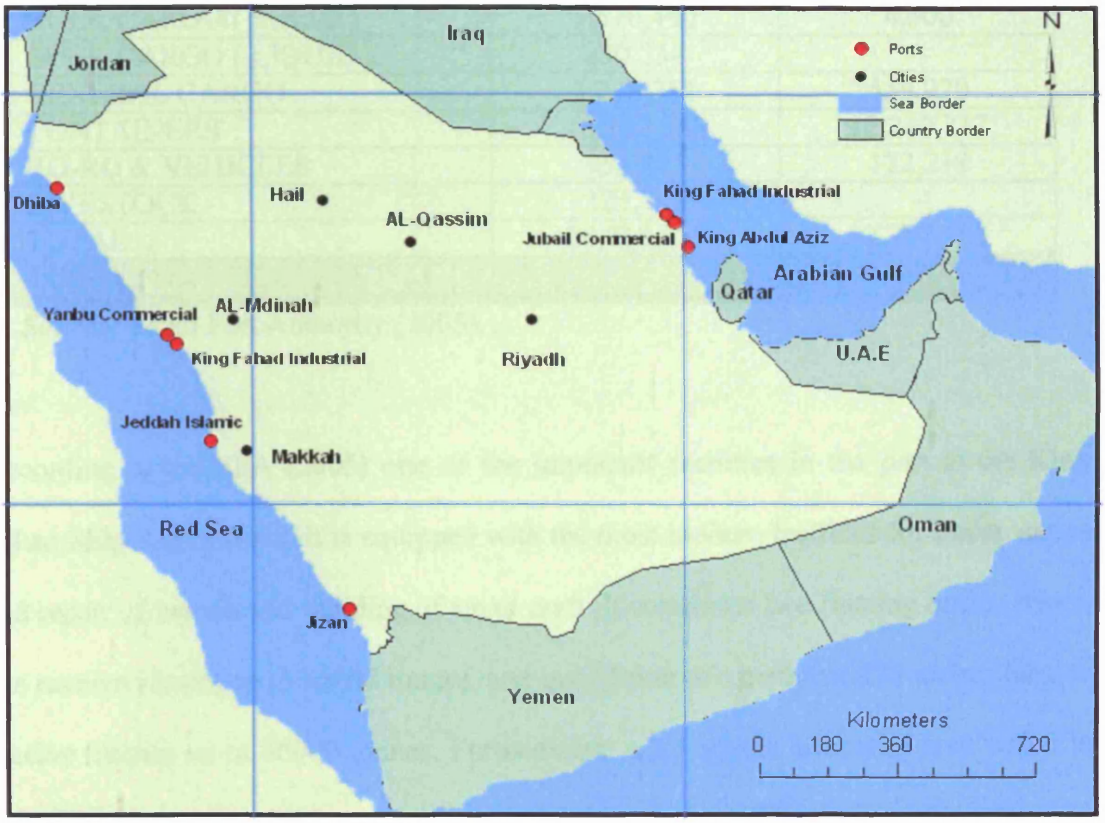
Saudi Arabia has a number of ports located on its two coasts which comprise a 1,800 kilometre coastline along the Red Sea, and one of 530 kilometres on the Arabian Gulf (see Map 6.4). Some of them are for industrial purposes and others are primarily commercial:

1. Jeddah Islamic Port.
2. King Abdul Aziz Port, Dammam.
3. King Fahad Industrial Port, Jubail.
4. King Fahad Industrial Port, Yanbu.
5. Jubail Commercial Port.
6. Yanbu Commercial Port.
7. Jizan Port.
8. Dhiba Port.

1- Jeddah Islamic Port:

Jeddah Islamic Port has a geographical advantage in that it has an excellent location in the middle of the international shipping route between east and west. In other words, it is a link point between the Indian Ocean, the Mediterranean and Europe. The importance of Jeddah Islamic Port increased and reached its maximum limit when the Kingdom was developing into a modern and civilized country. It is considered the Red Sea gateway for Saudi Arabia and it is the Kingdom's principal port serving the holy

Map 6.4: Ports in Saudi Arabia



Source: Saudi Ports Authority (SPA) 2006

cities of Makkah and Madinah. Based on SPA (2004), Jeddah Islamic Port is the largest port in Saudi Arabia, and handles 59 per cent of the country's imports through its 58 deep water berths. The start of development for this port was the establishment of the Seaport Authority in September 1976, and it expanded from a modest 10 operational berths in 1976 to the 58 berths of international status in service today (see Table: 6.2). This port, which is a congestion free harbour, occupies 10.5 square kilometres, with 58 deep water quays having an overall length of 11.2 kilometres with a draught reaching 16 metres. This can accommodate the latest generation of large container vessels (with a capacity of 6500 TEUs).

Table 6.2: Jeddah Islamic Port Throughput Type of Cargo (Tonne)

CARGO TYPE	DISCHARGED	LOADED
BULK CARGO (SOLID)	5,570,490	4,500
BULK CARGO (LIQUID)	230,734	--
GENERAL CARGO	3,238,351	459,970
CONTAINERS	16,592,369	12,210,817
RO-RO & VEHICLES	956,875	122,218
LIVESTOCK	125,702	--
TOTAL	26,714,521	12,797,505
TOTAL PORT THROUGHPUT	**39,512,026**	

Source: Saudi Port Authority (2005).

According to the SPA (2005) one of the important facilities in the port is the King Fahad Ship Repair Yard. It is equipped with the most modern facilities for maintenance and repair of vessels and building of small craft. It comprises two floating docks, which can receive vessels up to 45000 tonnes, and in addition two berths of 170 metres long to receive vessels up to 60000 tonnes. Furthermore, a 2.5 square kilometre area which is used as storage areas divided as follows: open storage area of 2.1 square kilometres and a covered storage area of 0.4 square kilometres consisting of 59 warehouses and transit sheds.

2- King Abdul Aziz Port, Dammam:

King Abdul Aziz Port is considered to be the main gateway for cargoes to the Eastern and Central Provinces of Saudi Arabia. In addition, it is the second largest seaport in the Kingdom after Jeddah, and is also the second in the Arabian Gulf after Jebel Ali Port in the United Arab Emirates. According to Al-Naeem (2000), the port has excellent communications with the interior of the country, particularly to the Eastern and Central provinces. Also, it is the only seaport in the Kingdom with a railway link, which

connects the port's quays and city directly to industrial complexes and other customers, especially in the dry port of Riyadh, with a regular daily schedule of passenger and freight trains. King Abdul Aziz port was established in 1949, and the responsibility for the port construction rested with ARAMCO. Development started after the Kingdom established the Seaport Authority in September 1976, and it has expanded dramatically since the first two operational berths were inaugurated in 1949, to 38 deep sea berths of international status in service today. Moreover, it can handle visiting ships without delay but there is ship room for expansion, in the shape of a further 2 possible berths, when required. Put simply, King Abdul Aziz Port is strategically placed to service the requirements of the oil industry, the continuous development of Riyadh, the capital, and the major provincial cities in the Eastern and Central Provinces.

Table 6.3: King Abdul Aziz Port, Dammam Throughput Type of Cargo (Tonne)

CARGO TYPE	DISCHARGED	LOADED
BULK CARGO (SOLID)	3,593,411	288,317
BULK CARGO (LIQUID)	56,587	2
GENERAL CARGO	3,714,874	134,703
CONTAINERS	4,830,054	3,698,628
RO-RO & VEHICLES	278,576	2,552
LIVESTOCK	23	--
TOTAL	12,473,525	4,124,202
TOTAL PORT THROUGHPUT	**16,597,727**	

Source: Saudi Port Authority (2005).

The port boasts 29 covered storage sheds, 17 of which are completely enclosed plus 260 hectares of open space. The port is capable of an annual throughput of 15 million tonnes of every type of cargo: containers, ro-ro, dry and liquid bulk, grain, general and reefer cargo and livestock (SPA, 2002) (see Table: 6.3). According to the SPA (2004), the port is fully self-sufficient with its own administration offices, mechanical and marine workshops, electrical, telephone and marine communications networks and water

refinery. It has its own clinic, fire department and a large housing complex for port employees, with mosques and a supermarket. Furthermore, staff training on every level is a high priority as the Saudization programme gathers pace.

3- King Fahad Industrial Port, Jubail:

The King Fahd Industrial Port at Jubail lies on a sea-lane to the north of the Jubail Commercial Port. The location for the industrial complex and port were chosen for their proximity both to the petroleum and natural gas reserves of the region and the deep navigable waters of the Arabian Gulf and thence to the markets of the Far East and Asia. The port was designed for the import of raw materials which are needed by the industries and for the export of the manufactured products. It products include petrochemicals, chemical fertilizer, sulphur and refined oil products. The construction of the King Fahd Industrial Port began in 1974, adjacent to the Jubail Industrial City. The port played an essential role in the construction of the Jubail Industrial City itself by providing specialized berths for the import of prefabricated modules. Because of its importance, the Saudi Arabian Seaports Authority has paid the utmost attention to the Jubail Industrial Port. Since it opened to traffic in 1982, the port has participated in this continuing success story and today takes pride of place among Jubail projects (Al-Kurtas, 2000). The height of success was in March 2005, when the King Fahd Industrial Port in Jubail was awarded the International Arch Prize for Europe Agreement, platinum class, in addition to a merit certificate for comprehensive management for 2005.

Table 6.4: King Fahad Industrial Port, Jubail Throughput Type of Cargo (Tonne)

CARGO TYPE	DISCHARGED	LOADED
BULK CARGO (SOLID)	5,824,117	5,037,828
BULK CARGO (LIQUID)	625,378	27,682,698
GENERAL CARGO	5,708	3,967
CONTAINERS	--	--
RO-RO & VEHICLES	--	--
LIVESTOCK	--	--
TOTAL	6,455,203	32,724,493
TOTAL PORT THROUGHPUT	**39,179,696**	

Source: Saudi Port Authority (2005).

According to SPA (2003a), the King Fahd Industrial Port has many good features: it has a total of 27 berths of which 19 are fully operational; there are 5 berths available for shallow draught vessels and port craft and there are 3 berths of 346 metres in length with 30 metre depth of water capable of accepting vessels of 360,000 MT DWT. Most of the berths operated by Saudi Aramco and the Saudi Iron and Steel Company (HADEED), where they handles the export of sulphur, oil, petrochemical products etc (see Table: 6.4).

4- King Fahad Industrial Port, Yanbu:

King Fahd Industrial Port at Yanbu has a strategic geographical position, being close to the Suez Canal and midway between America, Europe and the Far East through Bab Elmandeb. The port is situated near the Yanbu Commercial Port, and contributed to the setting up of Yanbu Industrial Complex, exporting its products to various parts of the world. This port lies on the Red Sea coast some 300 kilometres north of Jeddah Islamic Port, and extends some 25 kilometres along the coast. It is considered to be the largest port for loading crude oil, refined products and petrochemicals in the Red Sea. The Director General of King Fahd Industrial Port at Yanbu, Dr AI-Saadi (2000) stated that

this port is a natural port of call for oil tankers, containers, ro-ro and break-bulk vessels, offering access for a significant volume of local cargo, both import and export. More than one million tonnes of break-bulk and containerized cargo are generated annually at this industrial city (see Table: 6.5). This port was built specifically to serve the industrial complex and meet its requirements including export of the various industrial products such as construction material and equipment, which gives the port a significant role in the economy of the region. In 1981, the Saudi Aramco crude oil terminal started operations and other large-scale projects soon followed. One of the first was the Yanpet joint venture producing ethylene, ethylene glycol and polyethylene, which came on line in 1985 (SPA, 2000).

Table 6.5: King Fahad Industrial Port, Yanbu Throughput Type of Cargo (Tonne)

CARGO TYPE	DISCHARGED	LOADED
BULK CARGO (SOLID)	--	118,645
BULK CARGO (LIQUID)	1,899,295	30,322,636
GENERAL CARGO	3,503	3,058
CONTAINERS	126	--
RO-RO & VEHICLES	49	--
LIVESTOCK	--	--
TOTAL	1,902,973	30,444,339
TOTAL PORT THROUGHPUT	**32,347,312**	

Source: Saudi Port Authority (2005).

In terms of berths, this port has 24 berths and there is provision for all types and sizes of oil tankers and containers, general cargo, bulk cargo and Ro-Ro vessels. This port has storage areas such as an area of 167,067 square meters for container storage, an area of 10,000 square meters for storage of general cargo, an area of 800 square meters for hazardous cargo, and an area of 18,000 square meters covered by warehouses.

5- Jubail Commercial Port:

Jubail Commercial Port lies on the Arabian Gulf in the Eastern Province of the Kingdom of Saudi Arabia. The port functions as a commercial and industrial port and it is about 80 kilometres north of Dammam. The port was inaugurated by the late King Khalid bin Abdulaziz on October 1977, before which it was a small fishing harbour on Saudi Arabia's eastern Gulf coast. The modern port covers an area of about 50 hectares and in the east and west of the Port there is a breakwater berth of ten kilometres. Jubail Commercial Port is considered to be one of the biggest construction projects in the Kingdom, and has the most modern cargo handling, safety and fire fighting equipment.

Table 6.6: Jubail Commercial Port Throughput Type of Cargo (Tonne)

CARGO TYPE	DISCHARGED	LOADED
BULK CARGO (SOLID)	1,531,202	172,106
BULK CARGO (LIQUID)	788	--
GENERAL CARGO	529,627	126,688
CONTAINERS	4,894	9,232
RO-RO & VEHICLES	--	--
LIVESTOCK	--	--
TOTAL	2,066,511	308,026
TOTAL PORT THROUGHPUT	**2,374,537**	

Source: Saudi Port Authority (2005).

This port has an economic importance because of its effective role in export and import policy in the Eastern Region of Saudi Arabia, especially for the manufactured products of the Jubail Industrial City. This is because it is near to centres of production, which could lead to low costs of materials coming to Saudi Arabia and material export to world markets. According to the Director General of the Al-Jubail Commercial Port, Mr. Al-Tayeb (2005) the volume of the handled cargo (exports and imports) through the port increased considerably to 851,238 tons in 2003, up from 551,709 tons in the

previous year, however in 2005 exceeded 2000,000 tonnes (see Table: 6.6). The port is also set to play an increasing part in alleviating pressure on King Abdul Aziz Port in Dammam, 100 kilometres to the south. Furthermore, this port provides job opportunities for Saudi nationals, so it is playing an important part in the life of Saudis.

The Jubail Commercial Port consists of 16 deep water berths and has the capacity to handle all kinds of vessels except liquid bulk vessels: oil tankers, oil product tankers and petrochemical tankers and gas carriers. The old fishing port is also active, with 170 metres of quay, with a depth alongside of three metres that provides an important service in the off-loading of fish for local and inland markets. In terms of storage the Saudi Ports Authority has established open storage yards totaling 450,000 square metres, covered stores with total area of 87,000 square metres inside the port area, dangerous goods stores of 1800 square metres and storage yards with area of 900,000 square metres outside. The port has a vast area that can handle 14,000 containers in addition to a container station, the design of which is according to modern techniques of safety and fire fighting (SPA, 2003b).

6- Yanbu Commercial Port:

Yanbu Commercial Port is located on the west coast of Saudi Arabia approximately 206 kilometres north of Jeddah. It is a natural harbour sheltered by the mainland to the north and east and by coral reefs to the south and south-east. It is reached by a mile long channel. The port is considered to be Saudi Arabia's second Red Sea port, after Jeddah Islamic Port and is also the main port for Madinah, 160 kilometres to the east. In addition, it has served as the nearest gateway for seaborne pilgrims bound for the holy cities of Makkah and Madinah. Yanbu Commercial Port was, prior to 1978, relatively

small, with only two berths and able to accommodate vessels of up to 10 metres draught. But from 1979 until today, its expansion increased capacity to nine berths with the most modern facilities and equipment, and the capacity to handle more than three million tonnes of cargo per year, however in 2005 the port throughput was 1,175,581 tonnes (see Table: 6.7). Uthman (2000) stated that Yanbu Commercial Port has many of the constituents and characteristics required for it to continue to perform its role and become more effective in serving the national economy and development. The port has links to all regions of the country via a modern road network, together with the presence of branches of all government departments at the port, facilitating its usage.

Table 6.7: Yanbu Commercial Port Throughput Type of Cargo (Tonne)

CARGO TYPE	DISCHARGED	LOADED
BULK CARGO (SOLID)	1,001,905	20,000
BULK CARGO (LIQUID)	--	3,995
GENERAL CARGO	56,961	74,780
CONTAINERS	159	16,937
RO-RO & VEHICLES	579	265
LIVESTOCK	--	--
TOTAL	1,059,604	115,977
TOTAL PORT THROUGHPUT	**1,175,581**	

Source: Saudi Port Authority (2005).

According to the SPA (2000) Yanbu Commercial Port is suitable for handling different types of ships including general cargo, ro-ro, passenger ships, bulk-cargo etc. Also, it has a large fleet of cargo-handling equipment suitable for handling various types of general cargo, containers, unitized homogeneous cargo, heavy-lifts and dry-bulk cargo. In terms of storage, the cargo terminal is provided with extensive storage facilities. There are 6 transit sheds adjacent to berths and 3 warehouses with a total covered storage space of 61950 square metres. Additionally, it has a vast paved open storage area measuring approximately 529,400 square metres.

7- Jizan Port:

Jizan Port is ideally located on the southern-western coast of Saudi Arabia, around 190 miles north of Babalmandib Strait. It occupies the middle position between the ports of Sudan, Eritrea, Djibouti and Somalia, enabling its facilities to be used for the export of many Saudi industrial products to those countries. Also, locally, the Jizan region is linked to Asir and Najran by a good road network. In view of the proximity of those regions, which have a high population density and an active trade, the Port of Jizan is ideal for the import of their requirements and those regions nearby (Bakri, 2000). Based on Al-Ruwaithy (1983), Jizan Port consisted of two berths totaling 180 metres with 5-metre depth alongside. These facilities remained in use until the first stage of the modern port was completed in 1978. This stage was implemented as part of various measures to ease the mid-1970s congestion in the principal Saudi Arabian ports (Al-Sebaiheen, 1989).

Table 6.8: Jizan Port Throughput Type of Cargo (Tonne)

CARGO TYPE	DISCHARGED	LOADED
BULK CARGO (SOLID)	465,038	34,797
BULK CARGO (LIQUID)	--	--
GENERAL CARGO	27,662	280
CONTAINERS	--	--
RO-RO & VEHICLES	--	--
LIVESTOCK	--	--
TOTAL	492,700	35,077
TOTAL PORT THROUGHPUT	**527,777**	

Source: Saudi Port Authority (2005).

Now, the port of Jizan consists of 12 deep water berths receiving giant commercial ships. Furnished with modern equipment for handling goods, the Port has storage areas

for various types of goods and some 450 ships call at the port annually. Jizan Port is sheltered by a 3000-metre rubble-mounted breakwater and it is a modern, well-equipped, deep-water port with a highly skilled work force ensuring a quick efficient turn around of vessels at every opportunity.

The cargo imports of this port include livestock, barley (in bulk) and general cargo. The cargo exports include general cargo, foodstuffs, and cement clinker (bulk and bagged) (see Table: 6.8). In terms of storage, there is shed storage about 17000 square metres, open storage of about 60300 square metres and container terminal (open storage) of 122000 square metres.

8- Dhiba Port:

Dhiba Port is strategically located at the north end of the Red Sea coast of Saudi Arabia. It enjoys a natural harbour protected on all three sides by hills. This port has vast hinterland on the inland frontier up to the northeast coast of Saudi Arabia and extends up to the Mediterranean Sea on the maritime front. It is the nearest Saudi port to the Suez Canal and other Egyptian ports. The distance between Dhiba Port and the Suez Canal is 253 nautical miles where the vessel takes approximately 17 hours knots between them. The port was inaugurated in 1995 by Prince Fahd Bin Sultan, Prince of Tabuk region to serve the vast North West provinces of the Kingdom. Dhiba Port is considered the northern gateway to the Kingdom of Saudi Arabia and the smallest of the major Saudi Arabian seaports. It is also the newest.

Table 6.9: Dhiba Port Throughput Type of Cargo (Tonne)

CARGO TYPE	DISCHARGED	LOADED
BULK CARGO (SOLID)	168,970	--
BULK CARGO (LIQUID)	--	--
GENERAL CARGO	32,669	38,978
CONTAINERS	--	--
RO-RO & VEHICLES	233,202	52,138
LIVESTOCK	--	--
TOTAL	434,841	91,116
TOTAL PORT THROUGHPUT	**525,957**	

Source: Saudi Port Authority (2005).

The port is under continuous development by Saudi Ports Authority and has three berths of 200 metres and depths alongside of 10 metres. In addition, the port has excellent links with the interior and the regional centre, Tabuk some 200 kilometres inland via fast, superbly engineered highway through the dramatic hanat Uwayrid coastal range. The major regular users of the port are passenger ferries, including a fast catamaran, which bring some 330,000 people through the port during the year. From the Table (6.9), the port sees a large quantity of bulk cargo, bound for the northern hinterland on the excellent highway leading from the port (Miery, 2000). Regarding the storage area, there is a full covered storage area about 6000 square metres, a top covered storage area about 6000 square metres and an uncovered storage area about 150000 square metres.

From the throughput and the facilities of the ports one can notice that the ports are considered one of the major sectors which given government attention from the start of the five year development plans. Now the Saudi Ports have become major contributors to the Saudi economy and a link between the national and international economy. Bakr (2001) stated that Saudi Arabia has the largest port system in the entire Middle East, in terms of both berths and cargo volumes. When the Ports Authority was created, the

Kingdom had only 37 operational berths, but there are now more than 180 berths in six commercial ports and two industrial ports.

6.5 Conclusion

The development of transportation infrastructure plays an important role in the economic development of a country and, therefore, the kilometre-age of paved roads existing in a country is often used as an index to assess the extent of its development. The proper development of a road and rail network not only reduces the cost of transportation both in terms of money and time, but also helps in the integration of various regions within the country and better understanding of neighbouring countries at the international level. The transportation infrastructure in Saudi Arabia contributed to the development of the country by bringing in direct benefits from its role in the development of some tradable sectors such as agriculture, industry and commerce. Also, transportation infrastructure can contribute direct benefits in the mining field and the minerals sector generally, which is the focus of this research area as expressed in Chapter Seven. In general this contribution to the transportation infrastructure in the minerals sector may be considered as a progressive government policy to assist the tradable sectors to diversify away from the hydrocarbon sector. The role of transportation in this case is considered a very positive one.

However, one can note that during the 1970s and 1980s transportation was 'lagging', as the Saudi government was not spending wisely on transportation infrastructure; this was primarily because transport infrastructure was a non-tradable sector and required heavy expenditure. This led to contraction in the tradable sectors such as manufacturing and agriculture as they gained few benefits from this expenditure. This 'lagging' resulted

from a lack of policy and administrative absorptive capacity in the public sector which left government departments and regulatory frameworks ill-prepared for the challenge of translating resource revenues into economic development. Moreover, due to the various bureaucratic procedures between government agencies at that time, the distribution of interests between central cities and rural areas was neglected (Al-Metair, 1987). This phenomenon is addressed in the literature under the term 'Resource Curse'. However, some trends have emerged over the past few years that show Saudi Arabia can still effect meaningful change.

In vast countries like the Kingdom of Saudi Arabia, where the main population centres are not only scattered all over the country but are also separated by deserts, sand dunes, valleys and mountains, reliable means of transportation are essential. Therefore, the government of Saudi Arabia appreciates the importance of this sector and a lot has been achieved during the last few decades. At the present time, Saudi Arabia is served by more than 165,000 kilometres of roads, about one-third of which are paved and the rest, improved earth. In terms of railways, the Saudi Arabia government has started to expand its modest railway, by means of three large projects: the Landbridge, the Western Railway and the North-South Railway. Additionally, Saudi Arabia enjoys a number of ports that are equipped with the most modern equipment, machinery, installations and facilities for the handling of cargo. The Kingdom today not only enjoys an effective transportation system but also provides opportunities for choice between different transport modes. Thus, the growing complexity of the transport system is increasingly reflected in the competition beginning to emerge between transport modes.

Economic growth and the development of transportation infrastructure are closely related. One reason for this positive relationship is that transportation infrastructure

influences regional productivity through the facilitation of the efficient movement of goods and labour used in production. The reduction in time and effort required to produce goods translates directly into increased regional productivity. So, the critical issue for most mining projects in remote areas is the extent to which the costs of the required transportation infrastructure facilities are shared or allocated to the mining project alone. This affects the profitability of the mining projects considerably. Provision does exist for the Government to contribute directly to the costs of mining infrastructure, such as the energy for the projects, drilling of water wells and the workers' accommodation. It is the Government's intention that this should have a major positive effect on the development of mining projects. Therefore, it is necessary to identify and evaluate the level of the relationship between the transportation infrastructure and minerals development in Saudi Arabia in the next chapter (Chapter Seven).

CHAPTER SEVEN

EVALUATION OF THE RELATIONSHIP BETWEEN TRANSPORT INFRASTRUCTURE AND MINERALS DEVELOPMENT IN SAUDI ARABIA (THE CASE STUDY)

7.1 Introduction

National economic diversification is considered a strategic goal for the Saudi Arabian government. As mentioned in Chapter Four, "Dutch disease" exposed the Saudi economy to greater risk by making its export portfolio less diversified. Therefore, the importance of economic diversification is very significant, particularly when the exportable natural resources are expected to deplete in the foreseeable future. The minerals sector in Saudi Arabia is one of the economic activities that has already started to achieve this strategic goal of diversification away from oil-related activities as the main source of national income. Although non-oil mineral activities are far less significant than oil activities, their development has the potential to contribute to the economic diversification of the Saudi economy. Exploration and development of non-hydrocarbon mineral resources has, therefore, been a consistent objective of the government throughout successive Development Plans.

The territory of the Kingdom contains abundant strategic minerals such as phosphate and bauxite, as well as industrial raw materials that can be used in the domestic, regional and overseas markets after processing. The diversified geological terrain, strong economy and strategic location of Saudi Arabia in the GCC countries are among the most fundamental features attracting investment in the mineral industry. Furthermore, it is hoped that this sector will become a major source of revenue

generation for the Kingdom during the next decade. New mines and associated investments will also create employment opportunities in the Kingdom.

The development of a minerals sector has led to a high demand for transportation infrastructure, the provision of which has become a necessity. The number of roads and ports has increased to satisfy this demand and the railway network has expanded. The development of transportation infrastructure plays an important role in the economic development of a country, and therefore a critical issue for most mining projects in remote areas is the extent to which the costs of the required infrastructure facilities, including transportation, are shared or allocated to the mining project alone. This affects the profitability of mining projects considerably. Therefore, the main aim of this chapter is to identify and evaluate the relationship between transportation infrastructure, on the one hand, and phosphate and bauxite as strategic minerals, on the other hand, and thus the impact of this relationship on economic development in Saudi Arabia.

7.2 The minerals projects

As mentioned in Chapter Five, the phosphate and bauxite deposits exploration programmes will lead to the establishment of phosphate and bauxite industries and a number of downstream industries with encouraging economic indicators in the Kingdom. The two important deposits economically, Al Jalamid phosphates and Az Zubirah bauxite will be nuclei around which a number of industrial projects can be established. Furthermore, these projects will create a new pillar of the Saudi economy after hydrocarbons and petrochemicals and will make the Kingdom an important global player in the phosphate and aluminium industries. This strategy will assist the Saudi

economy to avoid the resource curse by investing away from oil sector as the main source of national income.

7.2.1 Al Jalamid Phosphates:

This project lies in the northern part of the Kingdom, about 120 kilometres east-southeast of Turayf city (see Map 7.1). The feasibility study for this project was prepared by the Ma'aden-Saudi Oger consortium and S.N.C. Lavalin of Canada and Jacobs of the U.S., and this study includes according to Abdullah S. Busfar, vice-president for corporate projects (2005) "The project consists of a phosphate mine and a beneficiation plant at Al-Jalamid, in Northern Saudi Arabia, a fertilizer production complex at Ras Az Zawr, on the shore of the Arabian Gulf."

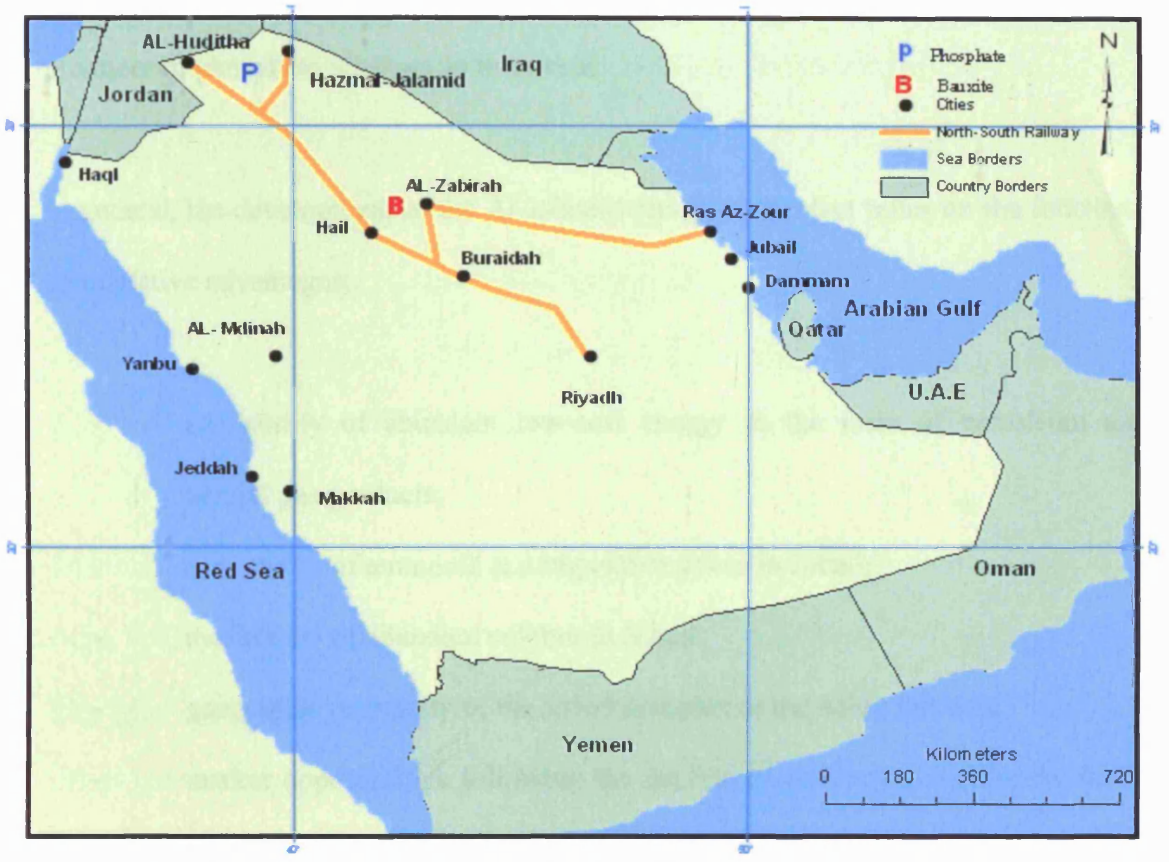
The feasibility study indicates that the Al Jalamid phosphate is estimated to contain 313 million tons of phosphates able to provide sustained production for at least 27 years. Also, the feasibility study indicates that 11 million tons of Al Jalamid phosphate will be mined annually, upgrading the concentration of ore to 32 per cent to produce 4.5 million tons of phosphate concentrates. This project is considering the largest single project that is occupying the thinking of Ma'aden planners is centered on a world-class deposit of phosphates. This resource could become a significant new source of exportable fertilizer in the form of dominium phosphate (DAP), which contains double the nutrient value of unprocessed rock. This is a big project and its location in the northern undeveloped part of the country would require the establishment of infrastructure for mining, processing and transport (Ma'aden, 2004).

Ma'aden assessed the mining plan at the Al Jalamid project to optimize equipment utilization. The deposits will be exploited by drilling and blasting, while draglines will remove the overburden and front-end loaders. Ma'aden also will provide the Al Jalamid project with a basic infrastructure, in that the energy for the project will be made available via turbine generators fired by fuel oil, with an installed capacity of 28 megawatt. Three water wells drilled and tested at the Al Jalamid site prove a sufficient water resource exists for the life of the project and hydrological modelling of the underlying Tawil aquifer has revealed a sustainable flow rate of 13 million cubic metres per year (Ma'aden, 2003). The initial plan for this project is to mine and beneficiate phosphate rock. The phosphate rock will then be transported via the North-South Railway (NSR) to the industrial city of Ras Az Zawr for conversion into dominium phosphate (DAP) fertilizer for export. The DAP export is expected to be phased into the market by 2009 to reach about 3 million tons per year.

The Ras Az Zawr site is about 60 kilometres north of Jubail Industrial City on the Arabian Gulf (see Map 7.1). Ras Az Zawr is a huge new industrial centre designed to serve the Kingdom's emerging minerals sector and has an $8 billion investment which will comprise the industries of the phosphate and aluminum projects. The main elements of the industrial centre at Ras Az Zawr will be three 4.1 million tons per year sulphuric acid plants, three 1.4 million tons per year phosphoric acid plants, and one 650,000 tons per year ammonia plant, to produce about 2.9 million tons per year dominium phosphate. The basic infrastructure of the industrial centre will include accommodation and utility services, port facilities, a 1,800 megawatt power plant, sub-stations and switchgear plus a dedicated port for Panamax-sized ships of up to 60,000 tons. In a press conference after the inauguration, Ali Al-Naimi, Minister of Petroleum and Mineral Resources and Chairman of Ma'aden Board of Directors, asserted that

"Ma'aden will build one of the first Mining Cities in the Middle East that will accommodate in one site all basic facilities for the production of mineral industries from mine to final product. He noted that the city will contribute in a unique manner to the growth of Saudi Arabia's Mining Industry" (Ma'aden, 2005).

Map 7.1: The North-South Railway of Minerals Projects



Source: Saudi Railways Organization (SRO) 2007

The estimated cost of the phosphate projects at Ras Az Zawr is around $1.9 billion, plus additionally about $400 million to develop the mines at the Al Jalamid site. In an interview the President of Ma'aden Dr. Al-Dabbagh said that the availability of molten sulphur and natural gas from within the Kingdom as a feedstock alongside the local phosphate rock will make it a highly competitive integrated production facility within

easy reach of growing Asian markets. Ma'aden intends to use the phosphate rock in the production of a number of value added products, such as fertilizers, chemicals, animal feed, and detergents. After the dominium phosphate plant reaches peak production in five years time, Saudi Arabia will be in direct competition with producer countries such as Morocco, Jordan and the USA, as it will produce a quarter of the world's DAP production. Furthermore, Al-Naimi (2004) said in that the phosphate fertilizer project will boost the Kingdom's non-oil exports and make the Kingdom the third largest producer of phosphate fertilizer in the world.

In general, the development of the Al Jalamid phosphate project relies on the following comparative advantages:

- availability of abundant low-cost energy in the form of petroleum and natural gas products;
- availability of ammonia at competitive prices in Jubail;
- availability of abundant sulphur in Jubail;
- geographic proximity of the Jubail complex to the Asian markets;
- market opportunities following the decline of production in Florida which has decreased by one third during the past decade; and
- approval of the necessary transport link between the Al Jalamid phosphates deposits and Ras Az Zawr.

Based on Ma'aden the development initiation of Al-Jalamid integrated phosphate project will be beneficial due to the following:

1. Maintain the Kingdom's future export capability through diversification of its products where the huge phosphate resources will play a major element;
2. Provide employment opportunities to Saudi work force, which is expected to directly employ about 1,500 personnel;
3. Indirect benefits to Saudi work force and institutions through related industrial and social services;
4. Enhancing urban development in the Northern Region;
5. Provide a transfer of technology in the field of phosphate fertilizers and other related chemical industries; and
6. Enhancing foreign capital investment.

7.2.2 Az Zubirah Bauxite:

This deposit lies in three main zones: the north zone, the central zone and the south zone, which together span a distance of 105 kilometres between Al-Qassim and Hail. The initial mining is earmarked for the south zone which is near Qibah town about 470 kilometres northwest of Riyadh (see Map 7.1). Smith (2003) stated that this reserve is the only known bauxite deposit in the Middle East. Bauxite is used in the production of alumina the main feed stock for the aluminum industry. The Bechtel Group carried out an extensive feasibility and marketing study on the deposit. Also, Ma'aden has signed a financial consultancy contract with Riyadh Bank and the Australian/New Zealand banking group to provide financial services for the feasibility study of the Alumina and Aluminum project. In interview with the Mining Manager of Aluminium Project Eng. Al-Shangiti (2006) said that the Aluminium Project includes the bauxite mine, an alumina refinery located on the Ras Az Zawr, an aluminium smelter located adjacent to

the alumina refinery, a port facility located at Ras Az Zawr, and infrastructure at both Az Zabirah and Ras Az Zawr to serve the production facilities.

The final feasibility study indicates that Az Zubirah bauxite is estimated to contain 126 million tons with an average grade of 57.3 per cent alumina and 8.2 per cent of silicon dioxide (USABC, 2005). Furthermore, Dr.Dabbagh said that the reserves of bauxite are sufficient for over thirty years with an annual rated capacity of 3.5 million tons of crushed bauxite ore. Ma'aden will provide the Az Zabirah project with basic infrastructure in that the energy for the project will be made available via two generators with an installed capacity of 750 KW. Water will be supplied from wells drilled into aquifers at a depth 200 to 600 metres below the site. The personnel accommodation will be in the nearby town Qiba. Efficient earth-moving equipment (scrapers) will be used and the bulk of the ore will be transported by truck to a stockpile alongside three railroad platforms to be loaded onto wagons. Therefore, Az Zabirah bauxite will be dependent on the same railway as the Al Jalamid phosphate, which is the North-South Railway (NSR), to carry the bauxite to an aluminum refinery to be located in the industrial city at Ras Az Zawr.

Based on Smith (2003), the feasibility study indicated that the project should not be limited to the construction of an aluminum refinery, but must aim to develop an integrated industry, because of the availability of bauxite, natural gas, petroleum coke and caustic soda, etc. in the Kingdom. Therefore, both the alumina refinery and the aluminum smelter will be part of Ma'aden's giant industrial mineral complex in Ras Az Zawr and the total cost of these projects is estimated at $3.8 billion including mine development and construction. The project's annual production is estimated at 1.4 million tons per year alumina from processing of the bauxite ore, and 623,000 tons per

year aluminum from processing of the alumina, as an initial output, which will then increase by about 200,000 tons per year because the smelter's design will allow for output to be more than doubled. Infrastructure facilities for the bauxite project at Ras Az Zawr will be shared with the phosphate project.

Dabbagh, the President and CEO of Ma'aden Company, said in an interview that Ma'aden will be seeking one or two strategic partners such as Alcoa Inc. or Alcan Inc., the world's biggest aluminum maker by sales, to participate in the project, and also that ninety percent of the production will be for export. The production of the Saudi alumina refinery and smelter is expected to increase the Gulf region's participation in the world production of aluminum from 6 per cent to 10 per cent of global production. The fully-integrated aluminum production facility will make Saudi Arabia one of the largest producers of aluminum by 2020, because the mined bauxite and the availability of cheap gas supplies mean its productions costs will be lower than any other aluminum producer. Sultan ibn Jamal Shawli, the Kingdom's assistant deputy minister for mining investment said in interview that "Ma'aden's major phosphate and bauxite projects will place the Kingdom on the world stage as a producer of downstream, value-added fertilizer and aluminum products." In addition, the global demand for aluminum is rising fast and eight million tons per year deficit in aluminum supplies is forecast by 2010 if recent levels of world economic growth continue.

Aluminum has a variety of uses such as kitchen foil, and high technological uses in the aerospace industry. Dr.Dabbagh indicated that the demand for aluminum is growing due to its characteristic of low weight and increasing use in car manufacture, power cables and paints. The Arabian Gulf area is considered one of the major, potential aluminum production areas. Dr.Dabbagh concluded that the projects will create new employment

opportunities for Saudi youth, establish new national financial resources and provide downstream Saudi products of international quality, competitive in international markets (cited in Ma'aden, 2002b)

Based on Ma'aden Az Zubirah Bauxite project will be beneficial due to the following:

1. provide direct and indirect employment opportunities for Saudi citizens;
2. stimulate related downstream industries; and,
3. increase the Kingdom's gross domestic product, (GDP) and improve its balance of payments.

7.3 Transport infrastructure for minerals projects

The transport infrastructure in the minerals areas, especially around the locations of phosphate and bauxite deposits are quite poor and almost nonexistent. Thus, in order to enhance the potential of the minerals projects and their exploitation, the improved transport infrastructure must be in place. In the past few years, two feasibility studies have been undertaken with a view to exploiting and transporting the Al Jalamid phosphate and Az Zabirah bauxite. The first option is to build a slurry transport pipeline and the second option is to build a railroad. This section compares these studies in terms of the benefits and problems of transport infrastructure and the methods for reducing mineral development costs.

7.3.1 The Slurry Pipeline

It is proposed that the phosphate concentrates will be transported as slurry through a 15-inch-diameter pipeline from the Al Jalamid area to the area of manufacture of DAP fertilizer. The design capacity of overall system throughput is about 4.5 million tons per year which will be reached after the initial two years of anticipated production. According to DMMR (1995) this option proposed two directions to transport the concentrates:

The first direction is about 1150 kilometres from Al Jalamid to the industrial Jubail city on the Arabian Gulf. This choice mainly depends on the availability of locally produced ammonia, sulphur and natural gas, and additionally the proximity of Saudi Arabia to major consuming markets. The capital cost for this project is estimated to be $346 million with operating costs estimated to be $2.02 million for a total of 6 pump station facilities. *The second direction* is about 703 kilometres from Al Jalamid to Haql city on the Red Sea i.e. the west part of the Kingdom (see Map 7.1). The capital cost for this project is estimated to be $282 million with operating costs estimated to be $2.07 million for a total of 4 pump station facilities and a valve station. This route to Haql appears to be shorter than the first route to Jubail but is conservatively defined to have a high point of 1600 metres above sea level. Therefore, it would be necessary to investigate the ability to bypass or tunnel this point and evaluate the cost impact of these choices that require significant wastage of energy in order to overcome this (Turney, 1999).

There are several problems involved in these two slurry pipelines e.g. the overall system throughput is about 4.5 million tons per year which necessitates the use of 15 outside diameter pipeline steel. This restricts the availability of suitable material from within the Kingdom as this diameter is considered to be non standard. Also, the pipeline steel is

the highest cost component within the project. Any change which affects the pipeline steel tonnage will impact the final price significantly. The cost of batching with water in these projects is considerable. Furthermore, to optimize these slurry pipelines would require field investigation to study constructability, geotechnical and physical conditions. Consequently, this option for transport infrastructure has about the downside of committing funds to an out of charter business which is economically less attractive than a railroad, which would act as a stimulus for economic development of the whole region (Ma'aden, 1999).

7.3.2 The Railroad

The railroad is called the North-South Railway (NSR) and its primary objective will be to connect the phosphate and bauxite mines at Al Jalamid and Az Zubairah to processing facilities located at the Arabian Gulf port of Ras Az Zawr. About 5.2 million tons a year of phosphates and about 3.3 million tons a year of bauxite would be transported to the smelters and refineries. In addition to mineral transportation, the North-South railway project would serve passengers and freight traffic from Riyadh to Al-Hudaitha. Relying on Ministry of Finance-Public Investment Fund to carry out the North-South Railway project, in May 2006 the Council of Ministers approved the licensing of a new firm named Saudi Arabian Railways (SAR) with a capital of $267 million and gave the company's general assembly the authority to float either full or part of its shares for public subscription.

The company is licensed to operate and manage the North-South Railway project, and additionally its related services and associated utilities, either directly or through firms with the required efficiency according to regulations. Moreover, the company is

authorized to transport minerals, raw materials, fuels, goods and passengers (Ma'aden, 2006). The licensing of this company comes after the Minister of Finance Dr. Ibrahim Al-Assaf signed a $136.8 million contract with a consortium of multinational companies led by the Louis Berger Group of the United States in November 2005, for the complete design and construction of a 2,400 kilometre freight and mineral transportation project. Besides the leading Louis Berger Group, other members of the consortium include Systra Engineering Consultancy Co. of France, Canarail of Canada and Saudi Consolidated Engineering Co. Khatib and Alami of Saudi Arabia. All the companies have a successful track record of accomplishing major engineering and railroad projects in the Middle East and the Mediterranean region (Hassan, 2005). The contract undertakes the general design of the transportation system and the operating plan, preliminary route definition, functional definition of systems and rolling stock, detailed design of the railway roadbed and track structure, and evaluation of SRO's existing infrastructure and superstructure. The contract also involves an economic and financial evaluation including options to offer passenger services or to build a 275km extension to Jordan (SYSTRA, 2005).

According to Saudi Arabian General Investment Authority (SAGIA) (2007) the Minister of Finance Ibrahim Al-Assaf, who is also the chairman of Public Investment Fund signed contracts in April 2007, valued at SR7.1 billion to build a north-south railroad project covering a distance of about 1,765 km for the transport of minerals and passengers. These contracts signed with a consortium of three international and national companies to build the project in 42 months. This project is divided into three major contracts for construction. The first contract for about 576 kilometres which will transport bauxite from the starting point at the Az Zabirah bauxite mine, with the line connecting through a direct link to the processing facilities at Ras Az Zawr. This

contract signed with a consortium consisting of the Binladen Group (in alliance with two German firms) and Mohammed Al-Swailem Co. in partnership with a German firm. The contract, valued at SR2.3 billion, involves railway, bridges, flyovers and tunnels.

The second contract is about 440 kilometres which will be from Az Zabirah to Al-Nafoud Desert. This contract signed with Al-Suwaikat Group of Companies (in alliance with Chinese firm). The contract, valued at SR1.9 billion, besides constructing flyovers, tunnels and bridges. The third contract is about 750 kilometres which will start from Al-Nafoud to Al-Haditha, Hazm Al-Jalamid and Al-Basita. This contract signed with Barclay Mowlem Co. of Australia in collaboration with Mitsui & Co. of Japan and Al-Rashed Co. of Saudi Arabia. The contract, valued at SR2.8 billion, involves railroad in addition to the construction of tunnels, flyovers and bridges.

This undertaking will require that more than 450 million cubic metres of sand and stone will have to be moved. In addition, the construction process covers the roadbed for 83 million m^3 of earthworks, concrete bridges for 254 sites and concrete culverts for 1059 sites. The main problem of this project is the costs associated with land acquisition and actual purchase price of land, especially in Riyadh and some agricultural areas (Al-Fadhil, 2006). Another issue is the location of this railroad through the desert, where the height of the dunes poses an enormous challenge for the contractors. Cited in Christina's article (2006) Klavs Wassard Hestbek Lund, a project manager for COWI said that "What sets this project apart is not only its scale but also its location, as the line will travel through extensive deserts where the height of the dunes poses an enormous challenge for the contractors," . Also he added that, "The extreme differences in levels mean that embankments of up to 60 metres in height have to be constructed. In addition we face the problem of sand drift".

With regard to the benefits of this project, Dr. Dabbagh (2004c) has said that "the construction of the proposed railroad from north towards south will contribute in the establishment of new mining projects with investments in excess of SR 22 billion. It will give a development boost to the national industrial sector and will be a new source of revenue for the country". Also, he said that "the railroad will not only link various regions of the Kingdom, but also be a powerful incentive for investment in mineral industries and other industrial enterprises, in addition to expanding the transport of oil and other petroleum products". In interview with 'Ahlan Wasahlan Magazine' (2005), Dr.Jubaira Al Suraisry, the Minister of Transport stressed his vision which considers "transport not only as a service to Saudi citizens but also as a major component in Saudi efforts to develop the national economy and to assume a significant and growing role in regional and international economics affairs". Furthermore, the railway line would also lead to the establishment of many other mineral projects worth SR5.5 billion to exploit the Kingdom's vast manganese, iron, nickel, titanium, silica and calcium carbonate.

7.4 Summary of findings

This case study dealt with the analysis of the relationship between transportation infrastructure investment and minerals development and looked at whether new transport infrastructure investment or an improvement in the system would result in economic development in the impact area in the form of employment growth, increased production, accessibility and location of industries. The main findings are as follows:

- Lack of infrastructure and non-availability of public services in the most promising mining areas (Al Jalamid Phosphates and Az Zubirah Bauxite)

have been major constraints on the exploitation of mineral resources. However, the Saudi representatives in Ma'aden Company claim that the North-South Railway, which links these minerals projects with their industries at Ras Az Zawr, will make the minerals sector a key economic sector that has promising potential to diversify the country's economic base away from oil.

- The minerals sector will become a third pillar of the economy after hydrocarbons and petrochemicals. It will have some positive effects on the national economy, such as constituting a source of additional revenue for the government and contributing to export diversification by generating additional minerals exports that should lead to avoiding the resource curse. Moreover, it is one of the main industrial activities sectors attracting foreign investment in the Kingdom.

- Al Jalamid phosphates will play a major role in the Kingdom's future exports. This project will enhance urban development in the Northern Region of the Kingdom. The phosphate industry provides a transfer of technology in the field of phosphate fertilizers and other related chemical industries. According to Ma'aden's estimates the phosphate fertilizer, with encouraging economic indicators, would make the Kingdom the world's third largest producer of phosphate fertilizer (Spencer, 1999).

- Az Zubirah bauxite will establish new national financial resources besides Al Jalamid phosphates and also provide downstream Saudi products of international quality, competitive in international markets. Furthermore, Dr.

Dabbagh the President and CEO of Ma'aden Company claims that Az Zubirah bauxite will boost the Gulf region's participation in the world production of aluminum from 6 per cent to 10 per cent of global production (Dabbagh, 2004c).

- Among the wide variety of strategy recommendations on how to avoid the resource curse is employment creation (Aissaoui, 2007). However, this strategy is not currently fully achieved in mineral projects in Saudi Arabia for two main reasons. Firstly, the expected growth in employment has not yet been realised and secondly, the Saudi labour force is inherently unable to carry out these projects due to its characteristics. According to Ma'aden (2004) the aluminum and phosphate industries will create employment opportunities which will generate 6,000 direct jobs and 40,000 indirect jobs for Saudi citizens who will work in the building and operating of the industry and associated projects. The Saudi labour force, only now being brought to competitive levels, as yet lacks the expertise to meet the construction, exploration and industrial requirements of the minerals sector.

- The North-South Railway will have impacts on firms not only through transport cost reductions but also through the scope for cost reductions throughout the logistics chain. Also, it will have a positive impact on the labour market through lowering wage levels and increasing the availability of labour because of the reduction in travel time. This railway will link key centres in the Kingdom such as Al Jawf, Hail, Al-Qassim, Majma'h and Riyadh thus making the area competitive for growth. Furthermore, it would also lead to the establishment of many other mineral projects to exploit the

Kingdom's vast manganese, iron, nickel, titanium, silica and calcium carbonate deposits.

- The impact of accessibility on the social, economic and physical aspects of life will be very apparent following the creation of the new transportation infrastructure in the Kingdom. The new railway will increase the level of economic activities inside the Kingdom. Indeed transport infrastructure appears so important to some enterprises that it is almost worth thinking of it as another factor of production. For example, the "economic cities" in Tabuk and Hail that will be a big boost to development in the region, mainly depend on the North-South Railway. Another aspect of better accessibility is the establishment of small markets in the small towns that the railway passes through, such as Qiba and Majma'h.

- The fieldwork conducted by the researcher indicates that the Az Zubirah bauxite project will play a major role in Qiba's development. For example, some markets have increased in size and economic activity, and accommodation, filling stations and restaurants have increased.

- The North-South Railway is connected solely with industrial and mineral development and currently there is a lack of regional and social development in areas away from the railway. Improved productive infrastructure could be used more efficiently to avoid the resource curse. Improved infrastructure plays an important role in reducing regional disparities and in improving the competitiveness of regions, by facilitating trade, the movement of labour,

and economies of scale. For example, transport investments in one region could lead to competitiveness problems in another.

- In the first stage, the North-South Railway will not meet the demand for social welfare. Social development is considerably influenced by the increased mobility conferred by transport development and for the average person this needs to increase the accessibility of places of work, suitable housing, shops, services and leisure activities.

- The strategic location of new industries relative to domestic and export markets is systematically influenced by the provision of effective transport infrastructure as analysis has shown that the North-South Railway has a major role to play in the choice of the minerals industry location at Ras Az Zawr.

- The transport infrastructure investment to ensure access to the east-coast of the Kingdom will be an important contributor to regional development, because of the export orientation of much of minerals industry. At Ras Az Zawr there will be huge potential for downstream industries as well, as there is potential to process minerals such as silica, magnesite, dolomite and calcium carbonates.

7.5 Conclusion

In Saudi Arabia, with lack of necessary infrastructure improvements, introduction of new transport infrastructure leads to large effects on economic performance. The results

of this analysis above have shown that transportation infrastructure provides a vital service to the local economy through its effects on minerals development. Therefore, the transport infrastructure should be accounted for as an important economic resource, the lack of which prevents normal economic development. Hence, government's role is to foresee future needs of an economy in transport infrastructure and fulfill them in the best way.

Regarding the significance of the minerals industry, the case study has shown that the mining sector has great potential to play a leading role in the diversification of the Saudi economy due to the Kingdom's enormous and relatively untapped mineral occurrences, large area (more than 2,000,000 square kilometres) and the increasing demand for raw materials both in domestic as well as international markets. The minerals industry in Saudi Arabia, which includes phosphate and bauxite, will become one of the main activities attracting foreign investment, and during the next decade it is hoped will be one of the causes of considerable economic growth in the region and the country. The mineral industry will also have several positive effects on the national economy, such as constituting a source of additional revenue for the government, increasing exports and contributing to export diversification, creating new opportunities for the creation of industrial activities in the Kingdom.

CHAPTER EIGHT

CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

Recognizing the dangers of relying on one source of income, exported oil, the government of Saudi Arabia has sought to utilize their huge oil revenues to develop other sectors of the economy. In this process, the complementarity between sectors has been realized; hence a "balanced growth" policy of development has been emphasized. Delineated and active planning in the form of Five-Year Development Plans has been implemented since 1970. In these plans serious efforts have been made to develop the minerals sector, especially during the last four development plans, taking into account the various constraints involved and the importance of this sector as a major source for economic diversification. Although there are many policies and tools that can be used to diversify the Saudi economy, this study focuses on the relationship between transport infrastructure and the minerals sector.

The research presented in this study has highlighted a number of issues that need to be carefully considered when examining the relationship between transport infrastructure and the development of the minerals sector. The main aims of this research as identified in chapter one have been met. One of those aims was to investigate the impact of the minerals sector on the economic growth of Saudi Arabia, with particular regard to highlighting the main characteristics of the Saudi minerals sector. Another was to examine the role of transportation infrastructure in the development of the minerals sector, with particular regard to putting forward suggestions that could lead to its

improvement. These aims were fulfilled through the analysis of documentation, official statistics, field observations and interviews. The design of the research was informed by a review of the existing literature, as well as the use of documentation and official statistics. The documentation and statistics were obtained from the Saudi Geological Survey (SGS), the Saudi Arabian Mining Company (Ma'aden), and the Ministry of Transport (MOT). Interviews were used to collect general information about both sectors, minerals and transportation in Saudi Arabia. Field observation was used to assess project activities and to obtain specific data on cases studies.

This chapter links the study's aims and objectives to its major findings. In addition, a number of recommendations are presented based on empirical findings. Some suggestions are given for possible future research in this area.

8.2 The main research findings

The first conclusion that can be drawn from this research is the valuable role that oil revenue has played in the process of economic development in Saudi Arabia. As explained earlier, Saudi Arabia was one of the poorest countries in the world before the discovery of oil, with low standards of living and fixed patterns of production, characterized by subsistence farming, fishing, some maritime trading amongst the Gulf states and nomadic herding: moving from one place to another with location being determined by the availability of water and pastureland for the herders and their animals. Since then, and particularly following the oil price increases in 1973-74 and 1979-80, oil revenue has increased dramatically which has enabled the kingdom to speed up the wheel of economic development by launching economic development

plans together with encouraging the private sector to play a major role in creating the modern Saudi Arabia.

There is no doubt that the economy of Saudi Arabia has grown dramatically over the past three decades, during the period of the five year development plans which started in the early seventies. However, the government of the Kingdom of Saudi Arabia has sought to allocate its massive oil revenues in a way that would transform its relatively undeveloped, oil-based economy into that of a developed, structurally diverse one. The government has made significant advances in modernizing the economy and developing its non-oil sectors in order to reduce dependence on oil export revenues and ameliorate the economic instability inherent in such dependence on a primary commodity. Moreover, the study concludes that this economic diversification is a key strategy in avoiding the "Resource Curse" which could expose the Saudi economy to greater risk by making it dependent on oil. This finding is similar to that reported by Sachs and Warner (1995b), Al-Hasan (1997), and Auty (2001a).

This study has shown that there are some countries that have abundant natural resources such as Australia, Norway, Botswana and Canada, that can provide a good example of successful development, while the majority of the resource-rich countries, such as Argentina, Mexico, Peru, Nigeria, Venezuela, and possibly including Saudi Arabia, provide an example of economic underperformance (Mehlum et al., 2006b). Saudi history (in chapter Four) has shown that any decline in oil prices or in the country's production of oil can prove disastrous for the economy in terms of budget deficits (Anderson, 1981; Cordsman, 1983; Nawwab, et al., 1995). This uncertainty is due to the economy's heavy reliance on a single export commodity, oil. With regard to the effect of a boom in one sector of the economy on the rest of the sectors, the oil sector boom in

the 1970s in Saudi Arabia conforms very closely with the assumptions of the Dutch disease theory, Auty (2001a) has also confirmed this result.

8.2.1 The Kingdom of Saudi Arabia as a resource abundant economy

Resource riches, such as oil reserves, have not proved to be the panacea to underdevelopment. On the contrary, they have become associated with a slowdown in economic growth across the world during the last three decades (Papyrakis and Gerlagh, 2003). With the benefit of hindsight, one can conclude that the Saudi government has failed to direct enough oil revenue to investment in manufacturing, agriculture, and education. Instead, much of the oil revenues has gone on consumption by the middle- and upper-income classes, for defense, and for public works that yield a low rate of return (Mikesell, 1997). With regard to the manufacturing sector, although manufacturing compensated for the modest size of the agricultural sector, it was dominated by oil refining which is a minimal diversification from oil extraction. Moreover, oil refining is capital- intensive and provides very little employment (Auty, 2001a). Hassan (1987) stated that the concentration of the industrial programme was based on the development of hydrocarbon based industries which the kingdom would exploit through an established economic advantage; industries essential to national security and regional manufacturing activities appropriate to the development of self sufficiency.

Together with petrochemical industry other industries developed include light and supportive industries, metal manufactures, construction materials and chemicals. The industry expanded in areas such as cement, industrial gases, intermediate petrochemicals, glass products, metal products, automotive parts, animal feed

concentrate, building materials and agro-industrial products. However, the performance of non-oil industry was not encouraging. The spending on industrial projects was relatively low due to certain recognised constraints such as lack of a skilled labour force. According to Auty (2001a) the growth within the manufacturing sector slowed to less than 5 per cent per annum 1990-95 compared with a growth rate in excess of 7 per cent 1985-90. In fact, an index of intra-industry trade that is taken as a measure of the degree of diversification and technical sophistication within the manufacturing sector, is much lower in Saudi Arabia than would be expected for a continuity its per capita income. Thus, the Saudi government failed to promote a highly productive manufacturing sector, which is regarded as the principal source of technological progress, to replace the reduction in export earnings following a decline in oil export prices. This result is similar to that reported by Mikesell (1997).

The development strategy of the Kingdom no longer assigns manufacturing industry the leading role in bringing about a more diversified economic base. Indeed, the service sector contributes a substantial portion to the economic diversification in the country, but that its share of the Non-Oil component of GDP has remained roughly constant over the past three decades. However, the service sector is the fastest growing part of the economy at present, with finance and business services, consultancies and property services prominent. Here the Kingdom could play the role of a regional pole which implies placing a much heavier weight on the services sector in achieving development objectives.

With regard to the private sector, it has remained stunted, and domestic private investors have directed their investments into real estate rather than invest in the manufacturing sector. Instead of promoting the traditional business-government dialogue and

cooperation, businessmen seek more subsidies and protection, tax-breaks and privileges (Abdel-Rahman, 2002). Furthermore, the recent conflicts and tensions in the region have adversely affected the investment climate and led to a delay in the implementation of some of the major private investments foreseen by the plan in such sectors as petrochemicals and mining (MOP, 2005). Consequently, the strategy of diversifying the economy by creating opportunities for private sector investors has made little progress.

The literature suggests that natural resource dependency causes a series of political dynamics, which when associated with oil and gas dependence can exacerbate adverse economic effects. For example, natural resource exploitation creates large economic rents, which accrue either to the government or to a few private owners of the resources. The empirical evidence suggests that countries with a large share of primary exports have bad growth records and high inequality, especially if the quality of institutions and the rule of law are bad (Frederick, 2007). In Saudi Arabia the rents are often distributed to those in control of the government and their relatives, rather than being used for broadly based national development (Mikesell, 1997). The literature suggests that there is a positive relationship between growth performance and good governance, where good governance has an important role to play in transforming resource abundance into economic development. The Saudi adjustment to the sharp fall in oil revenues is consistent with the thesis that resource rents relax economic discipline in the absence of a developmental state or consensual democracy.

There has been a lack of legal and regulatory frameworks to ensure transparency and adequate legal safeguards in the opening up of those markets to local and foreign investors. For example, the banks were owned by the princes and secured high returns (15 per cent in the late-1990s) on safe loans that included loans to the government

(Auty, 2001a). As a result, resource revenues induce corruption and rent-seeking incentives trump the returns on productive activities and stymie progress. Coupled with weak institutional constraints, this corruption reinforces existing inequality, and leads to slower growth in human capital, less entrepreneurship, and ultimately a hobbled economy.

Despite high expenditure on education in Saudi Arabia, the results have been disappointing. These efforts have succeeded on the quantity side of education and training but apparently failed on the quality and motivation side (Sirageldin and El-Ebraheem, 1999; Auty, 2001a). As a consequence, the national workforce was ill-equipped to flourish in a market economy. Private sector employers complain that Saudi graduates lack analytical skills and that they lack flexibility in their work practices (Financial Times, 1996). Thus, the countries that start relying on natural resource wealth seem to forget the need for a diversified and skilled workforce that can support other economic sectors once resource wealth has dried up and they start trying to diversify (Humphreys et al., 2007).

After the foregoing detrimental political and economic repercussions, the study formulates some preliminary solutions to address various private and public impediments to improving productivity and competitiveness that need to be formulated and implemented at different levels. The study concludes that combating corruption should be a priority for all governments. Thus, the government should establish a benign investment environment that includes regulatory and fiscal transparency, minimal bureaucracy, effective commercial law, and an appropriate regulatory regime. The literature suggests that better governance improves the investment climate by improving bureaucratic performances and predictability. Also, deregulation removes

bureaucratic forms of rent-seeking and replaces them with private sector competition (World Bank, 2003; UNDP, 2006).

This study concludes that good institutions are vital for averting a negative impact of natural resources. Moreover, good governance institutions are viewed as reducing uncertainty and promoting efficiency (North, 1981; Kolstad, 2007). The government of Saudi Arabia has realized that to promote a steady flow of technology, expertise, and capital into the country needs to establish a new agency which is considered an important distinguished leap for the Saudi economy. Thus, Saudi Arabian General Investment Authority (SAGIA) was established for this purpose: to deal and encourage foreign investors, and invite them to invest in Saudi Arabia (Alsaleh, 2006).

To forge a viable diversification and competitive enhancement programme, an attractive climate for private investment must be created to enable the private sector to assume its proper role in the local economic development process, through enhancing its investment in the production sectors. The study concludes (in Chapter Seven) that private participation in investment and employment could become significantly more diversified. To minimize the role of the public sector in the economy and the promotion of private sector activity and competitiveness, the privatization process should be speeded up and should include the full or partial privatization of public utilities and some large Government-owned industrial and other enterprises. The study concludes that privatization has been expanded in the past few years to include joint venture banks and public insurance companies. The Saudi government has also increasingly adopted BOT schemes to attract private investment in infrastructure, particularly railways. The literature suggests that privatization leads to better management of the enterprise, and

reduced opportunities for diversion of revenues to "off-budget" priorities (Boardman and Vining, 1989; Ascher 1999).

In recognition of the important role of science and technology in acquiring and enhancing national competitive advantage, the Kingdom (in the Eight Development Plan) is endeavoring to promote the national scientific and technological base to levels that would enable it to achieve the strategic objectives of socioeconomic development; the most important of which are economic diversification, enhancement of growth, and human development (MOP, 2005). In the past few years, there are some institutions concerned with promotion of creativity and innovation were established. For example, the King Abdul Aziz and his Companions Foundation for the Gifted, the Riyadh Science Foundation for increasing scientific awareness and the Department of the Gifted, under the Ministry of Education. Gylfason (2001a) stated that more and better education, which is a prerequisite for rapid economic development around the world: education stimulates economic growth and improves people's lives through many channels, by increasing the efficiency of the labour force.

8.2.2 The minerals sector

Faced with this disappointing performance, the Saudi government thinks that the mining sector has great potential to play a leading role in diversifying the Saudi economy. Mining is a vital sector in the economic development of countries such as Australia, Canada and Sweden, which have largely depended on their natural resources for the development of their economies (Alfi and Zagan, 2004). Furthermore, it has been regarded as a strategic factor for the inducement of future economic and industrial development in the country due to the Kingdom's enormous and relatively untapped

mineral resource base, including precious and base minerals as well as industrial minerals. There is also an increasing demand for raw materials both on domestic as well as international markets. Thus, the minerals sector has the potential to play a key role, but how will that potential be realised?

The literature argues that among the wide variety of strategy recommendations on how to avoid the resource curse, a number emphasize economic diversification away from the natural resource sector. However, this study provides a counter argument by highlighting the Saudi non-oil minerals strategy as a paradoxical example of successful economic diversification within the natural resource sector. This strategy affirms that economic diversification by non-oil minerals can be progressively extended through exploration, technological progress, and investments in appropriate knowledge. Indeed, minerals constitute a high-tech knowledge industry in many countries (Wright and Czelusta, 2002).

This study concludes that the aim of the Saudi government is to develop integrated downstream clusters of industry in the minerals sector, thus making the country a leading exporter in that regard. It therefore fulfils the very first criteria of processing the raw material into value-added products instead of exporting the raw materials for processing in more developed countries. The value addition that is taking place in the developed countries should in future take place in Saudi Arabia itself. Also Saudi Arabia has other advantages over the developed countries which dominate the world minerals industry, such as the location factor in terms of plant site close to input resources and the geographic proximity of Asian markets.

The challenges for the development of the minerals sector stem from the fact that the minerals industry will use petroleum and natural gas products as feedstock (such as ammonia and sulphur), and that it may therefore be affected by fluctuations in the unit price of oil. However, the widely disparate production costs of feedstock for the minerals industry would have significant implications for competitiveness. Another challenge for the development of minerals stems from the fact that the global mining industry has changed considerably in the 1990s. The role of markets and the private sector have become the driving forces whereas the role of the state has changed from owner and operator to regulator and administrator. Challenges facing the sector encompass reforms in public sector agencies and the establishment of an enabling environment for long-term private sector participation in minerals (Abdel-Rahman, 2002).

This study concludes that mining has been embraced by the Saudi government not only to diversify the national economy, but also to stimulate the economy, generate employment opportunities, attract foreign capital, and encourage citizens to invest their money. The government created the Ma'aden state mining company in order to achieve these goals. Within the context of these endeavors, a sizeable number of mineral deposits have been explored, and substantial knowledge of the Kingdom's geology and mineral potential has been gained, and as a result, a data base has been established that has helped to identify a number of mineral projects and deposits that give a sound basis for the development of the Kingdom's mining industry.

This study has revealed that the Saudi government is taking all the measures necessary to face the challenges that face the new promising mining investments during the eighth development plan in accordance with the reform policies formulated by the Custodian

of the Two Holy Mosques and the Crown Prince: for example, promoting manufacturing industries that depend on local mining products, encouraging and motivating banks and domestic financial institutions to extend credit and support to mining companies. In addition to the development of geological, technical and economic knowledge of mineral projects and relevant investment opportunities and completing the privatization of the Saudi Arabian Mining Company, Ma'aden (MOP, 2005).

In Chapter Five it was noted that the minerals discovered in the Kingdom of Saudi Arabia include phosphate, bauxite, gold, magnesium, gypsum, marble, iron ore, bentonite, copper, garnet, granite, graphite, high-grade silica sand, limestone, silver, and others. However, this study concludes that phosphate and bauxite minings in Saudi Arabia have become the main activities attracting foreign investment, and that during the next decade it is hoped that they will create considerable economic growth in the region and the country. As a result, the minerals sector will become a third pillar of the economy after hydrocarbons and petrochemicals. It will also have several positive effects on the national economy, such as providing a source of additional revenue for the government, increasing exports and contributing to export diversification, creating new opportunities for the creation of industrial activities in the Kingdom, and contributing to harmonious regional development and an improvement in level of regional inequality.

The Kingdom of Saudi Arabia is home to some of the largest phosphate deposits in the world. These are estimated at 3.1 billion tons, of which 1.6 billion tons is an estimated reserve, with 1.5 billion tons as a mineable resource. It is anticipated that the country could capture 16 per cent of the world phosphate market. Phosphate mining is the

principal pillar of some countries economies, for example: Morocco, Jordan, and Tunisia. Therefore, Al Jalamid phosphates can play a major role in the Kingdom's future exports and this project will enhance urban development in the Northern Region of the Kingdom. The phosphate industry can also stimulate a transfer of technology in the field of phosphate fertilizers and other related chemical industries. The development of a phosphate fertilizer industry, with encouraging economic indicators, the kingdom of Saudi Arabia has the potential to become the world's third largest producer of phosphate fertilizer furthermore; the proximity of Asian markets represents an additional competitive advantage (Spencer, 1999).

The Kingdom of Saudi Arabia is also rich in bauxite and has the potential to supply the aluminum industry in the GCC region. This reserve is the only known bauxite deposit in the Middle East. Az Zubirah bauxite could establish new national financial resources and also provide downstream Saudi products of international quality, competitive in international markets. Furthermore, it could boost the Gulf region's participation in the global production of aluminum from 6 per cent to 10 per cent. The aluminum and phosphate industries together could contribute $1.9 billion to the gross domestic product (GDP) of the Kingdom and would also create employment opportunities generating at least 6,000 direct jobs and 40,000 indirect jobs.

This study concludes that the mining sector is expected to experience accelerated growth during the next decade as a result of the new Mining Investment Code that will help attract domestic investors and boost foreign investment. This will, in turn, lead to increased total factor productivity, along with an increase in mineral exports, leading to a projected annual growth rate of some 7.9 percent during the Eighth Development Plan. The mining sector will promote substantial economic growth in the region and the

country, as a result of the fundamental features attracting investment in the mineral industry: the diversified geological terrain, strong economy and strategic location of Saudi Arabia in the GCC countries.

8.2.3 The transport infrastructure

The core of this study has involved an investigation of the relationship between transport infrastructure and the minerals sector of the Kingdom of Saudi Arabia. It is considered that transport infrastructure exists for the purpose of bridging spatial gaps, though these gaps can be expressed not only in terms of distance but also in terms of time and of cost. Therefore, the development of an effective, modern transport infrastructure can open many doors leading towards economic development; and transport can be seen as an initiator of economic development and also as an indicator of levels of economic development already achieved. This study concludes that the lack of necessary infrastructure improvements and the non-availability of public services in the most promising mining areas (Al Jalamid Phosphates and Az Zubirah Bauxite) have been a major constraint to the exploitation of the mineral resource base to date.

The government of Saudi Arabia understands the importance of this sector and a lot of progress has been made during the last few decades. At the present time, Saudi Arabia is served by more than 165,000 kilometres of roads. In terms of railways, the Saudi Arabia government has started to expand its modest railway network, by means of three large projects: the Landbridge, the Western Railway and the North-South Railway. Additionally, Saudi Arabia has a number of ports which are equipped with the most modern equipment, machinery, installations and facilities for the handling of cargo. The Kingdom today not only enjoys an effective transportation system but also provides

opportunities for choice between different transport modes. Thus, the growing complexity of the transport system is increasingly reflected in the competition beginning to emerge between transport modes.

Chapter Six highlighted the role of the state in the development of transportation infrastructure during the last 30 years. However, there are some critical findings relating to transport development, such as a lack of coordination and inadequate transport forecasting. Al-Metair (1987) stated that some transportation projects are viewed as wasteful, and unresponsive to the actual needs of the people. The government agencies who were concerned with transport construction were often not fully aware of future transport growth and needs. Moreover, the distribution of interests between central cities and rural areas was neglected because of various bureaucratic procedures between government agencies.

As a result, the excessive spending of the Saudi government on public infrastructure including transportation infrastructure during the 1970s and 1980s, as a non-tradable sector (as expressed in Chapter Four), came from a lack of policy and administrative absorptive capacity in the public sector which frequently leaves government departments and regulatory frameworks ill-prepared for the challenge of translating resource revenues into economic development. Hence, this policy led to contraction in the tradable sector which ultimately leads to the resource curse.

This study concludes from Chapter Seven that the North-South Railway is considered an economic lifeline for minerals development in the Kingdom, as it will facilitate the transport of raw materials and provide mobility for workers to reach the work place and for products to access the market place. Moreover, it should facilitate the diversification

of the national economy and has the potential to be a powerful instrument in promoting long-term growth and employment. The North-South Railway will have impacts on firms not only through transport cost reductions but also through the scope for cost reductions throughout the logistics chain. It will also have a positive impact on the labour market through reducing wage levels and increasing the availability of labour because of the reduction in travel time. According to Aissaoui (2007) the regional cooperation is considered a further means of diversification. Its potential stems from the economic and social diversity of key areas within one country. However, regional and social development in the area away from the North-South Railway has been neglected due to poor planning.

The analysis in this study has shown that the North-South Railway has a major role to play in the choice of the minerals industry location at Ras Az Zawr. Furthermore, this study concludes that the transport infrastructure investment to ensure access to the east-coast of the Kingdom will be an important contributor to regional development, because of the export orientation of much of the minerals industry. Lem, (2002) stated the positive effects of transportation infrastructure on the aspects of economic development through; production costs, industrial location, regional productivity and costs of inter-regional trade. At Ras Az Zawr there is huge potential for downstream industries, to process minerals such as silica, magnesite, dolomite and calcium carbonates.

This study concludes that at the beginning of the development plans the transportation sector was one of the reasons for the resource curse, because it could not be seen as having achieved a significant degree of diversification; it had not stimulated productive investment and greater non-oil output and it had failed to contribute to the expansion of export markets beyond oil products. Moreover, it failed to promote long-term growth

and employment. However, from the late 1990s until now, the Saudi government made considerable investments in promoting other productive economic sectors such as agriculture, industry and commerce. In addition, the transportation sector contributed to the development of the country by bringing in direct benefits from its role in the development of these sectors. Also, as mentioned in Chapter Seven, the transportation sector can contribute direct benefits in the mining sector and its development. Therefore, the transportation sector stimulated the productive sectors to diversify away from the oil sector, through increasing production, reducing travel times, increasing employment and improving accessibility. In this case, the transportation sector is considered as a catalyst for economic diversification which is considered one of the better solutions to avoid the resource curse.

Finally, this research urges Saudi policy makers to diversify the national economy away from oil in many ways, one of which is the exploitation of minerals by improving the transport infrastructure. This study concludes that the transport infrastructure improvements impact on transport cost reductions, products and labour markets by reducing journey times and commuting. In addition, this study expects that the investment in transport infrastructure will be a powerful instrument in promoting long-term growth and employment.

8.3 Recommendations

With reference to the foregoing conclusions the following recommendations are made to help the Saudi planners and decision-makers formulate future adjustments for improving their diversification policies.

1. In spite of there being many ways to diversify the Saudi economy, the study recommends that efforts should be intensified and expanded in the area of minerals development in order to achieve economic diversification and to maintain a thriving economy, and in addition to prepare the country for the inevitable future in the new post-oil world economy of the next few decades.

2. To avoid the negative impact of natural resources, the study recommends that the Saudi government should adopt good industrial and economic policy, supported by fiscal prudence and adequate institutional capacity.

3. The study recommends to the policy makers that emphasis needs to be placed on the redistribution implications of large transport infrastructure projects, in particular on the important economic resources locations and activities.

4. It should not be forgotten that the improved transport infrastructure performance is not only needed in strategic minerals areas (Phosphate and Bauxite), but expansion into other minerals areas is also required. Successful transport policies in their turn must bring together national needs as seen by the government and the aspirations of the investors in their own projects.

5. The study recommends to policy makers that they pay more attention to the wider impacts of transport infrastructure investment on regional development and to develop guidance for government.

6. The study recommends that there is a need to develop information about the transport infrastructure in Kingdom of Saudi Arabia in an accurate and ready to

use digital format for different costs (travel time or length) taking into account the traffic variables. This will help researchers investigate issues related to the accessibility in different minerals areas.

7. The study recommends that the diversification strategy should aim to expand investment opportunities for the private sector through legal and regulatory frameworks that would open markets to local and foreign investors in order to become a more important factor in the economic diversification process, thereby ensuring transparency and adequate legal safeguards.

8. In order to develop a successful privatization program, the study recommends that transparency, accountability, and credibility must be the most effective pillar for any government policy; therefore, it recommends that all government agencies should deal in a transparent way with private sectors.

9. A major issue in progressing towards the development of non-oil income is employment and human resources development. Therefore, this study recommends that the Saudi labour force should be brought to competitive levels to meet the requirements of mineral development. Additionally, 'Saudization' should be encouraged in the private sector by a skills enhancement policy.

10. With regard to general education, the study recommends that the reforming should be in educational system to be in line with market needs and with a knowledge-based economy. It also includes the courses on mining principles and practices should be taught in vocational schools and universities. Moreover, sending students and researchers to institutions of higher education abroad in the

various branches of science and technology of minerals would be advantageous to future minerals development.

8.4 Future work

Future research should extend the investigation of issues related both to the transport infrastructure improvements and mining projects in this thesis. The future projects include the following:

- One of the most needed areas of research is the study of the economic importance of expansion projects on the transport infrastructure side, such as the Western Railway and the Saudi Landbridge, plus the study of their impact on economic activities and the national economy.

- Further research should focus on other diversification strategies and their impact on the economy of Saudi Arabia, such as manufacturing and services.

- Further research should focus on the development of mining in the Kingdom of Saudi Arabia, especially strategic minerals that have large reserves such as iron, silica sand and feldspar. The analysis of the most recent minerals data from the Saudi Geological Survey and Ma'aden Company could provide useful information toward this end.

- Finally, this study does not cover the whole country; there is therefore a need to extend the research to cover new minerals areas and to open up the possibility

for additional investigation into the role of transport infrastructure in these areas. The interviews can be designed to identify the new mining sites.

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