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**The role of Industrial Development Banks in
Financing and Promoting Technological Change**

**The Case of the
Saudi Industrial Development Fund**

by

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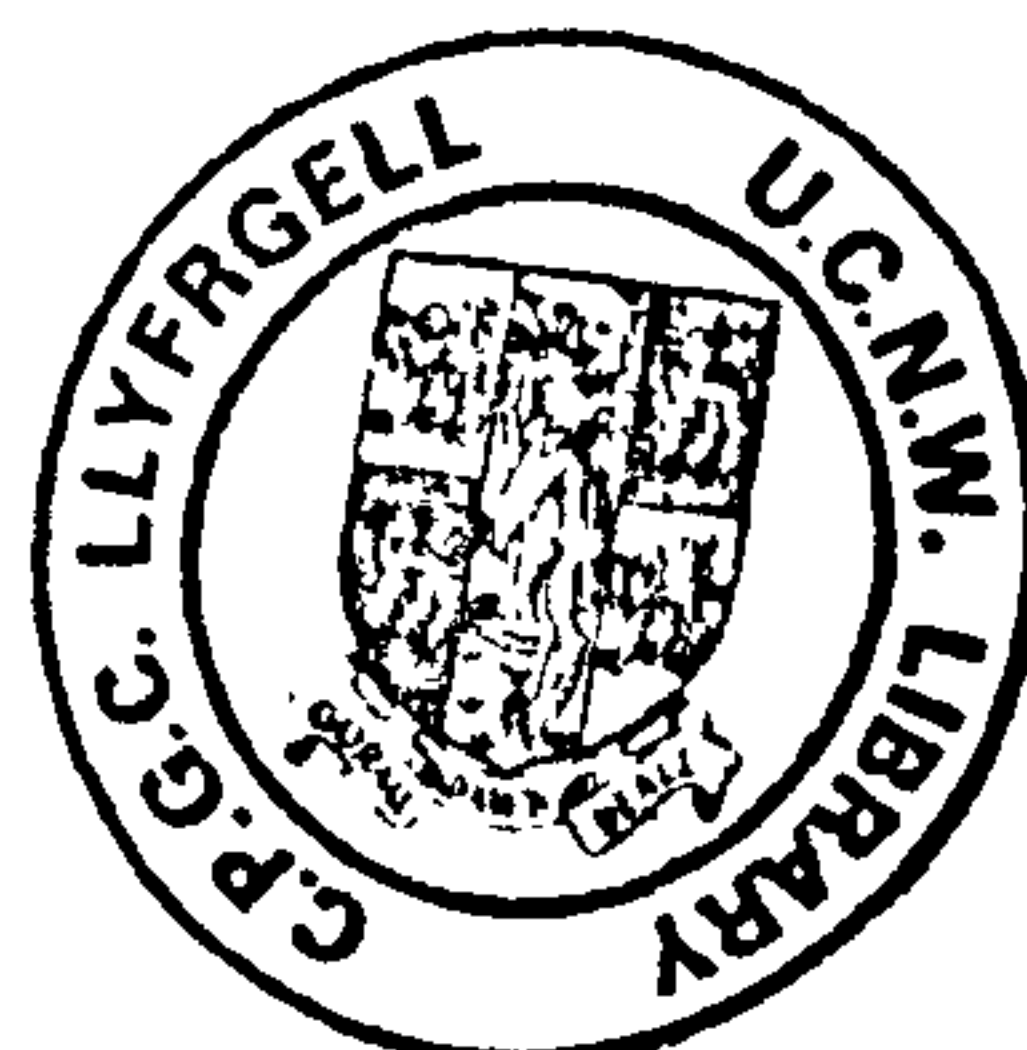
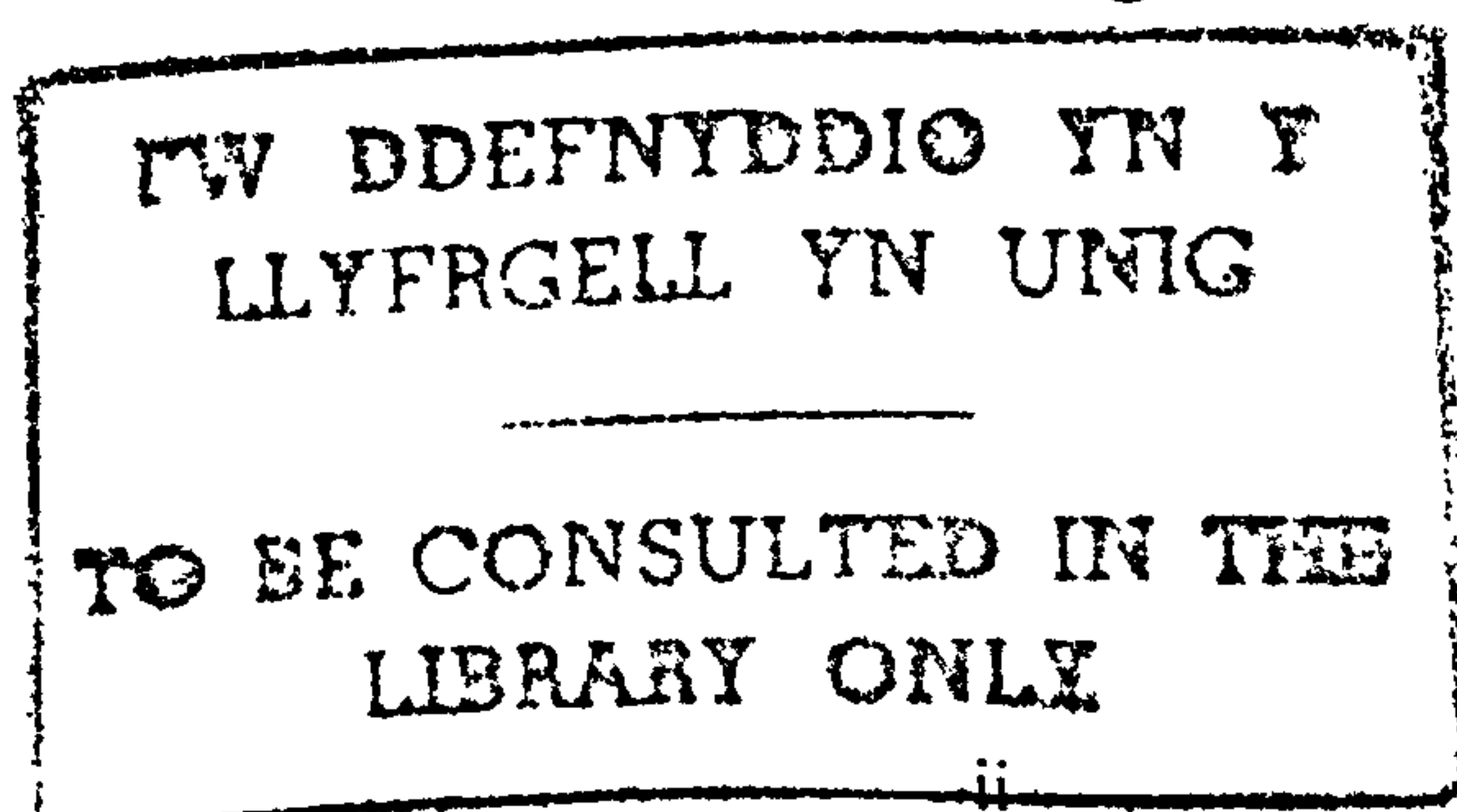
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**A Doctoral Thesis in Banking and Finance Submitted to the University
of Wales at Bangor**

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Acknowledgments

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made in this thesis. Thanks be to Allah for the opportunity offered to undertake the study and for his assistance that has enabled me to completed it.

Abstract

Over the past few years, there has been increasing interest in the technological functions of development banks. In addition to providing medium and long-term loans, a development bank can be a major player in a national science and technology system of a developing country, and can perform a very active technological role which may be at least as important as that of any specialised technological institution.

The chief concern of this study has been whether the Saudi Industrial Development Fund (SIDF), as a development bank, does in fact function as expected in influencing and stimulating technological change in Saudi Arabia. The main research questions explored were: How effective has the SIDF been as an instrument of technological change? Has it really been an essential factor in the processes of industrial and technological change or has it been no more than a source of finance?

It is evident that the ability of a development bank to promote and stimulate technological change, however, is influenced to a large extent by the country's national banking system and the position of the development bank in this system. Another important factor affecting a development bank's general attitude towards its technological function is the economic and technological sophistication of the country in which that bank is operating. The analysis of the technological role played by the SIDF within this thesis has been based on an understanding of the above characteristics. The study began in Chapter Two, by providing a broad picture of relevant economic and associated socio-economic characteristics of the Saudi economy: this served as a background to the more detailed analysis in the subsequent chapters. Chapter Three then reviewed the historical background of the banking and financial sector in Saudi Arabia. The organisational structure of the financial sector, together with the respective financial conditions of the banking system, was examined in order to put in perspective the role and the place of the SIDF within the overall financial system of SA.

Chapter Four was then dedicated to describing and analysing the main characteristics of the Saudi S&T policies and systems and special attention was given to certain technological institutions which have been established in order to promote and stimulate technological change activities in SA. Among these institutions, the role of the SIDF and how that institution fits into Saudi's S&T policies and systems was

highlighted. Chapter Five surveyed the body of relevant literature on the ways development banks might contribute positively to industrial and technological change. Chapter Six looked at the organisational structure of the SIDF and tried to shed some light on the Fund's lending record.

Throughout this thesis, it has been emphasised that any development bank has a multifaceted role in promoting and influencing technological change by means of many different channels of influence, and this is reflected in a wide variety of technological change indicators. For this reason we have utilised more than one method of data collection and investigation in order to test the hypotheses of this study. The empirical research of Chapters Seven, Eight, and Nine have all focused specifically on the examination of the technological role of the SIDF. Each chapter has employed one investigator or one method. These chapters explored some possible indicators of technological influence by the SIDF and revealed some interesting empirical findings.

The overall analysis of this study revealed that the SIDF has vigorously participated financially in the development of the private industrial sector in the Kingdom of Saudi Arabia; this has been achieved by extending free-interest medium and long-term loans. Over the period since its inception up to the end of 1995, the Fund had been able to approve a total of 1745 loans for the erection of 1365 industrial projects located throughout the Kingdom. Commitments to these projects totalled SR. 25,842 million, of which SR. 17,491 million has been disbursed.

In this study, however, we tried to focus more narrowly on the technological role of the SIDF and on the different ways in which the SIDF could contribute positively to technological change. Our investigation showed that the technological role as a strategic and operational target of the SIDF is very weak and has been largely ignored by the Saudi development planners as well as by the SIDF itself, despite the technological mission specified within the SIDF's Articles and the large volume of finance provided by the Fund

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Glossary of Terms and Abbreviations

ABEGS	Arab Bureau of Education for Gulf States
AGE	Firm's Age
BSDA	Bankers Special Deposit Account
CFA	The SIDF's Financial Assistance to Chemical Industry
CJVF	Chemical Joint Venture Firms
CR	Currency Ratio
EFA	The SIDF's Financial Assistance to Engineering Industry
EJVF	Engineering Joint Venture Firms
ESIS	Electronic Securities Information System
FIN	SIDF's Finance
FIR	Financial Inter-relations Ratio
FRF	Firms Received Finance from the SIDF
FRNF	Firms Received No Finance from the SIDF
GCC	Gulf Cooperation Countries
GDP	Gross Domestic Product
IDB	Islamic Development Bank
IDBs	Industrial Development Banks
IR	Saudi Interest Rate
JVs	Joint-Venture firms
KACST	King Abdulaziz City for Science and Technology
M ₂	Saudi Currency in Circulation, Demand Deposits, and Time and Saving Deposits
MIE	Ministry of Industry and Electricity
MOP	Ministry Of Planning
MR	Monetary Ratio
NIR	New Issues Ratio
NOCF	Number Of Chemical Firms
NOEF	Number Of Engineering Firms
OAPEC	Organisation of Arab Petroleum Exporting Countries
OGDP	Oil Gross Domestic Product
OLS	Ordinary Least Squares
OPEC	Organisation of Petroleum Exporting Countries
PETROMIN	The General Organisation for Petroleum and Mineral
PIF	Public Investment Fund
R&D	Research and Development
REDF	Real Estate Development Fund
S&T	Science and Technology
SA	Saudi Arabia
SAAB	Saudi Arabian Agricultural Bank
SABIC	Saudi Basic Industrial Corporation
SAMA	Saudi Arabian Monetary Agency
SASO	Saudi Arabian Standards Organisation

SCIs	Sepecialised Credit Institutions
SCB	Saudi Credit Bank
SFD	Saudi Fund for Development
SFP	Specialist Finance Programmes
SIDF	Saudi Industrial Development Fund
SIZE	Firm's Capital Investment
SSL	Saudi Skilled Labour Force
SSRC	Saudi Shares Registration Company
TCD	Technical Consultants Division
TYPE	Firm's Type
VCPI	Value of Chemical Products Imported to SA
VEPI	Value of Engineering Products Imported to SA

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Part One: Research Plan

Chapter One

Aims and Methodology of the Study

1.1 Introduction

Industrial development banks (IDBs) play a central role in promoting the process of industrial development; in order to be effective, they should influence and promote technological change and assist in building a base for new modern technologies. The chief concern of this study is to focus on how effective the Saudi Industrial Development Fund (SIDF) has been in promoting technological change in Saudi Arabia.

The study will not deal directly with macro-economic policies which are crucial in determining the rate and direction of technological change. Our concern is specifically with the ability of development banks in general, and the SIDF (as an IDB) in particular, to influence both the process and direction of innovation and technological change, as well as to identify some of the major internal and external factors which might affect this ability.

Because rapid economic development in all sectors invariably requires capital accumulation and efficient investment, the Saudi government has undertaken to expand credit facilities in an effort to speed progress. The main reason necessitating this move was the absence in Saudi Arabia of an efficient network of financial intermediaries which has impeded the growth of long-term capital. Saudi government intervention has thus been deemed to be integral in supplying the long-term needs of the economy. The government

consequently set about the task of establishing development banks, which are known in Saudi Arabia as specialised credit institutions (SCIs), as well as expanding the credit facilities in various sectors of the economy. The Saudi SCIs are public institutions whose primary functions are the channelling of medium and long-term capital and the sponsoring of viable investments in development projects. The SCIs operate under government control and are obliged to follow the government's investment schedule. They are instrumental in realising the objectives of the Saudi development plans.

The Saudi Arabian Agriculture Bank, the Saudi Credit Bank, the Specialist Funding Programmes, the Public Investment Fund, the Saudi Industrial Development Fund, and the Real Estate Development Fund were all organised as SCIs to provide medium and long-term credit facilities for the development of agriculture, industry, and housing. In the past, these institutions were financed by budgetary appropriations but recently they have experienced an acute shortage of funds. Moreover, the repayment of loans has been an additional problem facing these institutions. For example, in the early 1980s the Real Estate Development Fund instituted a discount of 20 % on all interest-free loans repaid within a specified time period (usually 25 years) with a further 10 % discount if repayment was made as one lump sum (Presley and Westaway, 1989).

1.2 Background

Industrial development occupies a key role in the economic development of the Kingdom of Saudi Arabia. This role derives from the long-term strategy of diversifying the economic base through the development of non-oil producing sectors. The Kingdom's current sixth development plan (1995-2000), like its predecessors, emphasises the importance of

industrial development in future economic growth. Since its formation in 1974, the SIDF has been at the centre of the industrial sector as a catalyst for industrial development.

Article two of the statute of the SIDF (1974) specifies that one objective of the fund is to offer interest-free medium and long-term loans to existing private industrial institutions to enable them to expand their activities, replace their equipment, and introduce new modern technology (see Appendix 1). Since its inception and up to the end of 1995, the Fund has therefore approved a total of 1745 loans for the creation and expansion of 1365 industrial projects all over the Kingdom. Commitments to these projects totalled SR 25,842 million of which SR 17,491 million has been disbursed. Can we say, then, that the fund has fulfilled, directly or indirectly, the expectation concerning its technological role in SA? This is the main research question addressed in this thesis.

1.3 Aims of the study

The functions, tasks and responsibilities of development banks continue to be the subject of different opinions and heated discussion (Demissie, 1985). At one extreme, there are those who believe that a development bank is like any commercial bank, but with more emphasis on medium and long-term lending activities. At the other extreme, there are those who consider a development bank to be a major promoter of projects, with a correspondingly wide range of responsibilities.

Diamond (1957), the United Nations (1980), and Diamond and Reghavan (1982) have pointed out that, in addition to being a financial institution whose main task is to promote and finance the private sector, a development bank can play a vital role in the advancement of underdeveloped sectors of the economy. Houk (1967) and Pickett (1985), for example,

stress the catalytic function of development banks which in many cases is even more important than the mere provision of funds. In addition to its banking function, they claim a development bank must attempt to relate to the problems of development, the magnitude and importance of which may vary from country to country. Thus, most development banks offer technical, financial and managerial consulting services at all stages of a project, and some of them have developed long-term training programmes in order to help provide local entrepreneurs and experts at all levels.

Both the experience of developing countries and the relevant economics literature show that a development bank has an even more important role to play. Presently, experts in development banking are directing a great deal of energy to another important role of development banks; namely, the promotion and influencing of technological change (Jequier, 1981; Weiss and Jequier, 1984; Okazaki, 1995; and Murinde, 1996). Industrial development banks can and should have a catalytic leadership role in the promotion of technological change in the industrial sectors of developing countries. Gerschenkron (1962) asserts that technology has always been one of the primary factors assuring a high speed of development in a backward country which is entering the first stage of industrialisation. It is clear that a developing country's material standard of living and the character of its social and cultural life have always been closely related to the industrial technologies used.

Emphasising this point further, Gerschenkron (1962) suggests that, during the industrial revolution, the banks in France, Germany, the United States and Japan were closely associated with the development and diffusion of new technology. Furthermore, Hu

(1984) and Jequier and Hu (1989) stress that throughout history development banks have been closely associated with the growth of new industries and with the development and diffusion of new technology. They argue that the direct and indirect roles of development banks in this process of technological change have received very little attention from specialists in development, scientific and technological agencies, or from the financial institutions themselves. Bhatt (1993) argued along the same lines when he postulated that development banks, acting as financiers, could play an active role in promoting technological change and thus help in upgrading the traditional forms of technology, as well as in the creative adoption of modern technology. It is also possible for development banks to play a promotional role in diffusing the process of industrialisation through encouraging the development of small and medium size industrial projects (see, for example, Diamond and Reghavan, 1982) but this cannot be accomplished without the appropriate technological effort.

The central concern of this study is to focus on the question of whether the SIDF does in fact function as expected in stimulating technological change in SA. The main research question is specified below:

- **How effective has the SIDF been as an instrument of technological change?**
- **Has the SIDF really made a difference to technological change or has it been no more than a source of subsidised medium and long-term credit?**

With these basic questions in mind, this study will seek answers to the following related questions:

1. How much financial assistance has the SIDF been able to provide to economically desirable projects in the private sector of the Saudi economy over a period of 21 years from 1975 to 1995?
2. How much direct or indirect impact does the SIDF have on the quantity and quality of technological change in the industrial sector in Saudi Arabia in terms of:
 - a) promoting better choices and uses of technology, encouraging innovation, and contributing to the building up of Saudi technological capabilities.
 - b) offering technological advice to industrial institutions within the Kingdom.
3. Can the SIDF make a greater contribution to building up the country's technological capabilities and stimulating the processes of technological change?

These are the questions that this thesis will aim to answer, by investigating data (on SIDF activities) over a period of 21 years.

1.4 The Methodology and the Structure of the Study

This study is divided into five parts. The first part, Research Plan, comprises Chapter One, "Aims and Methodology of The Study". The second part, Institutional Background, contains three chapters: Chapter Two, "The Nature of the Saudi Economy and Economic Planning in Saudi Arabia", which is concerned with the general economy of Saudi Arabia and aims to provide a broad picture of relevant economic, and socio-economic characteristics to serve as a background for more detailed analysis in subsequent chapters as well as focusing on the industrialisation process in Saudi Arabia; Chapter Three, "The Banking and Financial System in Saudi Arabia", which reviews the current organisation of the Saudi financial sector and its structure and operations; and Chapter Four, "Science And

Technology Policies and Systems in Saudi Arabia”, sets out and analyses the main characteristics of the science and technology policies and systems in SA and also focuses on the specific role of the SIDF in promoting technological change and how that role fits into the government’s technological policies. The methodology of these three chapters is mostly institutional, policy-orientated, historical and descriptive.

The third part of the study, Technological Change And The Respective Roles of Development Banks: Select Theoretical and Empirical Literature Review, comprises Chapter Five. Chapter Five is a theoretical and empirical literature review and the central theme of this chapter is to survey the body of literature on the role of development banks in shaping, stimulating and influencing the quantity and quality of technological change. In addition, the conceptualising of technology, and definition and elements of technological change are considered; finally, the ways in which development banks can play their expected technological role are analysed.

The empirical research of this study is contained in the fourth part, Empirical Research and Main Findings: this part builds from the proceeding Chapter Five and earlier chapters. Part four includes Chapters Six to Chapter Nine. Chapter Six, “The Saudi Industrial Development Fund” presents the features and organisational structure of the SIDF and also analyses the SIDF’s sanctions and disbursements to different industries. The methodology is descriptive and analytical and the annual reports of the SIDF constitute the major source of data for this chapter: uniform data are available for each industrial sector, covering the study period, from 1975 to 1995.

Chapters Seven to Nine, focus specifically on an examination of the technological role of the SIDF and they essentially, comprise the main empirical research of the study. Chapter Seven, "The SIDF and its Technological Role - Case Study -", examines all the internal and external incentives and penalties that might affect the ability and willingness of the SIDF to promote and influence technological change in SA. The case study covers the SIDF, as the supply side, and Saudi industrial firms, as the demand side. The methodology deployed is survey questionnaires and structured interviews. In this chapter, we will develop a view of the technological role of the SIDF, and this will assist us in examining some of the major internal and external factors which influence the ability and willingness of the SIDF to act in this respect.

Chapter Eight, "The Effect of the SIDF Funding on the Rate of Technological Change in SA - An Econometric Analysis- " is concerned specifically with understanding more fully the technological role of the SIDF. First, an overview of the empirical models of technological change is presented, and then specific empirical work is undertaken. This chapter investigates the relationship between the amount of funding provided by the SIDF and the growth of technological change in SA measured by the number of new Saudi chemical and engineering firms established. The analysis focusing on two important industrial sectors in SA; namely, the chemical and engineering sectors, which are considered to be the most dynamic sectors of the Saudi economy. These two sectors illustrate effectively the degree of industrialisation and technological change in SA. The SIDF's total commitments to projects in these sectors reached SR 12,464 million in 1995, representing approximately 48 % of the total loans that have been approved by the SIDF

since its establishment up to the end of the year 1995. Consequently, the chemical and engineering sectors provide the best empirical data source for an explanation of the link between SIDF funding and support and subsequent technological change.

Chapter Nine “ The SIDF and Technological Change Activities in Saudi Industrial Firms: - A Field Survey Analysis - ” analyses the impact the fund has had on the extent and nature of technological change activities in manufacturing industries of Saudi Arabia. During the period from 1970 to 1995 the number of factories operating in Saudi Arabia rose from 199 to 2380. Of these 2380 factories, 1365 received financial assistance from the SIDF. In this study, over 430 Saudi firms were surveyed by means of a set questionnaire. The survey dealt with two groups of firms: Group One, those financed by the SIDF; and Group Two, those which had not received any financial assistance from the Fund.

Using a cross-tabulation analysis, the researcher examined whether there was a statistically significant relationship between the direction of technological change activities in the chosen firms and financial assistance received from the SIDF. Some of the activities used to assess the level of technological change were: the existence of a special department for designing and developing new products; a firm's involvement in new product development or the upgrading of existing products; a firm's involvement in the development or upgrading of its production methods; a firm's involvement in the development or upgrading of its machinery and equipment; cost reductions; the adaptation of existing products and processes to local conditions; spending on R&D; and other types of technological change activities.

Using an appropriate regression model (the probit model), the influence of the SIDF and other selected variables on the decision of the Saudi firms to engage in some technological change activities was also measured empirically.

Chapter Seven, Eight and Nine will enable us to have a better understanding of the technological role played by the SIDF. The overall methodology deployed in these three chapters, then, is that of a triangulation approach. In order to address the main research question of this study, a detailed case study, a selected econometric investigation and a field survey (including structured interviews) as well as further related statistical analysis are all deployed. Nachmias Chava and David (1996) argue that to minimise the degree of specificity of certain methods to particular bodies of knowledge, a researcher can use two or more methods of data collection to test hypotheses and measure variables; this is the essence of triangulation. For example, a structured questionnaire, they argue, could be supplemented with in-depth interviewing, existing records, or field observations.

The fifth part of this study, Conclusions, comprises Chapter Ten "Conclusions, Recommendations and Limitations of the Study". In this chapter a synthesis of the material and the findings from all the previous chapters is made, and some coherent policy implications for both the Saudi government and the SIDF are proposed. The chapter also discusses the limitations of the present study, and finally makes suggestions for possible areas of further research.

Part Two: Institutional Background

Chapter Two

The Nature of the Saudi Economy and Economic Planning in Saudi Arabia

2.1 Introduction

This chapter is concerned with the overall economy of Saudi Arabia. Its aim is to provide a broad picture of relevant economic, and socio-economic characteristics that will serve as a background to the more detailed analysis in subsequent chapters. It begins by providing a general overview of the Saudi economy. This is followed by a brief survey of planning and development in Saudi Arabia. Particular attention is also given to the role of industrialisation in Saudi Arabia.

2.2 Background

The Kingdom of Saudi Arabia is an Arabic Islamic monarchy with a political system lodged in Islamic traditions. Its rules and regulations ought to be governed by the Holy Quran and the teachings and sayings of the prophet Mohammed (Sunnah) which call for peace, justice, equality, consolation and respect for the rights of the individual. Saudi Arabia as a nation state was established on 23rd September 1932. It lies at the crossroads of three continents - Europe, Asia and Africa. It occupies about 80 % of the Arabian Peninsula and is approximately the size of Western Europe; 2,240,000 square kilometres, with a coastline of

Chapter Two

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2.1 Introduction

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1900 kilometers on the Red Sea and 610 kilometers on the Arabian Gulf. It is divided into five regions with an estimated population of about 13 million.

Saudi Arabia's economic system is based on free and private enterprise. The commitment of Saudi Arabia to a free economy derives from the teachings of the nation's religious code and its social traditions. Economic and social changes cannot be imposed by the government alone, but must come about through increasing participation of all elements of society in both the process of development and its benefits. To pursue this understanding, Saudi citizens have the opportunity to initiate and participate in economic activities and reap the rewards of their enterprise and hard work.

Saudi Arabia possesses a quarter of the world's proven oil reserves and is the largest exporter of oil in the world, producing currently (1996) about nine million barrels of oil a day. Dependence on oil is the obverse of the advantages derived from the abundance of oil. Rapid expansion of oil production has provided the Kingdom with both government revenues and foreign exchange to finance development. However, economic growth in Saudi Arabia, as this chapter will explain, has been primarily a product of this one sector rather than the substantial development of agriculture, mining and manufacturing sectors. Over dependence on oil has led to a strong policy conviction that the economy needs to be developed *via* diversification of production, exports and sources of government revenue. The Saudi government accordingly has announced some policy initiatives to deal with this present economic situation. In May 1994, King Fahd revealed the government's intention to relinquish many of the productive and beneficial services so that national capital may

participate in them. The Kingdom's authorities view economic diversification and the building of a strong industrial base as essential for the country's long-term economic health.

One of the key objectives of the country's succession of five year plans is the rapid development of non-oil industries. In 1974, the Saudi Industrial Development Fund (SIDF) was established to assist in financing large and medium industries. In 1976, Saudi Basic Industries Corporation (SABIC) was established to be responsible for the Kingdom's petrochemical industry. Other bodies and organisations were also set up to promote industrial development in the private sector such as: the National Industrial Company; the Saudi Venture Capital Group; the Saudi Advanced Industries Corporation; and the Saudi Industrial Development Company.

This essential metamorphosis in the Saudi Arabian economy and the policies and programs undertaken to reduce the dependence on oil and make a major contribution to the growth and diversification of the Saudi economy will be presented and discussed in the sections which follow.

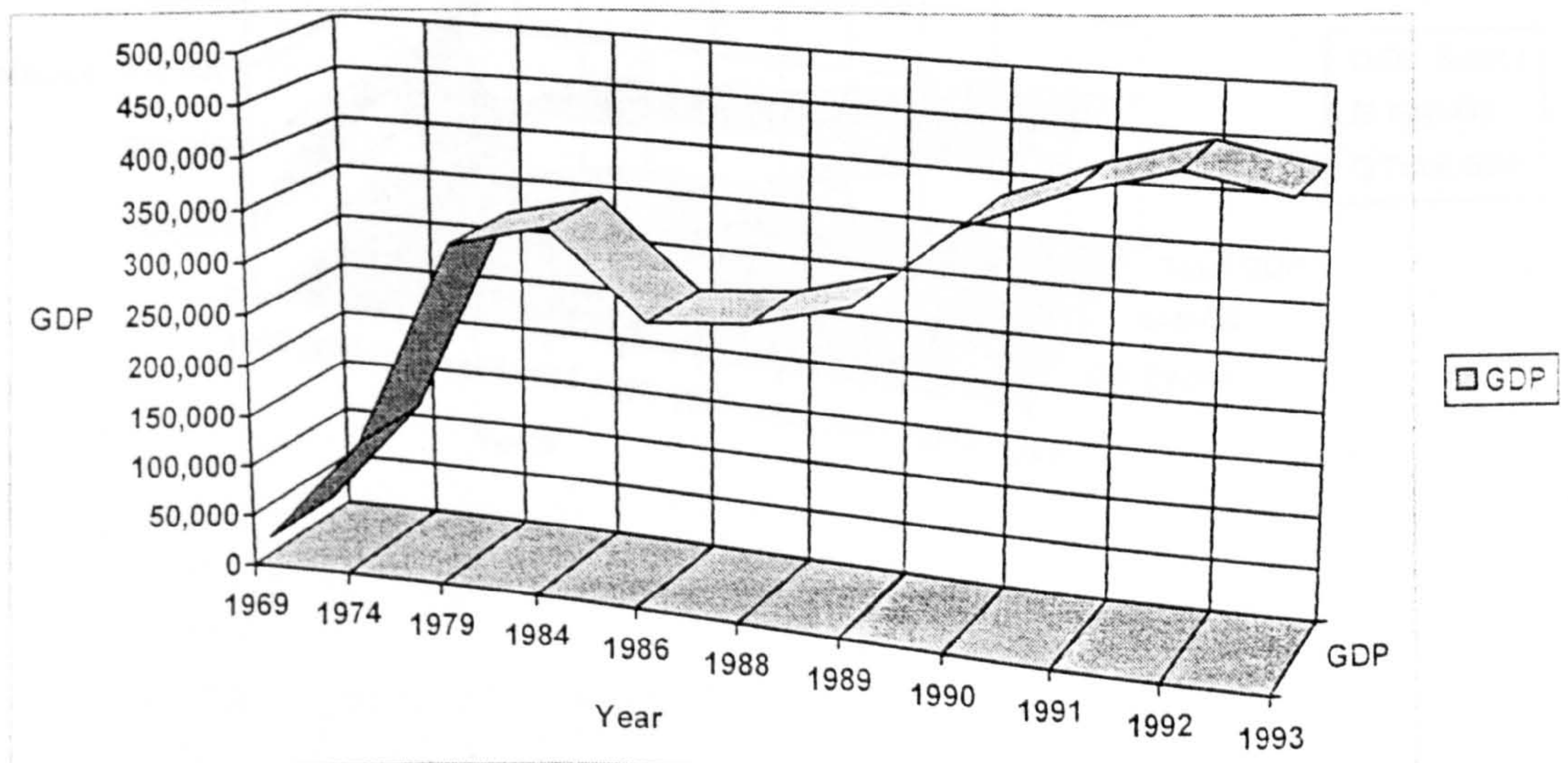
2.3 An Overview of the Saudi Economy

The aim of this section is to describe the features of the Saudi economy and to analyse the changes that have taken place in its various sectors. The dramatic change that has occurred in the oil sector has given the private sector a very important role to play in the future. The effects of the changes in the oil sector and the role of the private sector will be discussed in detail alongside a survey of the key changes to all sectors of the economy.

2.3.1 Gross Domestic Product Growth Rates

Economic performance can be measured not only by the growth of output and productivity but also by the changing structure of the economy (Presley and Westaway, 1989). Studying the growth of GDP will help to give at least a snapshot picture of the growth of the Saudi economy over the past twenty years. The gross domestic product showed substantial growth in the early 1970s (see Figure 2.1). The value of all goods and services produced by the country in current prices rose from SR. 16.6 billion in 1969 to SR. 324.1 billion in 1979. It is not surprising that the GDP increased very sharply because those years saw a substantial increase in the price of oil. In 1986 the GDP declined to SR. 267.8 billion, mainly due to the drastic fall in the output of the oil sector. In 1993, GDP increased to SR. 434.6 billion. This was also due to the extreme high production of oil: the value of the oil sector increased from SR. 67.5 billion in 1986 to SR. 158.4 billion in 1993.

Figure 2.1
Gross Domestic Product in Producers' Values
Million Saudi Riyals (in current prices)

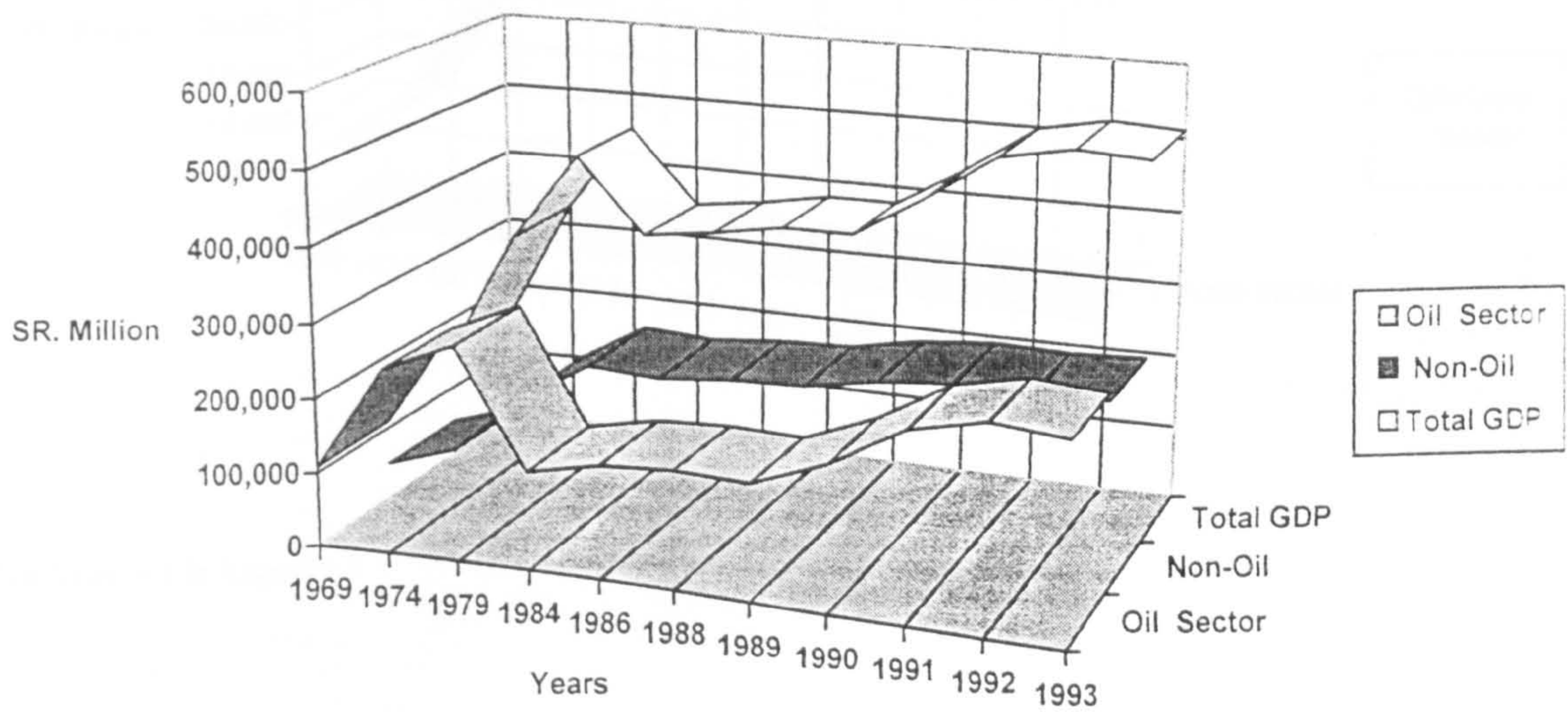


Source: Table A-1 in Appendix 2

Converting the nominal growth into real growth does not change the analysis given above. The real GDP at constant prices followed a similar pattern (see Figure 2.2). In 1969, the value of all goods and services produced was SR. 157.8 billion and in 1979 the real GDP peaked up to SR. 448.8 billion. The real GDP of the non-oil sector measured at constant prices of 1984 expanded at an annual average growth rate of 8.3 %; from SR. 48.7 billion in 1969 to SR. 214.9 billion in 1984. It increased then to SR. 250.5 billion in 1993 with an annual average growth rate of 1.5 % over the previous year.

Figure 2.2

Real GDP by Oil and Non-Oil Sectors

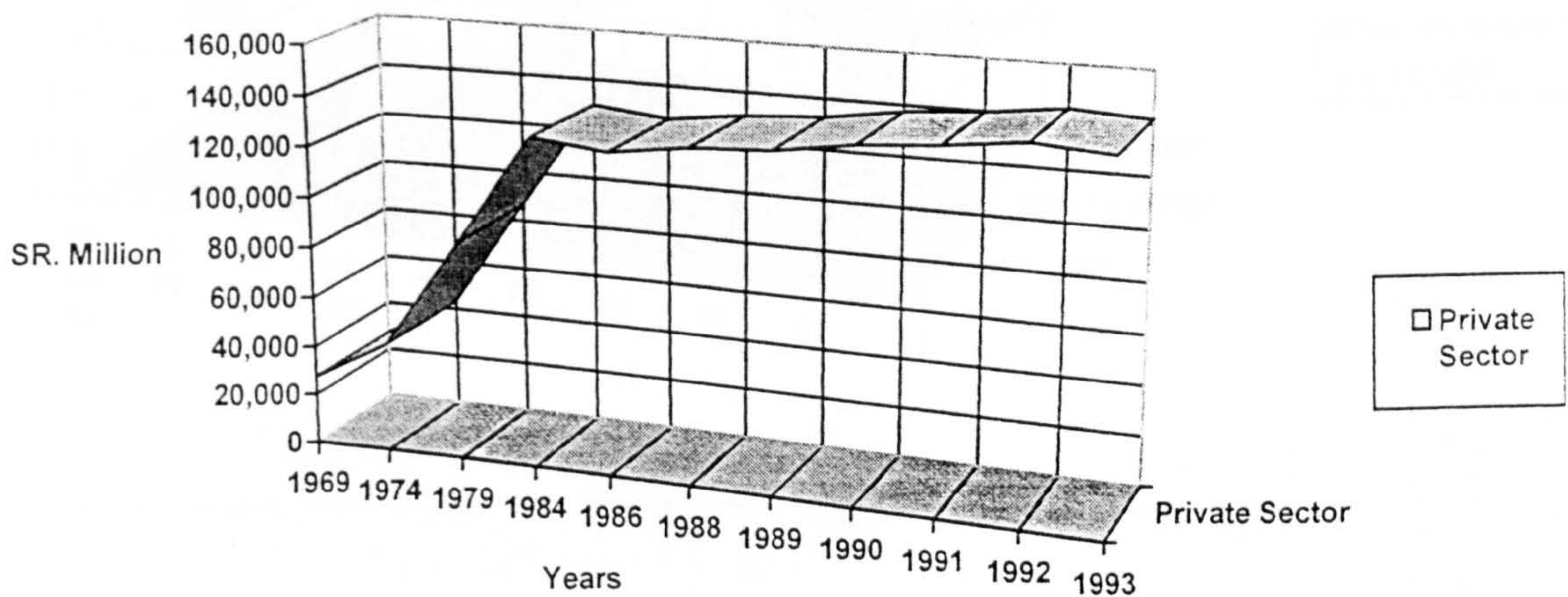


Source: Table A-2 in Appendix 2

The performance of the private sector including public enterprises is very similar to the performance of the non-oil sector. The contribution of the private sector in real GDP measured at constant prices increased from SR. 27.6 billion in 1969 to SR. 131.4 billion in 1985. However, it declined in 1986 to SR. 126.8 billion, but rose gradually to SR. 141.8 billion in 1993 (see Figure 2.3).

Figure 2.3

Performance of the Private Sector



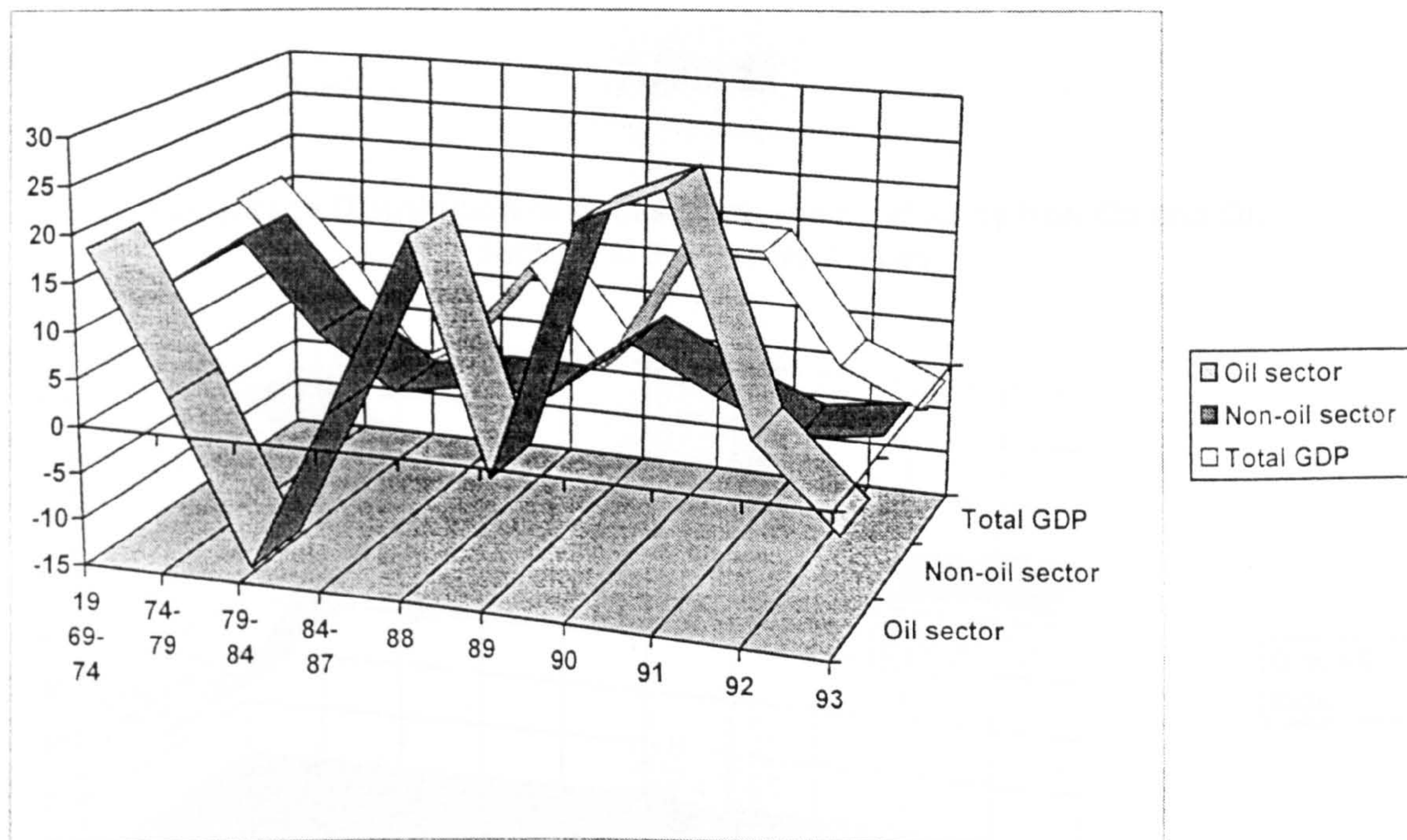
Source: Table A-2 in Appendix 2

Overall, during the first four government development plans (1970-1975, 1975-1980, 1980-1985, 1985-1990) the economy of Saudi Arabia has been able to achieve an average

annual growth rate of real GDP of 15.7 %, 6.5 %, -5.0 % and 1.7 % respectively, whereas average annual growth rate during 1969 to 1993 was 3.1 % (see Figure 2.4).

Figure 2.4

**Average Annual Growth Rates for Gross Domestic Product
by Oil and Non-Oil Sectors in Producers' Values
(at 1984 constant prices)**



Source: Table A-3 in Appendix 2

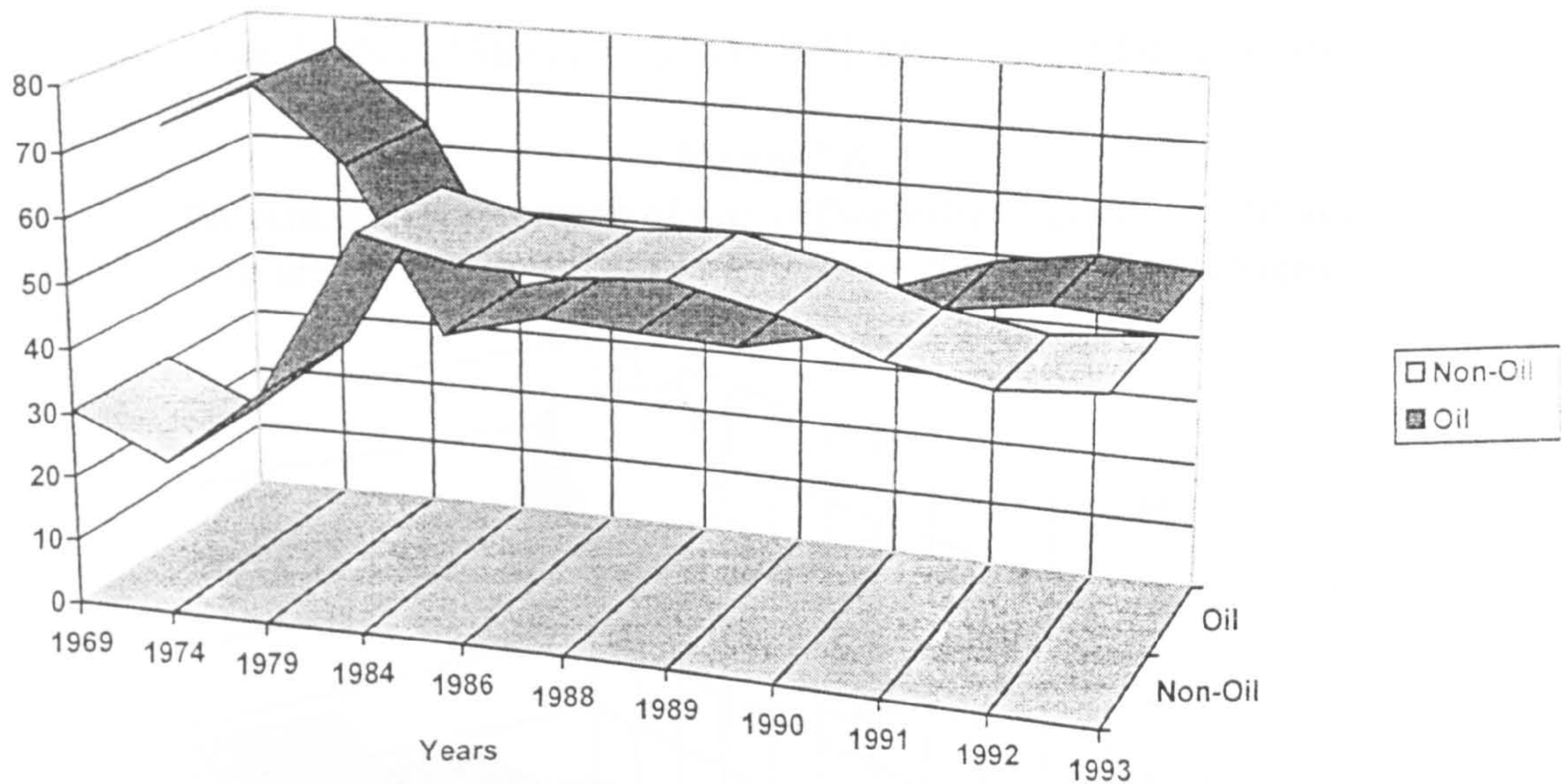
2.3.2 Gross Domestic Products by Sectors

Increasing the volume of output of goods and services, however, is not the only measure of economic development. The distribution of the Saudi gross domestic product according to economic activities is also important: Figures 2.5 and 2.6 give a more detailed breakdown of the Saudi economy. Figure 2.5 shows that the share of the oil sector in total GDP at

1984 constant prices increased from 67.9 % in 1969 to 75.3 % in 1974. This increase did not last long since it began to decline to 32.4 % in 1985 and recovered again, but not more than 50.2 % in 1993. The share of the non-oil sectors in the GDP in constant prices rose from 30.3 % in 1969 to 66.4 % in 1985. Thereafter, it fluctuated and reached 48.2 % in 1993.

Figure 2.5

Percentage Distribution of Gross Domestic Product by Non-Oil and Oil Sectors in Producers' Values



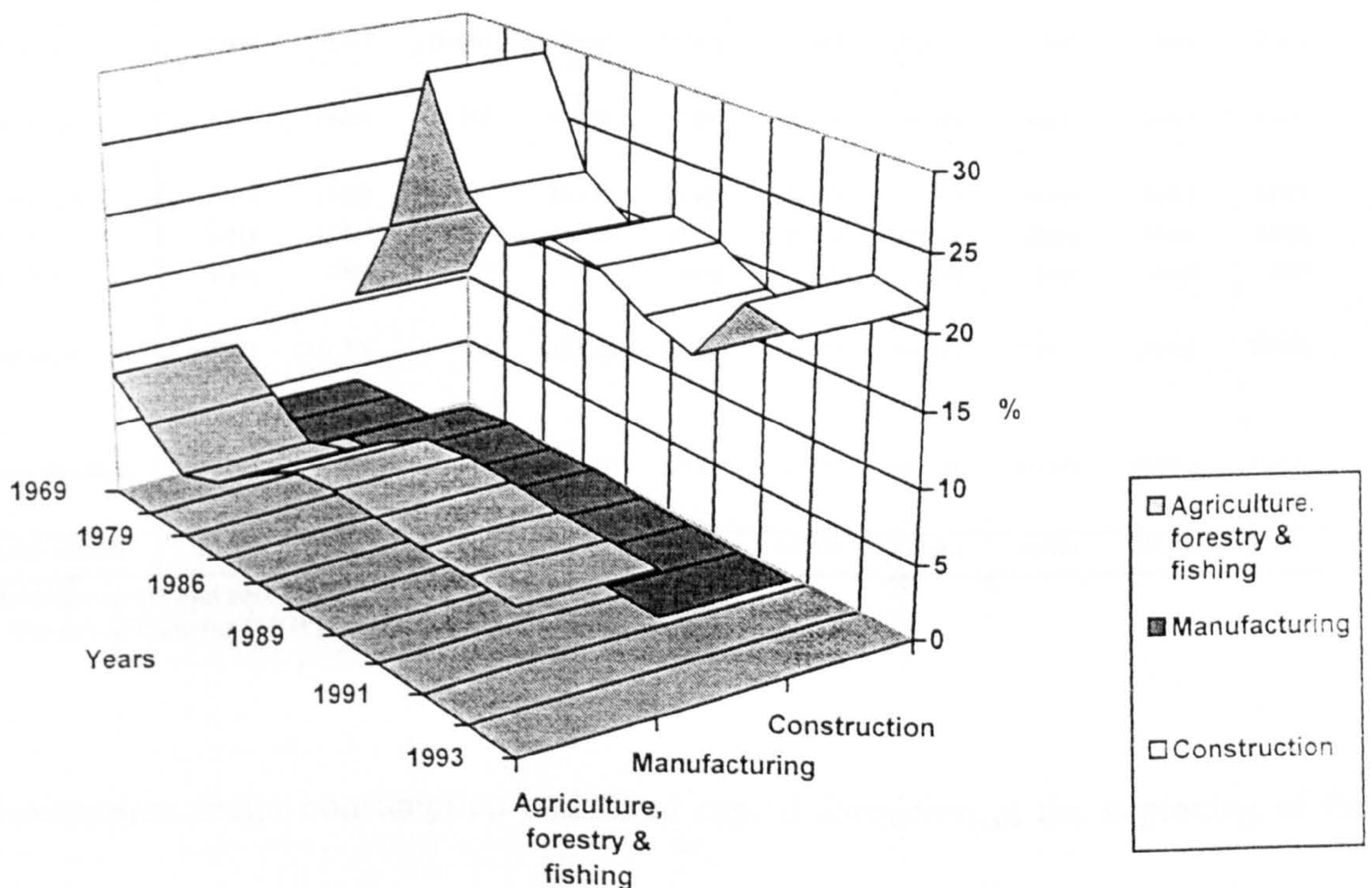
Source: Table A-4 in Appendix 2

According to Figure 2.6, the share of the construction sector in the real non-oil GDP at constant prices of 1984 increased during the first two plans from 10.5 % in 1969 to 29.1 % in 1979. But it dropped to 21.6 % in 1993. The share of the agriculture sector in the real non-oil GDP rose from 8.7 % in 1969 to 9.4 % in 1993. The contribution of the

manufacturing sector in the real non-oil GDP at 1984 constant prices increased from 3.9 % in 1969 to 6.7 % in 1986. As shown in Figure 2.6, the growth of this sector continued in spite of the fact that the growth rate fell slightly in the late years to reach 6.4 % in 1993. The share of transport and communications in non-oil GDP, however, decreased from 13.3 % in 1969 to 9.7 % in 1993; while the trade sector rose from 7.8 % in 1969 to 11.8 % in 1993.

The contribution of the oil sector in the GDP has also seen some changes. The share of crude oil and natural gas in the total GDP of the oil sector increased from 89 % in 1969 to 96 % in 1979, and then fluctuated to reach 88.5 % in 1993. Additionally, the share of oil refining rose from 7.5 % in 1969 to 16.5 % in 1988 and then to 14.4 % in 1993.

Figure 2.6
Percentage Distribution of Gross Domestic Product by Oil and Non-oil Sectors and Kind of Economic Activity Within Sectors



Source: Table A-5 in Appendix 2

2.3.3 Gross Domestic Product by Expenditure

Tables 2.1 and 2.2 show the GDP broken down into four categories. These tables show that fluctuations in crude oil prices have had a significant impact on government revenues and expenditure during the last twenty-five years. These data provide additional proof that the Saudi economy was strongly influenced by the oil price increase in 1973 and 1974 which, in turn, affected the structure and demand components of gross domestic products positively.

Table 2.1
Expenditures on Gross Domestic Product

Million Saudi Rivals (at 1984 constant prices)

	1969	1974	1979	1984	1986	1988	1990	1991	1992	1993
Consumption expenditure	38 140	76 319	205 661	280 409	265 881	243 777	266 311	276123	304861	296558
Government	19 732	47 303	106 449	121 055	112 783	96 619	113 744	118905	126500	108509
Private	18 408	29 016	99 212	159 354	153 098	147 158	152 567	157218	178361	188049
Changes in stock 1/	3 918	3 014	(9 691)	19 605	(12 686)	2 665	(5 897)	7045	5845	21371
Gross fixed capital formation	15 204	36 068	96 819	96 492	62 841	48 679	58 006	60173	76415	81361
Government GFCF	6 970	15 175	65 545	46 315	23 687	20 413	29 207	34417	18919	17595
Private GFCF	6 818	13 233	26 137	40 623	31 073	27 294	27 607	22651	51148	56512
Oil sector GFCF	1 416	7 660	5 137	9 554	8 081	972	1 192	3105	6348	7254
Exports of goods & services	115 081	248 576	298 630	145 530	165 944	183 325	215 442	220313	275000	245000
Less: Imports of goods & services	11 548	33 435	138 488	190 638	118 159	94 258	103 178	121951	137630	124790
Gross Domestic Product	160 795	330 542	452 331	351 398	363 821	386 188	430 684	441703	524491	519500

Note: 1/Includes errors and omissions.

Source: Ministry of Planning (MOP), 1990 and 1995.

Government sector consumption and fixed capital formation at the beginning of the 1980s, however, experienced a major change. During the third plan period (1980-1985).

there had been a deficit in the balance of payments: exports fell from SR. 298.6 billion in 1979 to SR. 145.6 billion in 1984, while imports of goods and services grew from SR. 138.5 billion to SR. 190.6 billion over the same period. Total consumption expenditure began to improve at the beginning of the fifth plan period, thus reversing its average annual decline of about 3.5 % during the fourth plan period (see Table 2.2). As a major component of final demand, total investments started to grow in 1990, thereby reversing their downward trend of the previous plans.

Table 2.2
Average Annual Growth Rates of Expenditures
on Gross Domestic Product

(at 1984 constant prices)
-%-

	1969-74	1974-79	1979-84	1984-89	1990	1991	1992	1993	1969-93
Consumption expenditure	14.9	21.9	6.4	-2.7	8.9	7.1	3.1	-2.7	9.4
Government	19.1	17.6	2.6	-4.7	20.4	12.7	-5.6	-14.2	7.5
Private	9.5	27.9	9.9	-1.1	1.7	2.9	10.3	5.4	11.4
Gross fixed capital formation	18.9	21.8	-0.1	-11.8	15.6	23.3	3.0	6.5	5.5
Government GFCF	16.8	34.0	-6.7	-12.7	34.8	1.5	-45.8	-7.0	4.4
Private GFCF	14.2	14.6	9.2	-6.9	1.1	59.4	41.6	10.5	7.3
Oil sector GFCF	40.2	-7.7	13.2	-20.9	-0.4	1.0	102.4	14.3	0.3
Exports of goods & services	16.7	3.7	-13.4	5.9	21.3	22.1	2.3	-10.9	0.4
Less: Imports of goods & services	23.7	32.9	6.6	-12.8	10.1	13.9	-0.9	-9.3	10.4
Gross Domestic Product	15.5	6.5	-4.9	2.1	11.9	15.4	2.9	-1.0	3.1

Source: MOP, 1990 and 1995.

2.3.4 The Role of Oil in the Economy

Oil was discovered in Saudi Arabia in 1938. Subsequently, oil has dominated the Saudi economy. At the end of 1970, the Kingdom's proven oil reserves stood at 138.7 billion barrels, they increased steadily to 141 billion barrels in 1974 and then rose sharply to 168.4 billion barrels by 1979 as a result of reassessments of known reserves. At the end of 1987, oil reserves were about 170 billion barrels. Due to the new discoveries in 1988 and 1989, the Kingdom's reserves rose to 260.9 billion barrels in 1991.

With respect to Saudi crude oil revenues, Table 2.3 and Figure 2.7 show that government revenues from oil increased from SR. 4.5 billion in 1969 to SR. 65.9 billion in 1974, and to SR. 164.4 billion in 1979. Since then, oil revenues have been steadily declining to SR. 75.9 billion in 1989. Translating these numbers to percentages, the contribution of oil revenues to total government revenues increased from 84 % in 1969 to 94.1 % in 1974, and decreased to 89 % in 1979 and then to 70.6 % in 1984.

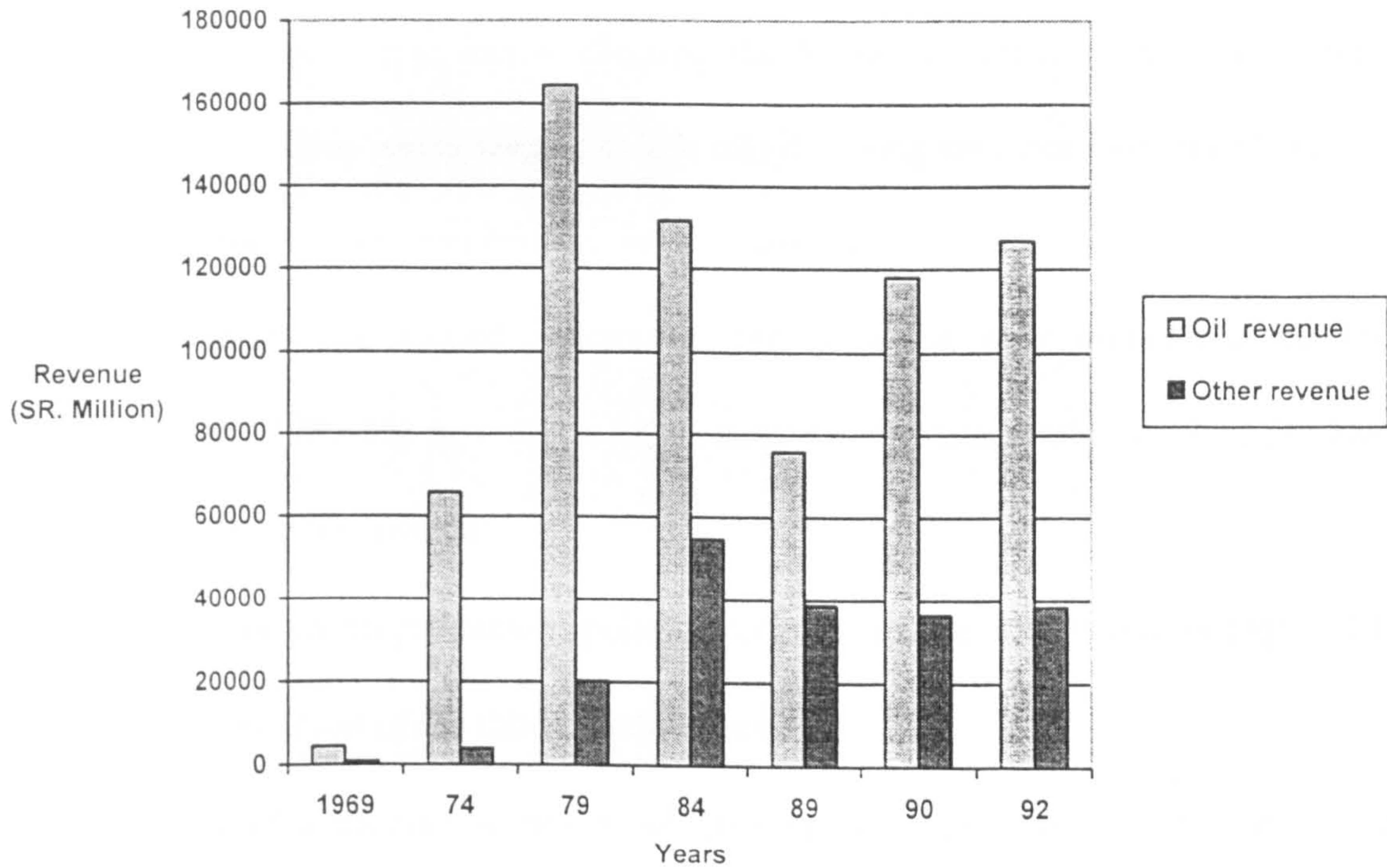
Table 2.3
Government Revenues (Actual)

-Million Saudi Riyals-

	1969	1974	1979	1984	1989	1990	1991	1992	1993
a. Revenues									
Oil revenue	4,549	65,911	164,434	131,640	75,900	118,142	***	127,027	***
Percentage	84.0	94.1	89.0	70.6	66.2	76.4	***	76.8	***
Other revenue	867	4,112	20,305	54,756	38,700	36,579	***	38,373	***
Percentage	16.0	5.9	11.0	29.4	33.8	23.6	***	23.2	***
Total Revenues	5,416	70,023	184,739	186,396	114,600	154,721	161,879	165,400	169,150

Source: MOP, 1990 and 1995.

Figure 2.7
Government Revenues (Million Saudi Riyals)



Source: Table 2.3

Recent developments in the world oil markets affecting oil revenues have, however, changed the relative share of oil revenues to 76.8 % of the total government revenues in 1992. Dependence on oil is also illustrated by the high ratio of oil exports to the Kingdom's total merchandise exports. Crude oil exports constitute the most important component of the Kingdom's total exports. The share of crude oil in total exports increased from 83 % in 1970 to nearly 94 % in 1979. Since then it has declined steadily to 75.5 % in 1993 (MOP, 1995). Such reduced dependence on oil is temporary and is the result of several factors. These factors include the increasing capacity of non-OPEC producers, particularly the North Sea countries, Mexico, Canada and Egypt; the development of

alternative energy sources; and more importantly falling world oil prices. Petroleum revenues have clearly played a key role in the Saudi economy and they will continue to be the most important economic factor affecting the Saudi economy. The government of Saudi Arabia realises this and is seeking to use this depleting resource more wisely in order to attain sustainable, longer-term benefits for the economy.

Major objectives and related policies for the oil sector were outlined in the third development plan (1980-85) in order to emphasise the important role of oil in the Saudi economy. These policies include:

- the pursuit of an oil production policy which emphasises the resources required for the implementation of the third development plan.
- the pursuit of a production policy which takes into consideration the ratio of the various hydrocarbon types contained in the national reserves.
- the pursuit of a production and research policy which will optimise individual oil reservoir life.
- to ensure that the best methods, technologies and facilities are maintained or introduced into the Kingdom's hydrocarbon exploration, production, and distribution activities.
- the support of the development of hydrocarbon-based industries within the Kingdom.
- the conservation of the national environment through the implementation of measures to protect on-shore and off-shore environment and ground water resources.
- the support of Saudi research into the Kingdom's petroleum resources: for example, at the universities.

- to encourage world conservation of hydrocarbon resources through international contracts and organisation.
- to continue the Kingdom's major role in OPEC with other member countries. in order to protect the value of hydrocarbons and to achieve a fair petroleum income; to support the welfare of OPEC citizens while taking into account the development of the world economy as a whole.
- to strengthen the organisation of Arab Petroleum Exporting Countries (OAPEC). Continuous co-operation will be maintained with member countries as well as participation in the planning and implementation of joint petroleum projects.

2.3.5 International Trade and the Balance of Payments

With minimal restrictions on international trade, the government of Saudi Arabia has become one of the important trading nations in the world. Being firmly in favour of free trade, Saudi Arabia puts no restrictions on imports whatsoever, except for religious rationale.¹ Saudi Arabia has allowed imports to enter the country virtually tariff free and without the administrative barriers which are frequently found elsewhere.

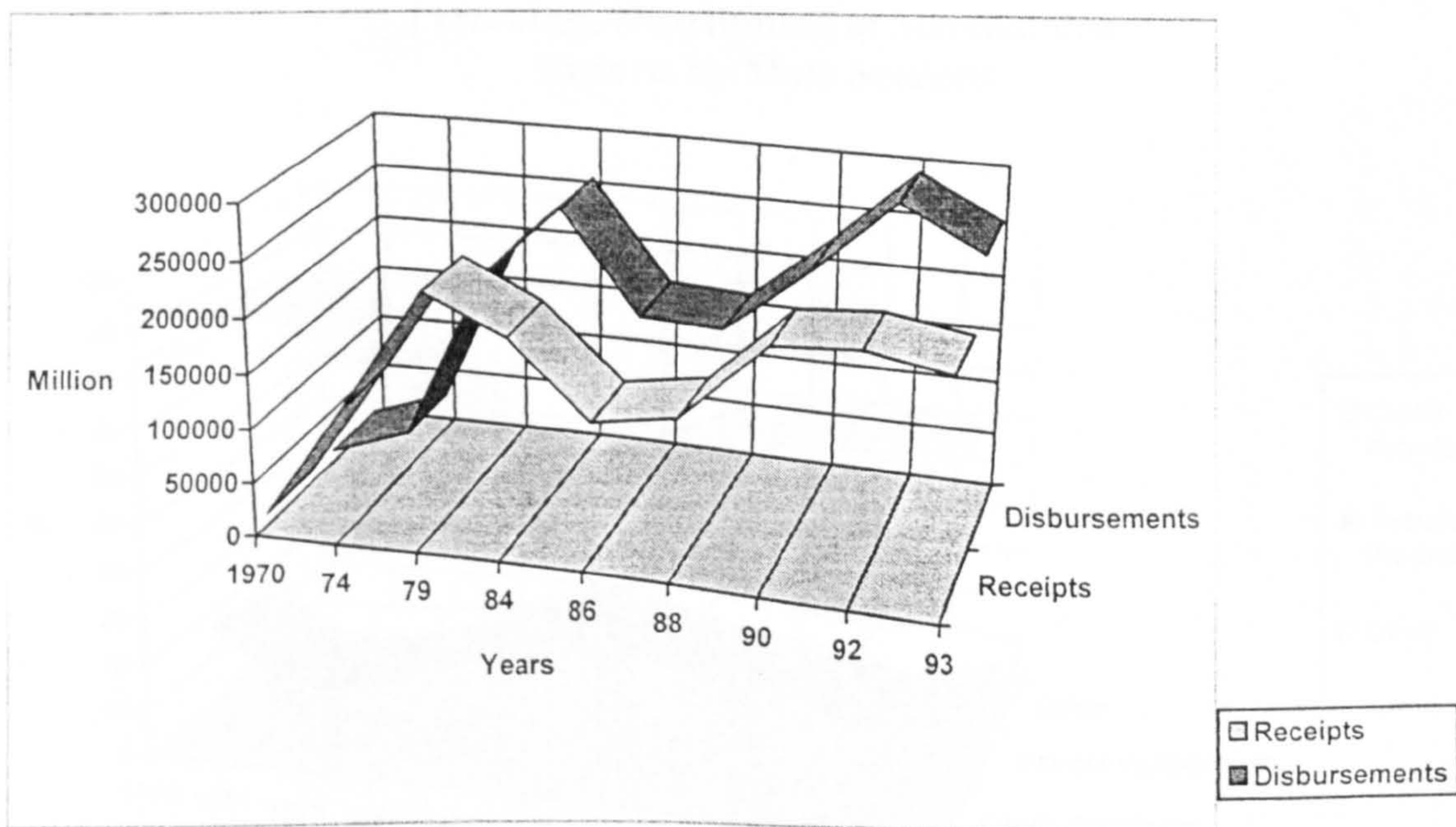
As is demonstrated by Figure 2.8 and 2.9, trade plays a major role in the Saudi economy. The structure of the overall Saudi Arabian balance-of-payments reflects the prototypical characteristics of an oil economy. The correction of world oil prices during the 1970s has had a positive impact on all items of the current account of the balance of payments.

¹ Saudi Arabia operates some religious restrictions on imports like pork and liquor and any other related products.

From 1970 to 1979, the total value of foreign receipts increased from SR. 10.7 billion to SR. 227.7 billion (see Figure 2.8). Despite the fact that the increase has covered all items of these accounts, the increase of the value of the merchandise exports has been the greatest. Crude oil exports constitute the most important components of the Kingdom's total merchandise exports. The share of crude oil increased from 83.2 % in 1970 to nearly 94 % in 1979 (see Figure 2.9), and steadily declined to 75.5 % in 1993. Petroleum products represent the second major export item. In 1993 petroleum products constituted 15.6 % of total merchandise exports, leaving 8.9 % of total exports for other commodities such as animals, chemicals and agricultural products.

Figure 2.8

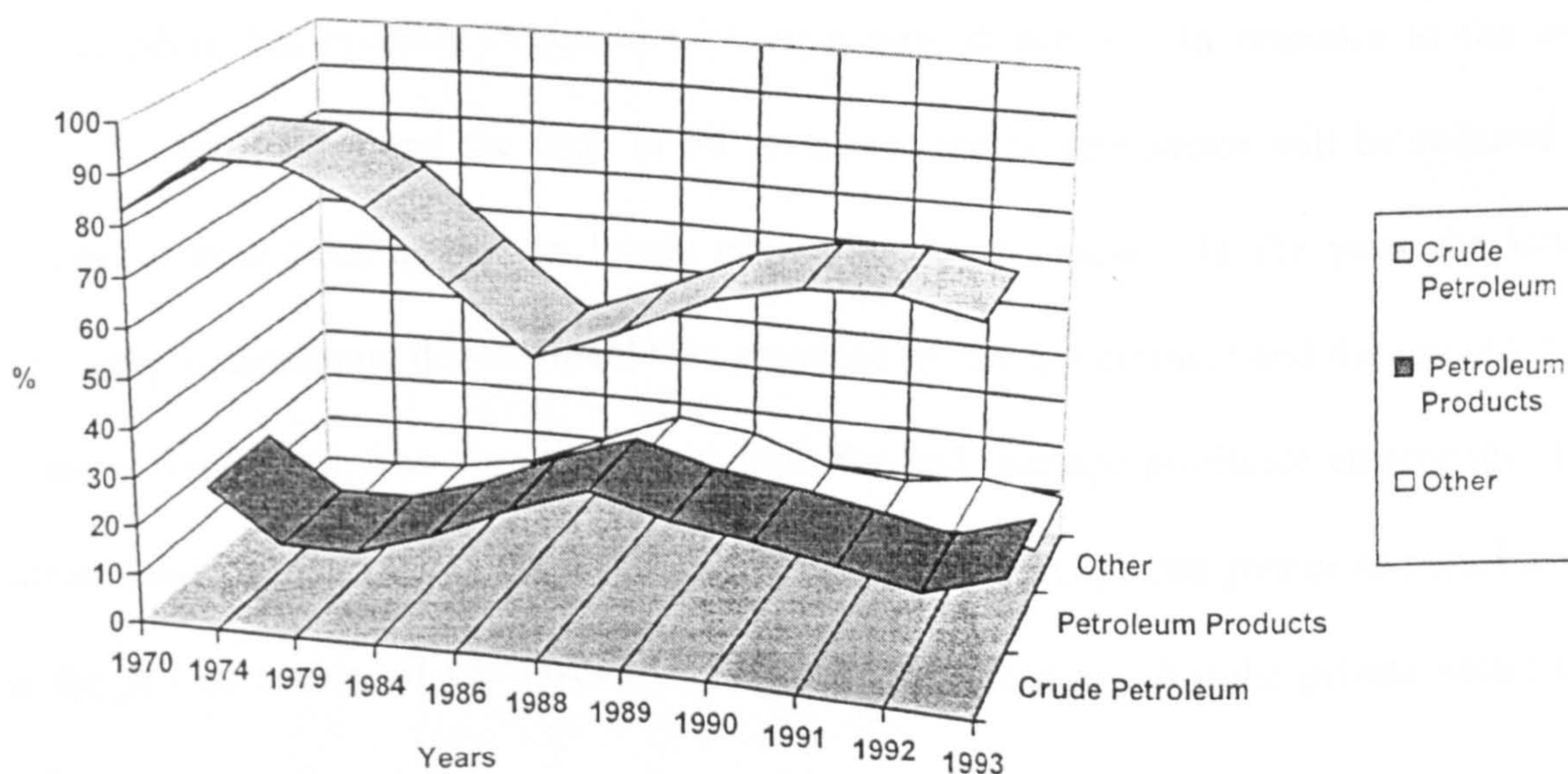
Receipts & Disbursements of Current Account of Balance of Payments



Source: Table A-6 in Appendix 2

The disbursements side of the current account also witnessed a similar increase during the same period (see Figure 2.8); it increased from SR. 10.4 billion in 1970 to SR. 193.4 billion in 1979. The direction of economic development has been the major determinant of the volume and composition of the Kingdom's imports. Transport equipment, machinery, mechanical and electrical equipment, base metals and construction materials constitute high percentage of total merchandise imports. However, because of the world oil markets in the 1980s which had adverse effects on the receipt side of the current accounts, merchandise exports fell to SR. 126.2 billion in 1986. On the other hand, the disbursements continued to increase due to the government's commitment towards financing the economic development plans. This development costs the country a current account deficit of SR. 96.4 billion in 1991.

Figure 2.9
Percentage Distribution of Merchandise Exports by Main Sections



Source: Table A-7 in Appendix 2

International trade is expected to continue to play a major role, not only in the Saudi domestic economy, but in Saudi's international trade as well. In other words, international trade is the "engine" that will provide the needed power for Saudi Arabian economic development for years to come.

2.3.6 The Role of the Private Sector

With an intention to diversify and expand the economy, and to build a more broadly based, stronger, efficient, and competitive private sector for the future, the Saudi government has both formally identified and strongly emphasised the role of the private sector. In support of this major role, the government has established a broad set of policies, provided more incentives to the producing sectors of industry, agriculture and mining, and tried to create a favorable environment for private sector investment and growth through ensuring a gradually increasing level of expenditure throughout the previous development plans.

The importance of the private sector's role in the economy and in the development of the Kingdom has recently begun to take on a new direction. In response to the new economic difficulties and the drop in oil revenues, the private sector will be required to assume a more leading role in future economic development. In the past, the initial leadership in economic development was provided by the government and the primary role of the private sector has always been to look for and manage profitable enterprises. The current development Plan (1995-2000, pp145-165), therefore, placed greater responsibilities on the private sector. It identifies five important contributions that the private sector can fulfill:

- to raise the overall level of efficiency in the economy by making more efficient use of scarce resources and improving productivity;
- to replace non-Saudi manpower by Saudis and create new job opportunities for citizens;
- to diversify the economic base and reduce the dependence on hydrocarbon resources by entering into new fields of investment directed towards domestic and world markets;
- to reduce the financial burden of government through participating in financing development projects; and
- to raise labour productivity by participating effectively in upgrading technical and administrative skills through training.

In spite of the government's commitment to the role of the private sector, further efforts and initiatives are required from both the private and public sectors. More co-ordination is needed between them if they are to have a positive influence on the private sector's pattern of growth (Presley and Westaway, 1989). The private sector will not be able to strengthen its competitiveness in the producing sectors if there are not enough programs and macroeconomics policies introduced by the government, or through joint efforts by both sectors, as appropriate: such as in the field of export promotion, encouraging joint ventures, and stimulating investments that lead to the upgrading of the technology base.

An efficiently functioning financial market is another area which need to be improved if the country wants to achieve its private sector development objectives. The private

sector's historical dependence on the government will not last forever. Private capital and other alternatives for financing the future expansion of the private sector need to be encouraged by appropriate means.

2.4 Planning and Development in Saudi Arabia

This section will offer an introduction to development planning in Saudi Arabia. It will endeavour to stress the long-term strategic goals of the Kingdom's development, which have been formulated since the first development plan. The efforts and achievements of every particular plan will be examined.

2.4.1 A Background to Development

The Kingdom of Saudi Arabia has accommodated a system of development planning since 1970 when oil revenues provided the means for the government to improve economic and social conditions in the country. The additional expansion of the Kingdom's oil income during the first and second development plan periods generated more opportunities for the government to invest in attempting to achieve greater economic growth. A modern economic infrastructure has been created to diversify the economy and reduce dependence on oil. Major improvements have been made in the provision of public services, particularly in health, education and social services.

A special feature of SA planning is integrating the government development actions with the dynamism of the private sector in a free market economy. Each plan has identified the strategy to be achieved and has allocated the tasks of implementing the strategy to the government or to the private sector as appropriate.

The basic principle underlying the Kingdom's development has been the sustenance of religious values and the provision of national security. Under these two basic principles, several broad goals have guided the Saudi development plans. These goals are of the (MOP, Fifth Development Plan, 1990):

- diversifying the economy and reducing dependence on oil;
- raising living standards and improving the quality of life;
- maintaining economic and social stability;
- regional development;
- strengthening the role of the private sector in the economy;
- broadening the linkages between the Kingdom and other nations;
- developing and completing the physical infrastructure;
- developing human resources.

Under these broad long-term goals, each specific plan has represented a special consideration, all of which lead to structural changes in the economy and more effective control over the development process.

2.4.2 The First Five-Year Development Plan (1970-1975)

The general objectives of economic and social development policy implicit in the first development plan were to raise the living standards and the welfare of the people of S.A. Also, the plan intended at the same time to provide for national security and maintain economic and social stability. The specific objectives of this plan were:

- increasing the rate of growth of the gross domestic product:

- diversifying sources of national income and reducing dependence on oil, through increasing the share of other productive sectors in gross domestic product;
- developing human resources:

The plan involved around SR. 80 billion of expenditure, mainly in developing basic infrastructure, particularly public utilities, and in improving government services. In addition, a major emphasis was given to the private sector to improve its ability in order to partake in the process of economic development.

In an attempt to diversify the economy and to reduce its dependence on oil, the plan aimed at increasing the output of other productive sectors, specifically agriculture and industry. The sectoral plan focused on increasing agricultural and industrial output by, respectively, 4.9 and 9.5 % per annum. However, the amount allocated to these sectors was relatively very small. The allocations for industry and agriculture accounted for 6.3 % of the total planned outlay.

In terms of plan performance, the plan was considered relatively successful (El-Mallakh, 1982). The annual growth rate of 15.5 % exceeded the projected GDP growth rate of 9.8 % . However, in terms of the goal of diversification, the plan did not achieve its aims in the agricultural and manufacturing sectors. Expansion in manufacturing and agriculture fell short of the respective plan targets. However, an important achievement was expansion and growth in the labour force of about 20 % to a level of 1.6 million people in 1975.

In general, the management and implementation of the first development plan has provided the Saudi government and the Planning Authority with invaluable experiences: that proved useful in the Kingdom's second five year development plan.

2.4.3 The Second Five-Year Development Plan (1975-1980)

Unlike the first development plan, Government expenditure during the second plan reached nearly SR. 700 billion, almost nine times as much as during the first plan. Stated in broad terms, the goals of this plan were to:

- maintain the religious and moral values of Islam;
- assure the defense and internal security of the Kingdom;
- maintain a high rate of economic growth by developing economic resources, maximising earnings from oil over the long term, and conserving depleted resources;
- reduce economic dependence on exports of crude oil;
- develop human resources by educating, training and raising standards of health;
- increase the well being of all groups within society and foster social stability under circumstances of rapid social change;
- develop the physical infrastructure to support achievement of the above goals.

In terms of financial allocations for the second plan, infrastructure and productive investments experienced the highest expenditure followed by education, defense and aid, food subsidies and general reserves. To meet the target of reducing economic dependence on crude oil, the private sector was targeted to become increasingly more active in the economic development of the Kingdom. To ensure the implementation of the role of the private sector in the second plan, the government placed a great emphasis on accelerating investments in the physical infrastructure. This encouragement of the private sector and diversification of the non oil sector was stimulated through four main policies: 1) acceptance of a foreign labour force to assist in the economic development programmes

during the second plan period; b) supporting internal migration from rural areas to urban areas where more industrial employment opportunities are available; c) all possible government assistance and financial stimulation in the development of productive sectors; and d) technological advancement through the prudent utilisation of international co-operation agreements.

Overall, during the second plan period the Saudi economy registered considerable progress despite the actual GDP growth rate being 8 % less than was planned over the plan period. The plan was successful in attaining a higher rate of growth in the non-oil sector and in helping improve the infrastructure of the economy of SA (El-Mallakh, 1982).

2.4.4 The Third Five-Year Development Plan (1980-1985)

In May 1979 the Council of Ministers approved the Kingdom's third five-year plan covering the period from 1980 to 1985. The total allocations for the plan were approved at SR. 783 billion. In keeping in line with the long term goals for the Kingdom's development, the strategy for the third plan consisted of three important medium-term objectives. These objectives were:

- structural change of the economy;
- expanding participation and social welfare in development; and
- increasing economic and administration efficiency.

Increased oil revenues in the early years of the plan and the prevailing world oil market conditions had a positive impact on the scale and annual distribution of government expenditure over the plan period as a whole. Over the plan period as a whole the non-oil economy grew at an average rate of 5.1 %. This growth rate in the non-oil economy began

to reflect desired structural changes. The sectoral growth rates over the plan period were: agriculture 8.7 %, manufacturing 14 % and the utilities 24 %.

At the end of the third plan period, the manufacturing and agriculture sectors had reached a significant size. Employment in manufacturing, which accounted for 5.6 % of the work force in 1980, grew at an average annual rate of 19.3 % and represented 9.3 % of total employment in 1985.

All in all, the contribution of the non-oil private sector and the Saudi agricultural employment which was generated during the third five-year plan period reflected a considerable progress in development planning performance.

2.4.5 The Fourth Five-Year Development Plan (1985-1990)

In 1985 the Kingdom's fourth five-year development plan was approved for implementation during the period 1985-1990. It came at a period of great change in the financial circumstances of the Kingdom. The oil market conditions at the time of the fourth plan put the government's revenue at a level substantially less than during the third plan. The objectives of this plan, therefore, became to ensure continuity with the strategy of the third plan. The major objectives of this plan were to:

- continue structural change in the economy, to diversify the economic base and reduce dependence on crude oil as the main source of national income;
- encourage the rapid development of the private sector as the principal mechanism for achieving economic diversification;
- improve the economic efficiency of the government sectors;

- complete the infrastructure projects necessary to achieve long term economic and social development goals;
- further develop the Kingdom's human resources.

The fourth plan clearly envisaged an expansion in the role of the private sector and diversification of the economy. At the same time the plan stressed health, education and other social services. To accomplish these objectives the government approved a total of SR. 1,000 billion expenditure. However, the further worsening of world oil markets in the beginning of the plan period forced the Saudi government to reduce spending to 20 % below the target of the fourth plan. This re-emphasises the role of oil in the economy of Saudi Arabia, which makes the SA goal of economic diversification a difficult and challenging one.

The shortfall in government expenditure during the plan period ruled out the plan's growth targets from being achieved. Nevertheless, the general performance of the non-oil sector as a whole can be considered respectable, particularly in the agriculture and petrochemical industries, which sustained high growth rates throughout the plan period (MOP, 1990).

As total government expenditure decreased, a major change also occurred in the structure and in the priorities of the government. Expenditure on transportation and communication was reduced to about two thirds of its planned level. The largest reductions were made in the expenditure categories of economic resources, municipals and housing, where expenditure cuts were about 50 % of their planned levels. The smallest cutback was

made in the area of human resources developments, which retained 84 % of the original planned expenditures.

In general, the decline in government expenditure over the fourth plan period was proportionally less than the overall budget cuts. In the second year of the fourth plan, the Saudi budget deficit reached SR. 69 billion. Based on this crucial condition we can state that the outcome of economic planning in Saudi Arabia during the fourth development plan was not surprising.

2.4.6 The Fifth Five-Year Development Plan (1990-1995)

After a twenty year period of economic planning in Saudi Arabia, the fifth development plan was approved to cover the period 1990-1995. With the basic infrastructure completed, the fifth plan came to be regarded as the beginning of the second planning stage. It aimed to take the economy forward to a better stage in which the private sector will assume a leading role and more participation in the ownership of public services in the fields of power generation, communications and transport.

The major objectives of the fifth development plan as established by the Council of Ministers were to:

- develop human resources, thus ensuring a constant supply of manpower, upgrading its quality and improving its efficiency to meet the requirements of the national economy;
- reduce dependence on the production and export of crude oil as the main source of national income;

- continue with real structural changes in the Kingdom's economy, so as to establish a diversified economic base with due emphasis on industry and agriculture;
- complete the infrastructure projects necessary to achieve overall development;
- further encourage private sector participation in socio-economic development;
- achieve balanced growth throughout all regions of the Kingdom.

These were the most important objectives which the fifth development plan aimed to achieve. However, during the early years of the plan period, the Gulf War was initiated. Most of the government's revenue was drained by expenditure on the cost of the war. In 1992, the deficit represented 9.2 % of SA's gross domestic product. Until now (1996), oil revenues remained less than the Kingdom's expenditure. Between 1995 and 1996 the budget deficit was announced at SR. 15 billion; compared with SR. 40 billion in the previous year.

In summary, approaching the end (in the year 1995) of the fifth development plan, economic planning in SA had made important progress towards its general goals. A large-scale modern infrastructure development has been completed: this is seen, for example, in the establishment of the industrial cities of Jubail and Yanbu, refineries, petrochemical complexes, hospitals, desalination plants and universities.

2.4.7 The Current Five-Year Development Plan (1995-2000)

With the beginning of this sixth development plan, the Kingdom of Saudi Arabia has completed twenty five years of the process of development planning. During this time, economic planning in Saudi Arabia has been concerned with the establishment of a solid

infrastructure base, the development of human resources and the diversification of the economic base away from its dependence on a single natural resource. The current development plan will stress the continuing commitment to these tasks by emphasising building upon, and extending the developments that have been already accomplished (MOP, Sixth Development Plan, 1995). The major objectives of the sixth development plan are to:

- develop and increase the employment opportunities of Saudi manpower;
- raise the level of economic efficiency in both government and private sectors;
- enhance the private sector's role in the national economy.

With the completion of this plan, economic planners in SA expect that the Kingdom will have made substantial progress towards achieving economic development for both the present and future generations.

2.5 Industrial Development in Saudi Arabia

Because industrial development has a conspicuous role to play in the growth and diversification of the Saudi economy, this section will examine the features of industrial development in the Kingdom and review the Government's objectives, policies, programmes and achievements related to that development.

2.5.1 Features of Industrial Development Plans in the Kingdom of Saudi Arabia

The economic policy of the Saudi government aims at diversifying the Kingdom's economic base by reducing the dependence on the export of crude oil. Therefore, the

objectives of industrial development have been defined as follows (Ministry of Industry and Electricity, 1986):

- increasing the productive capacity of the national economy in a manner that enables it to produce a group of diversified commodities at costs that are competitive in both the local and overseas markets.
- making use of the great advantages availed by the low costs of energy and the abundant quantities of raw materials emanating from petroleum and its industrial derivatives, and also from the agricultural, mineral and fishing wealth; utilising these advantages and resources to diversify the economic base.
- expanding and deepening the relations of the Kingdom with international technologies.
- encouraging the utilisation of the capacity of the private sector in conversion industries.
- realising a balanced regional industrial development.
- enhancing the productivity of the industrial sector by encouraging the establishment of factories with optimum producing capacities.
- reducing the dependence of industry on non-Saudi workmen, by developing national skills and increasing the capabilities of technical and general education, and adopting the approach of in-service training.
- increasing the degree of cooperation and integration among various existing industries.

Beside the fact that the Ministry of Industry and Electricity is the principal agency and licensor of new manufacturing utilities, the industrial structure in Saudi Arabia is based on two pillars. The first is the basic industries sector which depends on hydrocarbons, while the second is the conversion industry sector. The Kingdom's industrial production domain consists of the following:

Firstly, there are the projects established and managed by the Saudi Arabian Basic Industries Corporation (SABIC), which comprise of mainly the downstream hydrocarbon industries and, to a lesser degree, the heavy metals industry. These industries require investment of considerable capital and involve massive power consumption. The materials resulting from refining oil and processing gas are the raw materials for these industries; their petrochemical products are primarily for export. The production plants of these industries are technologically very advanced and the controlling companies are usually joint ventures with foreign partners whose share capital may well vary but is always no more than 50 % of the whole.

Secondly, there are the factories licensed by the Ministry of Industry and Electricity and owned by the private sector. Most of these enterprises are privately sponsored and eligible for Saudi Industrial Development Fund loans. The products of these industries are intended primarily for the domestic market. The Government grants private sector investors a range of investment incentives such as leasing land at nominal prices in industrial areas, loans granted by the SIDF, preferential purchases by state organisations, training grants and, in some cases, tariff protection.

Thirdly, there are the small factories composed largely of labour-intensive small workshops in repair and small scale production activities. These workshops are licensed by local municipalities and obtain commercial registration from the Ministry of Commerce. The financing needs of this sector are limited mainly to the availability of operational capital and raw materials rather than their need for equipment and installations. Finance comes mainly from the owners of these factories, and this can sometimes be supplemented by grants from the Saudi Credit Bank if the owners have agreed to complete their training at the Public Institute of Technical Education and Vocational Training.

2.5.2 The Role of the Saudi Government and the Private Sector

Contributing to industrial development, which is a key component of the economic development strategy of Saudi Arabia, the government has continued in its efforts to strengthen the industrial sector. Among the achievements which have been made during the period 1970-1995 (as was mentioned earlier) is the completion of the infrastructure in the two major industrial cities of Jubail and Yanbu. These cities are primarily targeted at developing basic industries related to oil derivatives, petrochemicals and minerals, as well as to spur the development of secondary industries derived from these basic industries in addition to the associated support industries. In pursuit of a balanced regional development objective, the Government has also established eight industrial cities with different general utilities and services necessary for the establishment of factories in different areas of the Kingdom.

As the government wishes to encourage businessmen to invest in projects that are beneficial to the national economy, some incentives have been established. These incentives include (Ministry of Industry and Electricity, 1992):

- a) offering loans and capital participation on the basis of easy and encouraging terms;
- b) assisting businessmen in forming industrial companies among them together with further assistance in their organisation;
- c) offering the financial and technical aid required for operating factories;
- d) exemption of machinery, equipment and raw materials from customs fees;
- e) exemption shares of foreign partners in projects and capital from taxes imposed on company profit as provided in the regulations of foreign capital investment;
- f) giving preference to national products in government purchases;
- g) granting lots of land in the industrial zones for erecting factories thereon;
- h) rendering assistance in exporting the national products;
- i) assistance in the selection of industrial projects, the preparation of economic feasibility studies and the evaluation thereof.

In turn, the private sector has benefited from these incentives. This has been shown by its increased participation in establishing manufacturing enterprises. The GDP share of the industrial sector in 1993 thus stood at 3.1 % compared to 1.2 % in 1969 (see Table A-4 in Appendix 2).

2.5.2.1 The Saudi Basic Industries Corporation (SABIC)

The SABIC is one of the most important government authorities established in order to support the industrial sector. It was established with a capital of SR. 10 billion, its purpose

being to set up, operate and market the products of basic industries based on local hydrocarbonic and mineral resources, as well as other downstream and supporting industries. Since 1979, the SABIC has established 15 industrial complexes in different cities.

In 1991-92 the total production capacity of the Saudi Basic Industries Corporation stood at about 14.4 million tons, while the actual production reached 13.1 million tons; accounting for 91 % of the total production capacity.

During the same year, the total manpower employed by the SABIC and its associated corporations stood at approximately 9730 employees. Saudi nationals constituted 62 % of the total force. Net profits made by the SABIC during 1991-92 were SR. 2,295 million compared with SR. 148 million in 1985-86.

2.5.2.2 The Saudi Industrial Development Fund (SIDF)

The Saudi Industrial Development Fund (SIDF) was set up in 1964 as a financial machine affiliated to the Ministry of Finance and National Economy, to support and develop the national industrial sector in the Kingdom of Saudi Arabia. The fund has played a fundamental role in expanding the base of locally manufactured products by offering medium and long-term loans in addition to the consulting services required in the administrative, technical, marketing and financial spheres.

Investors who obtained industrial licenses are entitled to apply for loans that amount to 50 % of the total cost of the project including the initial requisites of operational capital. The period of settlement depends on the expected cash flow of the project; the maximum period for settlement is no more than fifteen years.

Total loans approved for industrial projects reached a cumulative figure of SR. 25.8 billion in 1995, compared with SR. 150 million in 1975. These loans have been approved to assist a total of 1365 industrial projects and they have made an important contribution towards the establishment of several industrial projects such as food stuffs, chemicals, cements, building materials, engineered products and other products as well.

2.5.2.3 Other Government Authorities Supporting the Industrial Sector

Although the above government authorities have contributed greatly in establishing a favourable industrial climate within the Kingdom, there are other organisations which have been set up by the Saudi government. Among these organisations is the General Organisation of Petroleum and Minerals and the Saudi House for Consulting Services.

The General Organisation for Petroleum and Minerals (PETROMIN) was established in 1962 to undertake the responsibility of developing petroleum and mineral industries and improving them on sound economic and commercial bases. Other tasks of PETROMIN include the construction, operation and maintenance of oil refineries devoted to domestic consumption and export markets. Since its inception PETROMIN has been able to establish three oil refineries to meet the needs of domestic consumption. It has also established a refinery for the basic lubrication oils and laboratories for the production of final products of lubrication oils. In addition, it has set up a pipeline for the transport of crude oil from the fields of the Eastern Province to Yanbu on the west coast as well as another pipeline for natural gas. This is in addition to numerous other projects in the different fields of PETROMIN activities.

In the case of the Saudi House for Consulting Services, the house was established in 1977 to be the first specialised consulting house set up by the Saudi government. The house functions on a commercial basis exactly like any private consulting firm. The main objectives of the house are:

- the development and improvement of national consultation practice in a manner that meets with the requirements of economic development in the Kingdom, and the needs of government agencies and the institutions of the private sector;
- the development of a basic foundation of national consulting bodies in all fields and preparation of the potential required for their development and improvement of their efficiency in accordance with the most modern technological methods to become an efficient alternative for the foreign consulting activity.

2.6 Conclusion

This chapter has charted and analysed the Saudi Arabian economy over a period of twenty five years (1970-1995). It has been emphasised that a key feature of the economy of Saudi Arabia is its great dependence on petroleum revenues; the oil sector is likely to continue for the foreseeable future as the dominating influence in the Saudi economy. As a result, it is practically meaningless to analyse economic development in SA without considering at the same time the key role of oil in the Kingdom.

This chapter has provided an overview of structural change in the Saudi Arabian economy with emphasis on the major components of the GDP, such as agriculture and manufacturing. The dominance of oil in government revenues is transparent; particularly during the first two five-year development plans. The Saudi Arabian planners have been

aware for some considerable time that diversification of the productive base of the economy is vital, and can only come with sustained efforts in industrial and agricultural development. In an attempt to improve the amount of agricultural and industrial output, the government has established vehicles like the Saudi Basic Industrial Corporation, Saudi Industrial Development Fund, Saudi Agricultural Bank, and some other governmental authorities; all for the purpose of promoting economic development.

Although diversification is a major objective of the Saudi's economic development policy, this chapter has shown that the agriculture and manufacturing sectors are still relatively under-developed in terms of their respective contributions and growth. Furthermore, the contribution of the non-oil private sector has been greatly influenced by the government's oil revenue, and has depended upon government subsidies and other expenditure to encourage these sectors.

Chapter Three

The Banking and Financial System in Saudi Arabia

3.1 Introduction

The financial sector assumes an important role in SA, particularly because of the intention of the Saudi planners to give the private sector a much greater significance during the current (1995-2000) development plan. As the focus of development shifts to private sector activities, the financial sector is expected to play a paramount role in the financing of investment requirements. This chapter reviews the historical background and modern evolution of the SA banking and financial sector. Following this, the organisational structure of the financial sector, together with the respective financial conditions of the banking system and other financial institutions, will be examined. This survey is necessary in order to put in perspective, within the overall financial system of SA, the role and place of the SIDF.

3.2 Historical Background

Prior to the establishment of the Saudi Arabian Monetary Agency (SAMA) in 1952, the financial system in Saudi Arabia was quite primitive by modern western standards (Wilson, 1983 and Al-Jasser, 1986). There was, for example, no Saudi currency. The economy was based generally on foreign currencies, particularly the British Pound sterling, Maria Theresa dollars, Indian Rupee and the Ottoman sovereign. At the time (1932) of the unification of

the different regions of the country, the first Saudi silver currency, the Riyal, was issued. Stabilising the full-bodied silver currency proved hard, and the Government consequently experimented with different monetary arrangements. In 1952 a new gold based Riyal coinage was issued but the terms of reference under which the SAMA was established prevented it from issuing any paper currency.

Due to the need to improve the financial and banking system of the Kingdom, SAMA was established in 1952. The founding of the SAMA was an important event in the financial development of Saudi Arabia (Financial Times Business Publishing Ltd (FTBPL). 1980). SAMA was established to strengthen the Saudi currency and to stabilise it in relation to foreign currencies. Its charter called upon it to provide overall coordination, guidance and regulation of the Saudi financial sector. In 1962 the Saudi Riyal (SR) was introduced to become one of the sixteen currencies that define the IMF's Special Drawing Right (SDR). Following the issue of the Saudi Riyal, the government began to encourage the expansion of local and foreign owned banks. The policy was successful; by the end of the third development plan, the number of commercial banks' branches had increased to 140. Government lending institutions were also established to provide medium and long-term credit and to be instrumental in realising the objectives of the Saudi development plans. Although the financial system in the Kingdom has developed dramatically during the fourth and fifth development plans, it needs further strengthening in order to be able to play its increasingly important role in financing the country's development.

3.3 Organisation of the Financial Sector

The structure of the Saudi Arabian financial system is relatively simple. It can be broken down into five categories. Apart from the SAMA, which is the central monetary banking authority, there are the commercial banks, specialised credit institutions (SCIs), other financial institutions, and the offshore financial markets.

3.3.1 The Saudi Arabian Monetary Agency (SAMA)

The SAMA was established in 1952 as a semi-autonomous government corporation connected to the Ministry of Finance. It was set up to regulate and manage the unstable conditions surrounding the Saudi Arabian monetary system which were manifested by many realised defects: these included the absence of a central bank, the non-existence of paper money acting as legal tender, and the country's dependence on a hybrid of foreign metallic currencies which led to violent fluctuations in the exchange rate of the Saudi Riyal.

The desire of the Saudi government to establish a new stable and convenient monetary system led to the charter of 1952, which in establishing the Saudi Arabian Monetary Agency, mapped out the functions of the SAMA in the areas of currency, fiscal affairs and financial and economic research. The currency affairs functions were stated as (Young, 1983):

- to stabilise and maintain the external and internal value of the currency;
- to hold and operate any monetary reserve funds earmarked for monetary purposes only;
- to buy and sell for government accounts gold and silver coin bullion;

- to advise the government about new coinage and handle the manufacture, shipment and issue of all coins: it being understood that coins would be issued only through and at the request of the agency;
- to regulate the commercial banks, exchange dealers and money changes as necessary.

As for the fiscal functions of the SAMA, the Royal Decree instructed that it was authorised to:

- receive and act as a depository for all government revenues, both domestically and internationally;
- make payments for purposes duly approved by the government through the Ministry of Finance.

At the same time the Royal Decree stated that the agency should not undertake any of the following functions:

- paying or receiving interest;
- receiving private deposits;
- making advances to the government or to private parties;
- engaging in trade or having an interest in any commercial, industrial or agricultural enterprise;
- buying or holding fixed property except what the Agency reasonably needs for its own operations;
- issuing currency notes.

However, the limitations of its original functions in prohibiting the issue of notes was corrected in December 1959 when a Currency Statute amended the 1952 Charter in order to allow the SAMA to issue paper money. In relation to paying or receiving interest the prohibition still stands; based on the Islamic view that usury or interest rate is forbidden. In fact, interest rates are charged to borrowers, but they are considered and labeled as administration fees¹.

These limitations on the monetary authority, some might argue, put more restrictions on the role of the SAMA as a fully-fledged central bank (Presley and Wilson, 1991). Some of these restrictions, which are considered very important for open-market operations, include the absence of a discount window and the non-existence of government debt.

In 1966, the SAMA began to define its relationship with commercial banks in Saudi Arabia. The "Banking Control Law" was initiated in order to prevent problems like illiquidity and insolvency. To prevent over-liquidity, if a bank's deposits exceed 15 times its capital and reserves, the bank must, according to this law, place 50% of the excess interest-free with SAMA. To prevent overstretching on loans, banks may not commit more than 25% of their capital and reserves in a single loan; nor is a bank allowed to lend to people associated with it, such as board members or auditors. A bank is also not permitted to acquire stocks of other banks. It is, however, permitted to acquire other (non-bank) stocks, given that their value is not more than 10 % of the capital of the company involved, or 20 % of the bank's own capital and reserves; whichever is the lower. These rules can be tightened or relaxed by the Minister of Finance as the economic situation dictates.

¹ Islamic banking can be defined as a financial system that operates without charge of interest. The interest rate in this system is replaced by a system of profit and loss shares.

Since its establishment SAMA has been able to play an important role in the development and supervision of the banking system within the Kingdom. In 1955 the Agency began to encourage foreign owned banks to expand their activities and to open new branches within the Kingdom, although final approval for such expansion rests with the Ministry of Finance. In its role of improving the professional skills of Saudi personnel, the SAMA established the banking training centre in 1970 in order to provide courses in banking, accounting, economics and other subjects. A major policy introduced by SAMA in 1984 was the Bankers Special Deposit Account (BSDA), a formal monetary instrument designed to complement other controls on commercial bank liquidity. The SAMA has also introduced a new debt instrument, a Treasury Bond, to help regulate liquidity in the economy and provide, at the same time, additional sources of revenue to the Saudi treasury.

Because of its awareness of the need for a well established equity market within the Kingdom, the Saudi Arabian government appointed the SAMA in the late 1980s to manage and supervise the creation and operation of such a market. Based on this, the SAMA recognised the global trend towards greater automation and floorless trading in the equity market. The automation of the Saudi equity market started in 1988 with the introduction of phase 1 of the Electronic Securities Information System (ESIS). Phase 1 automated settlement and assisted in providing liquidity. This was followed by phase 2 in 1990 with the introduction of an automated order management and execution system. In 1991, a price dissemination service for use by Saudi banks was introduced with the late addition of company information (e.g. reports and accounts). In 1993 a new service was also introduced to offer national coverage by extending some of the order management and

settlement delivery services to bank branches throughout the Kingdom and abroad. More details about the Saudi Equity Market and the system used in it will be presented in the following Section 3.3.5.

3.3.1.1 The SAMA's Balance Sheet

In addition to its sole responsibility of issuing the Saudi currency, the SAMA is the government's banker which receives all payments to the government and disburses government expenditures through cheques drawn by the Ministry of Finance and National Economy. Between 1965 and 1975 the total assets of the SAMA grew from SR. 3.96 billion to SR. 110.60 billion. This enormous increase was due to the international oil market in the early 1970s. It is also clear from Table 3.1 and Figure 3.1 that the assets of the SAMA continued to increase with some fluctuations in the early 1980s. However, the later developments in the world oil market, which have adversely affected the government's oil revenue, brought the total assets of the SAMA down to SR. 272.9 billion in 1991. Being the government's banker, there are several large accounts held by the SAMA that need to be analysed; and these may also be used to reflect economic conditions in the Kingdom of Saudi Arabia.

The Government Special Account, which refers essentially to the national reserves, has accounted for about 60 % of the total liabilities of the SAMA over the last few years up to 1985. During the last ten years, however, the picture has changed altogether. The percentage of the Government Special Account went down from 57.7 % in 1985 to a mere 3.1 % in 1991 (see Table 3.1). This illustrates the difficulties which the Saudi economy is facing and how the government's debt has started to take up a significant portion of the

government's reserve in recent years. The liabilities on documentary credits and others on contra accounts are also symptomatic of the same difficulties. These liabilities rose very sharply from SR. 88.7 billion in 1990 to SR. 144.9 billion in 1991 (see Table 3.2). This sizable increase in only one year illustrates the late and extensive action by the government in issuing government development bonds as a way of covering the budget deficits.

Table 3.1

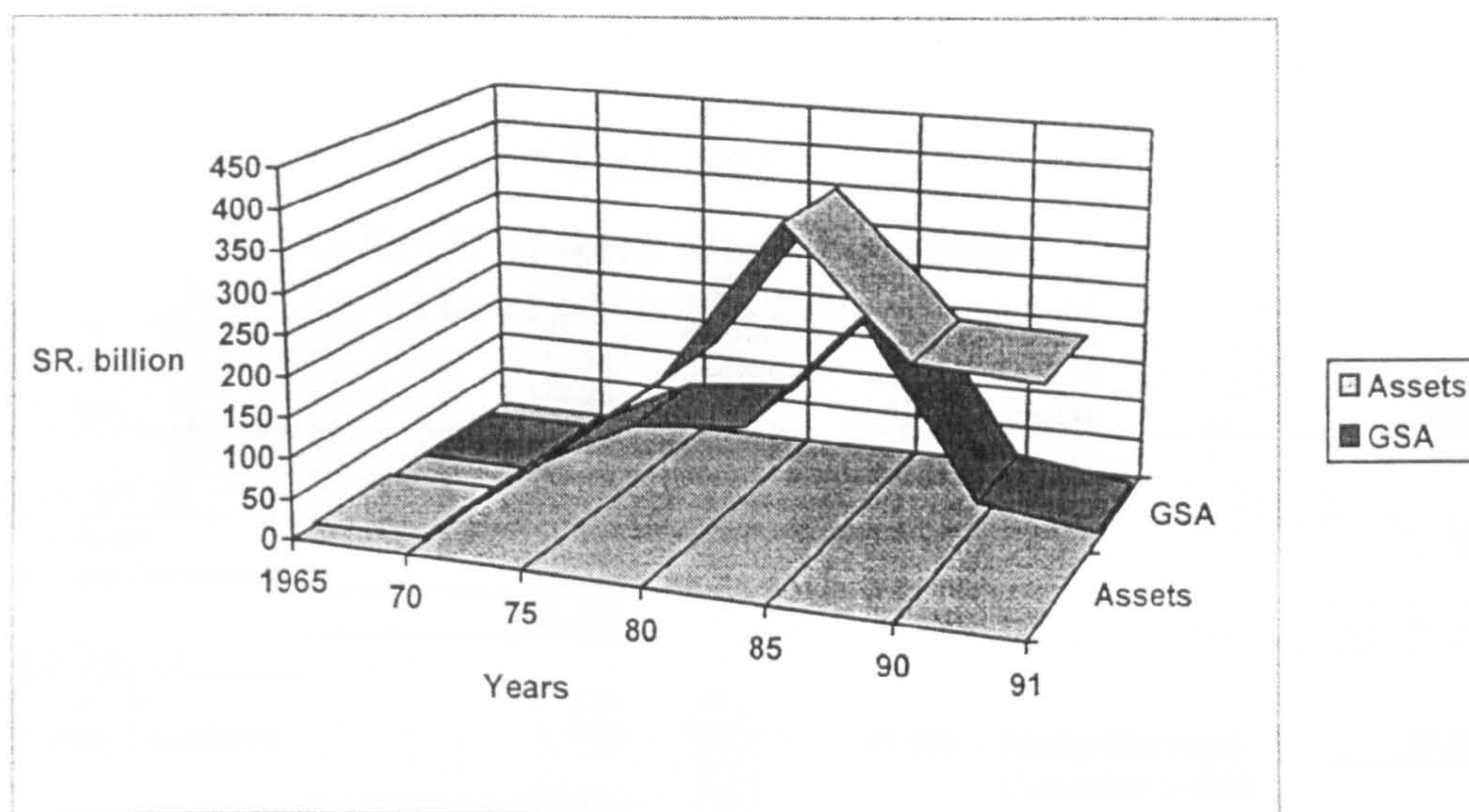
Total Assets and Liabilities of the SAMA (SR. billions)

Year	Total Assets	% Growth	Govt. Special Account	% Growth	% Share
1965	3.96	31.0	0.182	-31.6	4.6
1966	5.09	28.7	0.191	4.9	3.8
1967	5.77	13.2	0.200	4.8	3.5
1968	5.58	-3.3	0.209	4.2	3.7
1969	4.97	-10.8	0.435	108.2	8.7
1970	5.14	3.4	0.119	-72.5	2.3
1971	7.13	38.6	0.578	384.3	8.1
1972	13.71	92.4	4.490	676.5	32.7
1973	19.46	41.9	8.293	84.7	42.6
1974	40.63	108.8	27.808	235.3	68.4
1975	110.60	172.2	75.519	171.6	68.3
1976	160.03	44.7	89.188	18.1	55.7
1977	206.30	28.9	113.230	27.0	54.9
1978	205.57	-0.4	82.935	-26.8	40.3
1979	192.82	-6.2	65.776	-20.7	34.1
1980	224.93	16.7	89.080	35.4	39.6
1981	349.84	55.5	200.780	125.4	57.4
1982	469.20	34.1	303.490	51.2	64.7
1983	479.67	2.2	295.253	-2.7	61.6
1984	445.19	-7.2	263.544	-10.7	59.2
1985	424.38	-4.7	242.868	-7.8	57.7
1990	279.98	-34.0	28.797	-88.1	10.3
1991	272.90	-2.5	8.562	-70.3	3.1

Source: SAMA Annual Reports, 1965-1992.

Figure 3.1

Total Assets and Liabilities of SAMA



Source: Table 3.1

The local banks' deposits on banking department, on the other hand, accounted for no more than 25 % of the total liabilities in 1991. During the same year, the other liabilities together in the same department - which include in addition to the government Special and Reserves Accounts, those funds managed by the SAMA - accounted for 75.5 % of total assets and liabilities.

The asset side of the SAMA's balance sheet contains gold, foreign currencies convertible to gold, notes, coins, deposits with foreign banks, investment in foreign securities, and other assets. Despite the percentage of investment in foreign securities and deposits with banks abroad went down from 59.4 % in 1990, to 56.6 % in 1991, these two accounts are still considered predominant within the SAMA' total assets. The reason for

investing a high percentage of government assets abroad is due to the dominance of oil revenues in Saudi financial assets, and partly also a result of the inhibition on domestic interest.

Table 3.2
The Saudi Arabian Monetary Agency
Balance Sheet (SR million)

1990	Liabilities	1991	1990	Assets	1991
		Issue	Dept.		
	NOTES ISSUED				
41,792	In Circulation	46,880	756	Gold	756
7,834	In Banking Department	12,928			
<u>49,626</u>		<u>59,809</u>			
	CONS ISSUED				
147	In Circulation	156			
16	In Banking Department	20	49,033	Foreign Currencies Convertible to Gold	59,229
<u>163</u>		<u>176</u>			
<u>49,789</u>		<u>59,986</u>	<u>49,789</u>		<u>59,986</u>
		BANKING DEPARTMENT			
28,797	Government Special & Reserves Accounts	8,562		<u>Cash in Hand</u>	
4,287	Government Current Accounts	10,153	7,834	Notes	12,928
14,031	Other Government Agencies' Accounts	17,657	16	Coins	20
10	Retirement Pension Agencies' Accounts	434	7,850		12,948
6,394	Local Bank Deposits	6,740			
17,542	Independent Organiza- tions' Deposits	6,790	37,377	Deposits with Banks Abroad	51,931
159,133	Other Liabilities	162,577	128,857	Investment in Foreign Securities	102,658
			15	Gold & Silver	15
			56,097	Other Assets	45,362
<u>230,197</u>		<u>212,916</u>	<u>230,197</u>		<u>212,916</u>
		CONTRA ACCOUNTS			
<u>88,684</u>	Liabilities on Documentary Credits & Others	<u>144,884</u>	<u>88,684</u>	Documentary Credits and Others	<u>144,884</u>
		INDEPENDENT ORGANIZATIONS DEPARTMENT			
47,608	Retirement Pension Agency	46,348	20,869	Deposits with Banks Abroad	17,766
27,601	G O S I	16,767	13,421	Deposits with Local Banks	13,055
30,150	Development Funds	28,430	51,315	Investment in Foreign Securities	49,585
2,844	Islamic Development Bank	1,459	14,566	Investment in Local Securities	18,419
9,510	Other Organizations	12,610	17,542	Deposits with Banking Department	6,790
<u>117,715</u>		<u>105,616</u>	<u>117,715</u>		<u>105,616</u>

Source: SAMA Annual Report, 1993.

3.3.2 Commercial Banks

The SA's commercial banking system which now (1996) consists of twelve banks and a network of more than 1200 branches, has developed rapidly during the last few decades. The first stage of the development of commercial banking in SA started in the early 1930s with the opening of the first branch of the Netherlands Trading Society. Banking activities in this initial stage were very low. The first Saudi bank (the National Commercial Bank, NCB) was founded in 1951 and at that time it was no more than an upgraded foreign-exchange shop. The NCB's establishment was followed by the formation of the second Saudi-owned bank (Riyadh Bank) which has become the second-largest bank in the country after the NCB. By 1988 there were twelve commercial banks operating in Saudi Arabia (see Table 3.3).

All of these banks have been involved in banking traditional activities, such as accepting deposits from business, dealing in foreign exchange and facilitating the country's import trade. The Saudi banking market is nowadays influenced by foreign banking practices and every modern banking service is obtainable (Presley and Wilson, 1991). Automated teller machines (ATMs) and electronic point of sale (POS) are accessible nationwide. This is in addition to credit and debit cards, personal credit programmes and a growing range of innovative services which are rarely found in many developing countries.

Clear evidence of the growth of banking activity in Saudi Arabia is provided by the increase in the number of branches (see Table 3.4). In 1967 there were only 51 branches in the entire country; these branches were mostly concentrated in a few cities around the Holy places in the Western Province and in the oil cities in the Eastern Province. In 1985, the

number of branches jumped to 617 in addition to 38 seasonal branches associated with the Hajj. By the end of 1995, the number of bank branches in SA had reached 1200 (SAMA, 1996).

Table 3.3
The Commercial Banks Operating in Saudi Arabia

No	Banks	Establishm' t Date	Ownership
1	The National Commercial Bank	1951	Private
2	Riyadh Bank	1957	100% Saudi joint stock company
3	Saudi American Bank	1980	60% Saudi public and 40% Citibank
4	Saudi French Bank	1977	60% Saudi public and 40% Banque Indosuez
5	Arab National Bank	1975	60% Saudi public and 40% Arab Bank
6	Saudi Hollandi Bank	1974	60% Saudi public and 40% Algemence Limited, Nederland
7	Saudi Cairo Bank	1978	60% Saudi public and 40% Banque du Cairo
8	Saudi British Bank	1976	60% Saudi public and 40% British Bank of Middle East
9	Bank Al Jazira	1974	65% Saudi public and 35% National Bank of Pakistan
10	Saudi Investment Bank	1978	36% Saudi Public, 8% Gosi, 56% other banks
11	United Saudi Commircial Bank	1983	60% Saudi public and 40% other banks
12	Al- Rajhi Banking and Investment Corporation	1988	NA

Source: SAMA Annual Reports, 1975-1996.

Table 3.4**Regional Distribution of Bank Branches
(as at the end of fiscal years)**

Year	Western & Southern Provinces	Northern & Central Provinces	Eastern Province	Total
1981	142	120	90	352
1982	182	153	101	436
1983	226	184	114	524
1984	247	200	123	570
1985	267	222	128	617
1986	273	232	132	637
1987	293	246	135	674
1988	379	375	172	926
1989	409	397	179	985
1990	425	421	186	1032
1991	440	443	197	1080
1992	458	473	208	1139
1993	464	481	215	1160

Source: SAMA Annual Report, 1993

The rapid growth of the banking sector, not only in terms of branches but also in the breadth of its services, can be partly attributed to the absence of formal capital and money markets which has thus given the commercial banks the opportunity to perform a principal role in mobilising private capital and distributing it among the different sectors.

3.3.2.1 The Consolidated Balance Sheet of the Commercial Banks

On the assets side of the consolidated balance sheet of commercial banks (see Table 3.5), three items were very important and remained dominant until the year 1987: (1) cash in hand and with the SAMA; (2) foreign assets, and (3) claims on the private sector. In total, up to 1987 these items constituted about 95 % of total commercial bank assets. However, in 1988 their component shares in the balance sheet began to change, and unclassified assets started to acquire a similar importance. These latter assets consist mostly of the commercial banks' claims on the government sector. In 1986, 6 % of the total assets were unclassified assets, while 8 % were in cash, 51 % in foreign assets, and 35 % were claims on the private sector. Beginning in 1988, the growth of unclassified assets began to accelerate, reaching 26 % in 1993.

Foreign assets, on the other hand, have shown the greatest increase during the 1980s. Commercial banks argue that a big factor contributing to the greater emphasis on foreign assets (compared with the domestic markets), is the difficulty of securing collateral under Saudi judicial regulations. Because the charging of interest in general is prohibited in Saudi Arabia, the banks found that when they take a borrower to the Saudi Court, the Court will only enforce the repayment of the principal and will deduct interest paid and due from the amount in dispute. Some bankers, however, contend that innovative banks can manage to solve such a problem. They can get acceptable collateral within the existing system. A situation like this, in fact, gives the commercial banks just the right to worry about the security of their loans and concentrate more on their investment in foreign assets.

In the early part of the 1990s, the commercial banks' claims on the private sector began to increase, reaching 34 % of total commercial bank assets in 1993, compared with only 28 % in 1990. In comparison, the commercial banks' foreign assets fell sharply during the same period. In 1993 they constituted 36.5 % of banks' total assets as compared with 53.0 % at the end of 1990.

On the liability side, Table 3.5 shows that the deposits of commercial banks have grown from SR. 109 billion in 1983 to SR. 183 billion in 1993. However, the share of total deposits in the total liabilities of commercial banks fell from 75 % in 1983 to 60 % in 1993. The liabilities breakdown indicates that the share of demand deposits in total bank deposits has been declining in importance during the period from 1983 until the end of 1990. Since then, demand deposits went up by SR. 18.4 billion and their share in total bank deposits rose from 40 % at the end of 1990 to 45 % by the end of 1993. Quasi-monetary deposits, which include time and saving deposits, foreign currency deposits, and deposits for letters of credit and guarantees, have been increasing continuously since 1983. The only decline was in 1990; this later decline is a result of the Gulf War when some of the big depositors moved their deposits overseas.

By examining the items within the balance sheet of the commercial banks in Saudi Arabia, it is apparent that the balance sheets of Saudi banks have experienced a radical change since the end of the 1980s. During the last few years, government debt started to take up a significant portion of the balance sheet. At the end of 1993, the Saudi American Bank held 44.4 % of its assets in securities, mostly Saudi government development bonds; the Saudi British Bank in the same year had 43 % of its assets in securities (Cunningham.

1994). For the near future, the question must be asked how the banks in Saudi Arabia will perform in a contractionary economic situation combined with the recent decrease in oil prices.

Table 3.5
Consolidated Balance Sheet of Commercial Banks
(As at the end of fiscal years)

-Million Rivals-

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
BANK CASH	10,245	11,018	13,186	13,918	18,594	10,689	11,751	11,636	12,678	10,653	11,551
I) Cash in Tills	1,649	1,439	1,281	1,253	1,517	1,336	1,293	1,726	1,768	2,008	2,511
II) Statutory	4,492	4,561	4,610	4,872	5,056	5,867	5,853	5,780	7,270	7,746	8,112
Deposits with SAMA											
III) Free Reserves	2,484	2,009	1,097	834	980	411	1,196	751	1,424	707	621
IV) Other	1,620	3,009	6,198	6,959	11,041	3,075	3,409	3,379	2,216	192	261
FOREIGN ASSETS	71,052	73,400	72,770	86,672	102,198	114,741	118,844	123,467	118,951	106,372	111,017
CLAIMS ON PRIVATE SECTOR UNCLASSIFIED ASSETS	56,001	59,280	58,081	59,264	58,804	70,523	73,281	65,295	73,616	87,161	102,741
TOTAL ASSETS & LIABILITIES	145,247	152,566	154,528	170,659	191,059	216,239	233,585	232,055	258,330	275,192	305,711
TOTAL DEPOSITS	109,293	114,146	113,373	121,927	129,305	142,473	146,304	143,662	171,223	177,408	183,255
MONETARY	51,667	48,361	46,171	47,569	51,940	57,719	57,875	57,488	75,850	84,160	82,214
I) Business & Individuals	44,919	43,915	43,458	44,561	47,947	54,444	55,640	55,338	72,879	81,245	80,115
II) Official Entities	6,748	4,446	2,713	3,008	3,993	3,225	2,235	2,150	2,971	2,915	2,099
QUASI-MONETARY	57,626	65,785	67,202	74,358	77,365	84,754	88,429	86,174	95,372	93,248	101,041
FOREIGN LIABILITIES	8,498	8,944	11,145	14,288	24,485	28,727	34,603	30,172	27,936	32,509	37,243
CAPITAL & RESERVES UNCLASSIFIED LIABILITIES	10,038	11,893	13,008	13,148	13,542	14,954	15,719	17,359	18,783	24,457	30,199
	17,418	17,583	17,003	21,296	23,727	30,085	36,959	40,862	40,389	40,818	52,891

Source: SAMA Annual Reports, 1992 and 1993.

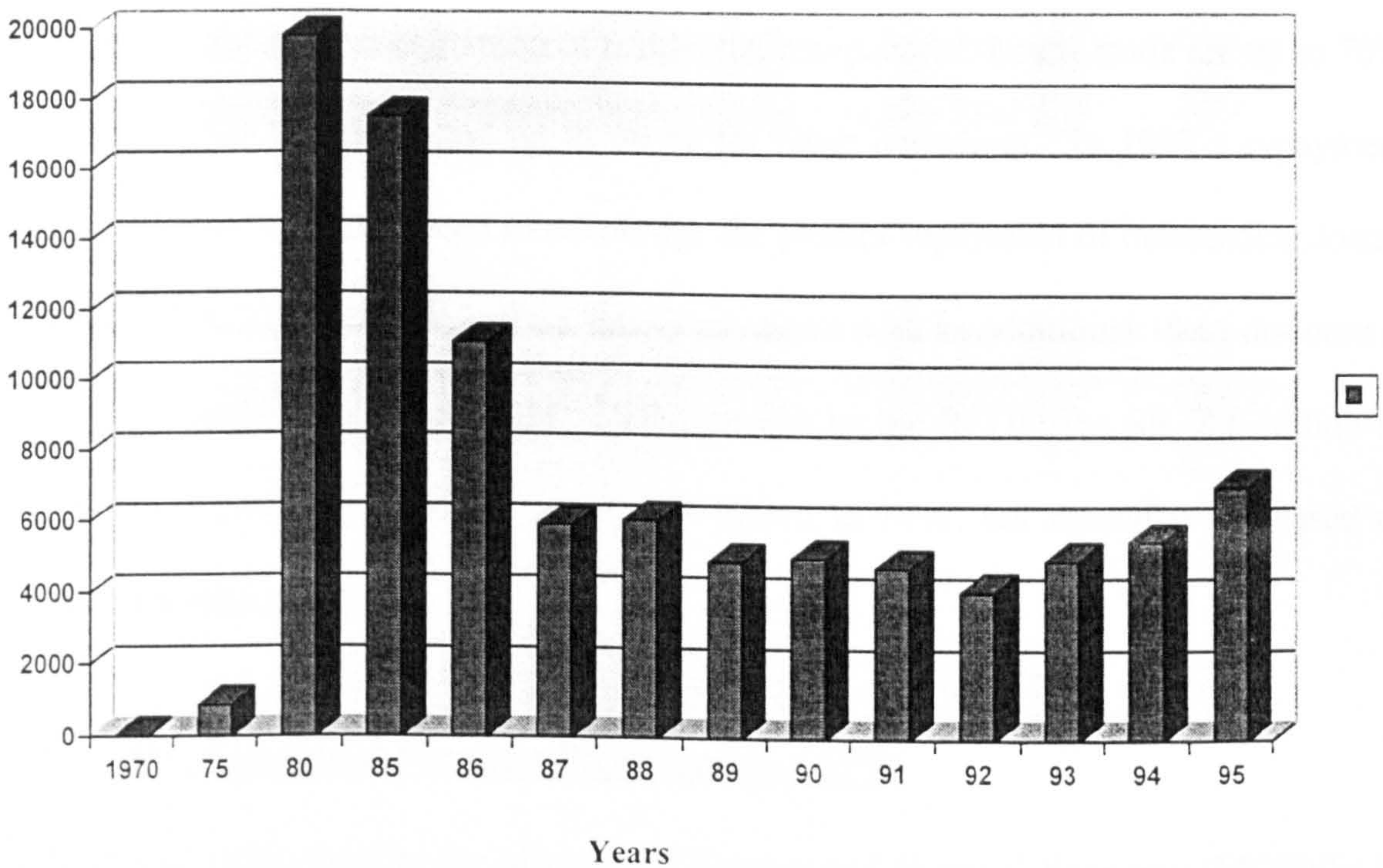
3.3.3 Specialised Credit Institutions (SCIs)

Since commercial banks primarily concentrate on short-term finance, the Saudi government realized early on the need to establish government lending institutions that would extend medium and long-term credit; and will, at the same time, help to promote agricultural, industrial and housing development. These institutions were established to provide development loans at a relatively low cost with complete government financing. They therefore, do not have to sell bonds to the public or accept private deposits to raise the necessary funds. The government policy stipulated that these institutions should extend interest-free credit except for an administrative cost of 2.5 % of the value of the loan.

The duration of the loans is different from one institution to another. Real Estate Development Fund loans last 25 years; Industrial Loans usually extend between 5 and 15 years. In the past, these institutions have been financed by budgetary appropriations. However, during the last few years, most of them have used outstanding loans repayments to meet any new lending activities to the various sectors of the economy. The total investment credit disbursed by all of the above specialist credit institutions experienced high growth during the first three development plans (1970-1985). As can be seen from Figure 3.2, the total financial assistance provided by the SCIs rose from SR. 16 million in 1969 to SR. 19.8 billion in 1979 and then decreased to SR. 17.6 billion in 1984; thereafter, it declined to about SR. 7 billion only in 1995. As a group they are permitted to lend to both individuals and households. Individually they specialise in lending to particular sectors. These institutions are discussed below.

Figure 3.2

Total Financial Assistance Provided by the SCIs (SR. Million)



Source: MOP, 1995.

3.3.3.1 The Saudi Arabian Agricultural Bank (SAAB)

This institution was established in 1962 in order to provide short, medium and long-term loans to the agricultural sector. All loans can be used for a wide range of purposes, including the purchase of seed, fertilisers, animal stock, construction, drilling and integrated investments such as large scale dairy projects. Loans disbursed by the SAAB rose sharply from SR. 16 million in 1969 to SR. 2.3 billion in 1985, but then began to decline reaching SR. 671 million in 1994.

3.3.3.2 The Real Estate Development Fund (REDF)

The REDF was created in 1974 in order to provide loans for private residential house construction and for the construction of residential compounds. Loans made are up to 70% of cost for owner occupiers and up to 50 % for other borrowers. In 1980 a repayment incentive scheme was introduced to encourage the prompt repayment of outstanding loans. A discount of 20 % is now allowed on timely payments with an additional 10 % discount if repayment is made in one lump sum. Disbursement by the REDF was SR. 8.6 billion in 1979 and then gradually dropped to SR. 1.9 billion in 1991, but thereafter increased to reach SR. 4.8 billion in 1994.

3.3.3.3 The Specialist Finance Programmes (SFP)

This fund was established by the Ministry of Finance and National Economy (MOFNE) to meet a specific need within the economy. In the early years of the second development plan there was an enormous demand for construction goods, but local contractors were not able to procure the necessary equipment to implement government contracts for roads, buildings and digging works. Loans, therefore, were granted for between 50 % and 60 % of the cost. Loans extended by the SFP increased from SR. 48 million in 1974 to SR. 635 million in 1979, and then declined to reach SR. 55 million in 1994.

3.3.3.4 The Public Investment Fund (PIF)

This fund is a division of MOFNE and was established to promote the diversification of the economy. It provides capital to public sector organisations in the form of loans and equity subscriptions. Some of these organisations were the Saudi Arabian Airlines (SAUDIA), the

General Petroleum and Mineral Organisation (PETROMIN) and the Saudi Basic Industries Corporation (SABIC). Lending by the PIF grew from SR. 603 million in 1974 to SR. 3.3 billion in 1979 and fluctuated to reach SR. 6 million in 1993. The fund provided no financial assistance in the year 1994.

3.3.3.5 The Saudi Credit Bank (SCB)

This bank was founded in 1971 to extend loans to low income Saudi families for a number of purposes such as, marriage, artisan workshops and home improvements. Credit extended by the SCB has continued increasing from SR. 40 million in 1974 to SR. 283 million in 1994.

3.3.3.6 The Saudi Industrial Development Fund (SIDF)

The SIDF is considered to be the third most important government fund. It was established in 1974 to finance private sector industrial ventures and to accelerate the private sector's involvement in the industrialisation of the country. The mission of the SIDF is not only to provide interest-free credit, but also to provide technical, financial and marketing advice to entrepreneurs.

3.3.3.7 Consolidated Balance Sheet of the Specialised Credit Institutions

It can be seen from Table 3.6 that the total assets of these institutions have been growing continuously during the last twenty years. Total assets grew from SR. 17.5 billion in 1976 to SR. 212 billion in 1993; most of these assets were in loans. In 1993, for example, the percentage of loans to total assets was 71 %. The investments category on the assets side

refers primarily to the participation of the Public Investment Fund in the ownership of some privately-owned companies, such as the Saudi Arabian Airline. As mentioned in the previous section, the funds needed for the operation of these institutions are contributed by the government from its annual budget. Therefore, we can see that the paid-up capital of these institutions is basically their only source of funds.

Table 3.6
Consolidated Balance Sheet of the Specialized Credit Institutions (Million Riyals)

YEAR	1976	1977	1978	1979	1980	1981	1982	1983	1984
ASSETS									
Monetary Assets:	4,236.1	2,461.4	4,382.4	4,545.8	8,759.6	8,090.4	9,142.1	6,095.0	4,765.6
Saudi Currency									
(Notes and Coins)	1.3	2.1	2.8	4.3	2.1	2.5	4.6	2.4	3.6
Dep's with SAMA	3,727.9	1,956.2	3,834.3	3,568.7	8,041.3	7,344.7	8,281.5	5,396.8	3,410.7
Deposits with Local Banks	506.2	502.4	530.8	966.9	690.1	721.0	826.8	676.4	1,226.3
Monetary Assets Under Collection	0.7	0.7	14.5	5.9	26.1	22.2	29.2	19.4	125.0
Loans	11,883.9	27,160.4	41,555.9	58,756.3	76,032.0	97,458.0	119,270.2	138,130.0	155,641.0
Investments:	731.3	6,913.5	6,417.4	5,827.2	6,178.3	7,297.6	9,002.5	9,693.7	11,190.9
Domestic	139.3	6,040.2	5,469.4	4,837.0	5,171.2	6,004.6	7,676.0	8,235.7	9,743.6
Foreign	592.0	873.3	948.0	990.2	1,007.1	1,293.0	1,326.5	1,458.0	1,447.3
Fixed Assets	8.0	14.2	8.6	8.1	14.1	25.0	12.7	43.4	8.0
Other Assets	606.3	916.5	1,251.4	966.6	1,391.0	1,519.0	3,113.4	3,709.3	3,915.7
TOTAL ASSETS	17,465.6	37,466.0	53,615.7	70,104.0	92,375.0	114,462.0	140,540.9	157,671.4	175,521.2
LIABILITIES									
Paid-up Capital	14,793.6	32,093.6	42,144.6	68,954.6	90,882.3	112,985.0	138,253.7	154,512.6	172,088.8
Reserves	150.0	326.5	408.3	517.5	503.4	689.8	787.3	954.0	954.0
Due to:									
Local Banks	3.6	0.5	-	-	-	-	-	-	-
Others	1.2	15.5	1.6	2.0	76.7	93.2	10.2	6.6	15.1
Borrowing from:									
SAMA	-	-	-	10.0	-	-	9.9	15.0	-
Government	10.0	14.8	10.0	-	-	-	-	10.4	-
Others	3.7	-	4.9	6.1	8.0	9.0	-	4.8	23.5
Earmarked Reserves	2.7	18.0	24.3	45.7	57.6	75.0	85.0	94.1	105.1
Other Liabilities	2,500.8	4,997.1	11,022.0	568.1	847.0	610.0	1,394.8	2,073.9	2,334.7
TOTAL LIABILITIES	17,465.6	37,466.0	53,615.7	70,104.0	92,375.0	114,462.0	140,540.9	157,671.4	175,521.2

Table 3.6 (continued)

Consolidated Balance Sheet of the Specialized Credit Institutions

YEAR	1985	1986	1987	1988	1989	1990	1991	1992	1993
ASSETS									
Monetary Assets:	7,018.5	9,019.7	13,291.5	15,306.9	18,496.9	16,996.8	18,927.9	19,266.2	25,670.0
Saudi Currency									
(Notes & Coins)	3.2	1.8	2.9	1.2	4.3	3.3	2.0	2.7	2.6
Deposits with SAMA	5,279.1	6,961.6	10,573.3	13,229.7	15,285.2	12,634.1	13,282.5	15,088.0	20,755.7
Deposits with Local Banks	1,564.7	1,970.0	2,694.9	2,028.2	3,156.9	4,316.4	5,592.3	4,012.5	4,870.8
Monetary Assets Under Collection	171.5	86.3	20.4	47.8	50.5	43.0	51.1	163.0	40.9
Loans	163,789.9	166,609.6	166,401.6	165,988.3	164,958.0	160,400.1	159,124.2	152,871.9	151,649.8
Investments:	10,688.1	11,170.0	13,814.4	14,081.0	14,178.8	16,822.5	19,028.8	22,870.0	22,523.0
Domestic	9,223.6	9,586.2	9,666.7	9,933.7	9,971.3	12,387.8	14,554.9	18,564.2	18,225.0
Foreign	1,464.5	1,583.9	4,147.7	4,147.3	4,207.5	4,434.7	4,473.9	4,305.8	4,298.0
Fixed Assets	43.7	44.9	46.1	45.1	141.8	49.8	90.1	126.3	106.8
Other Assets	3.861	2,735.2	2,169.0	625.9	726.0	8,728.4	9,146.5	13,117.4	12,034.6
TOTAL	185,401.4	189,876.4	195,722.6	196,047.2	198,501.5	202,997.6	206,317.5	208,251.8	211,984.2
LIABILITIES									
Paid-up Capital	181,294.8	183,905.3	188,648.0	189,473.0	186,997.9	189,535.6	189,995.0	189,498.0	189,497.9
Reserves	954.0	954.0	954.3	954.0	954.0	954.0	954.0	954.0	954.0
Due to:									
Local Banks	-	-	-	-	-	-	-	-	-
Others	13.4	11.7	10.9	13.2	16.3	15.1	14.4	13.6	17.6
Borrowing from:									
SAMA	-	-	-	-	-	-	-	-	-
Government	-	15.1	17.0	11.6	9.2	9.4	3.9	-	12.9
Others	-	0.8	-	11.6	-	-	6.3	7.0	3.4
Earmarked Reserves	122.1	150.0	182.0	194.0	206.0	206.0	206.0	206.0	206.0
Other Liabilities	3,017.1	4,839.5	5,910.4	5,398.8	10,318.1	12,277.5	15,137.9	17,573.2	21,292.4
TOTAL	185,401.4	189,876.4	195,722.6	196,047.2	198,501.5	202,997.6	206,317.5	208,251.8	211,984.2
LIABILITIES									

Source: SAMA Annual Report, 1992/93

3.3.4 Other Financial Institutions

The expansion of the Saudi financial sector is also reflected in the establishment of a number of development financing institutions which have been set up by the Saudi government for specific interests. A selection of some of the most important of these institutions are:

1) The Saudi Fund for Development (SFD).

The SFD was established in 1974 in order to provide development assistance to friendly developing countries. The initial capital of this fund was SR. 10 billion. It was established by the Saudi government in response to appeals made by developing countries for help when the increase of oil prices in the early 1970s put pressure on their balance of payments.

2) The Islamic Development Bank (IDB).

The IDB is an international Islamic development bank which started operations immediately after its establishment in Jeddah (Saudi Arabia) in 1975. The bank has 28 member countries. It provides loans to, and participates in, joint ventures in member countries.

3.3.5 The Saudi Capital Market

No formal capital or money markets exist in the Kingdom of Saudi Arabia. The principal responsibility for channeling resources from savers to investors, and allocating investment resources among different activities according to relative rates of return, rests with the Saudi Commercial Banks. The banks operate through the electronic securities information system (ESIS). This system was partly established in response to the Al-Manakh crisis in Kuwait in 1982 (Kawash, 1994). Trading is over-the-counter and is limited to the 12 banks

comprising the Saudi Shares Registration Company (SSRC). The SSRC has a central unit coordinating market order and works as a clearing system after trade execution. The SSRC then reports trades on a daily basis to the SAMA.

Growth in trading has been rapid since the mid 1980s. In 1994, the volume of shares traded was 152 million; more than 50 times higher than in 1985. The growth in the value of shares has been even more noticeable. As can be seen from Table 3.7 and Figure 3.3 the value of shares traded in 1994 was SR. 24.9 billion compared with SR. 13.7 billion in 1992. and nearly SR. 8.5 billion in 1991.

Table 3.7
Saudi Arabian Stock Market Growth 1985-94

Year	Number of Transactions	Volume (00s)	Value Traded SR(10,000s)	% change	Capitalisation (SR billion)
1985	7.842	39,363	75,998	-	67.00
1986	10.833	52,630	83,075	9.0	63.40
1987	23.267	120,123	168,552	102.9	72.80
1988	41.960	146,413	203,679	20.8	85.90
1989	110.030	152,720	335,369	65.1	107.30
1990	85.298	169,384	440,324	30.9	97.30
1991	90.559	307,581	852,731	93.7	180.80
1992	272.075	351,999	1,369,883	60.7	206.10
1993	319,582	603,076	1,736,003	27.2	197.90
1994	357,700	1,521,000	2,487,100	43.0	145.10

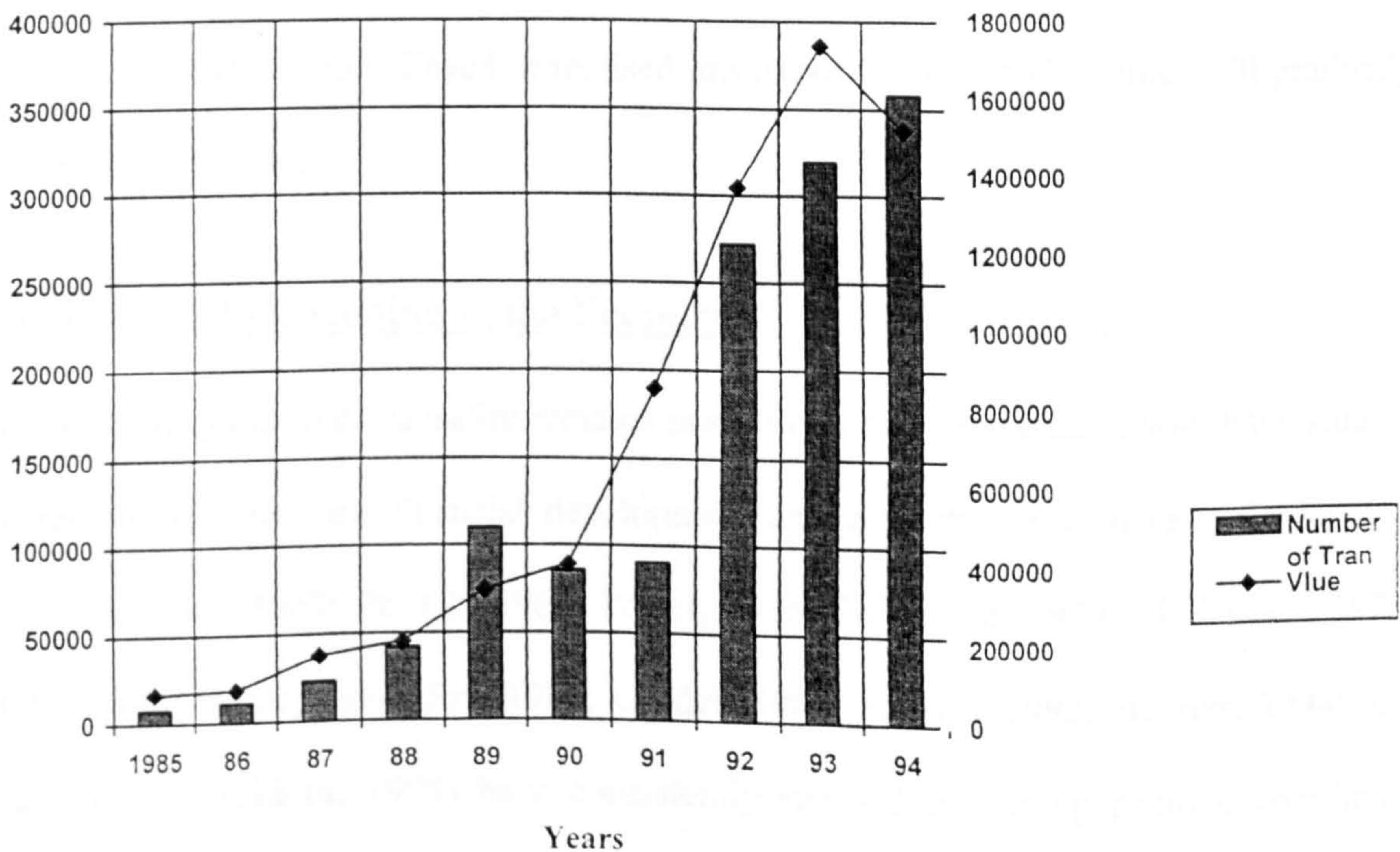
Exchange rate: \$1 = SR 3.75
Source: SAMA, January, 1995

The number of transactions has also risen from 7,842 in 1985 to 357,000 in 1994; more than a 45-fold increase. The market is very large, and by the standards of the region it is the

largest in the Middle East in terms of market capitalisation (Kawash, 1994). By the end of 1993, 89 banks and companies were trading their shares in Saudi Arabia. However, the market is characterised by a low level of trading compared with the volume of shares. In 1993 the volume of shares traded was equivalent to only 8 % of the total shares. This low level of activity may be attributed to the extent of government control of shares and the way the market operates. Of the total, the Saudi government owns about 41 % while 3.8 % is owned by foreigners who are not allowed to trade. The remainder are held by investors, a few of whom may keep their shares (which are in many cases very large) in order to maintain their influence in companies and in many instances, in the market itself.

Figure 3.3

The Value and The Number of Transactions of Saudi Shares



Source: Table 3.7

The banking sector, which is the largest part of the market with about 40 % of market capitalisation, has been the centre of attention for the last few years during which time (with two exceptions) all local banks have issued new shares. The cement and services sectors with about 25 % of the market capitalisation, have been among the most interesting sectors in the first half of the 1990s. The industrial sector, which accounts for 20 % of the market capitalisation, was dominated by the Saudi Basic Industries Corporation (SABIC) which accounted for more than 14 % of the Saudi market account capitalisation at the end of 1992 (O'Sullivan, 1993).

With the Saudi economy slowing down in the early 1990s, it is improbable that the Saudi market in the second half of the 1990s will make major advancements. Observers in SA think that the possibility that the Saudi currency (Riyal) might be devalued by the central bank puts a further discouragement on trading. Perhaps when these kinds of latter popular concerns become allayed or realised, investment in the stock market will gradually become more favoured.

3.4 Financial Deepening in the Economy

Although the question of causality remains unresolved, most economists who have studied the relationship between financial development and economic growth (e.g. Gurley and Shaw, 1955 and 1967; Patrick, 1966; Porter, 1966; Goldsmith, 1969; McKinnon, 1973; Drake, 1980; Gupta, 1986; Fry, 1988; Gertler, 1988; Pagano, 1992; Hermes, 1994; and Gregorio and Guidotti, 1995) have consistently stressed the strong positive correlation between the two, and moreover, the apparent importance of financial institutions in the

process of economic development. Gurley and Shaw (1955 and 1967) seemed to lean to the view that the relation between both financial development and economic growth is a two-way process.

Goldsmith (1969) was one of the first to study empirically and in detail the financial structures of more than thirty developed and developing countries over the 1860-1960 period. He concluded that financial development and economic growth were somehow inter-related. Although he could not establish the causal direction between the two, he compiled an extensive list of indicators of financial development. These indicators are differentiated by the type and inclusiveness of the data used. Goldsmith used the financial inter-relations ratio (FIR) to measure the ratio of the total financial assets to the total real assets of an economy; as a kind of proxy for the size of the financial superstructure. Another ratio - the new issues ratio (NIR) - captures the pace at which the financial system is growing in order to accommodate the growth of the real economy. Goldsmith also suggested another group of ratios for establishing the importance of different financial institutions in relation to the rest of the financial system.

The following exploratory investigation will be limited to the analysis of a subset of the most important of these ratios developed by Goldsmith (1969) in order to demonstrate the relative importance of the financial system in the Saudi economy. For this purpose, three groups of ratios will be explored: the currency ratios; the monetary ratios; and other financial ratios.

3.4.1 The Currency Ratios

In a developing country like Saudi Arabia, the currency ratios (CR) are very important because currency is introduced to people as a substitute for holding savings in the form of tangible assets. We, therefore, expect that as the real economy grows, currency ratios will rise steadily at the early stages of financial development. This is due to the monetisation of the economy and the convenience and security of holding currency instead of tangible assets. However, these ratios are then expected to start declining as more financial instruments are created by financial institutions with more attractive attributes such as higher yield, convenience and safety (Al-Jasser, 1986).

As shown in Table 3.8 and Figure 3.4, the CR_1 (currency outside banks to money supply (M_1)) has been declining over the last twenty years. It went down from 52.1 % in 1975 to a low of 34.1 % in 1993. Although the ratio fluctuated during some periods, the general trend was downwards. The ratio being around 35 % indicates that some financial development is taking place in Saudi Arabia, especially if we recognize that the ratio for some other developing countries was higher during the same years. In 1984, for example, the CR_1 ratios for South Korea, Mexico and Egypt were 45.6 %, 47.8 %, and 57 % respectively (Al-Jasser, 1986).

The other two ratios CR_2 and CR_3 (currency outside banks to money supply (M_2 , M_3)) have also been witnessing measurable decreases over the same period. CR_2 has fallen from 46.2 % in 1975 to 24.7 % in 1993; while CR_3 declined from 38.6 % to 18.9 % during the same period. This large decline in CR_2 and CR_3 when compared with CR_1 is attributable to

the attractiveness of the interest-earning time savings and other quasi-monetary deposits with domestic banks.

Table 3.8
The Currency Ratios CR₁, CR₂ and CR₃

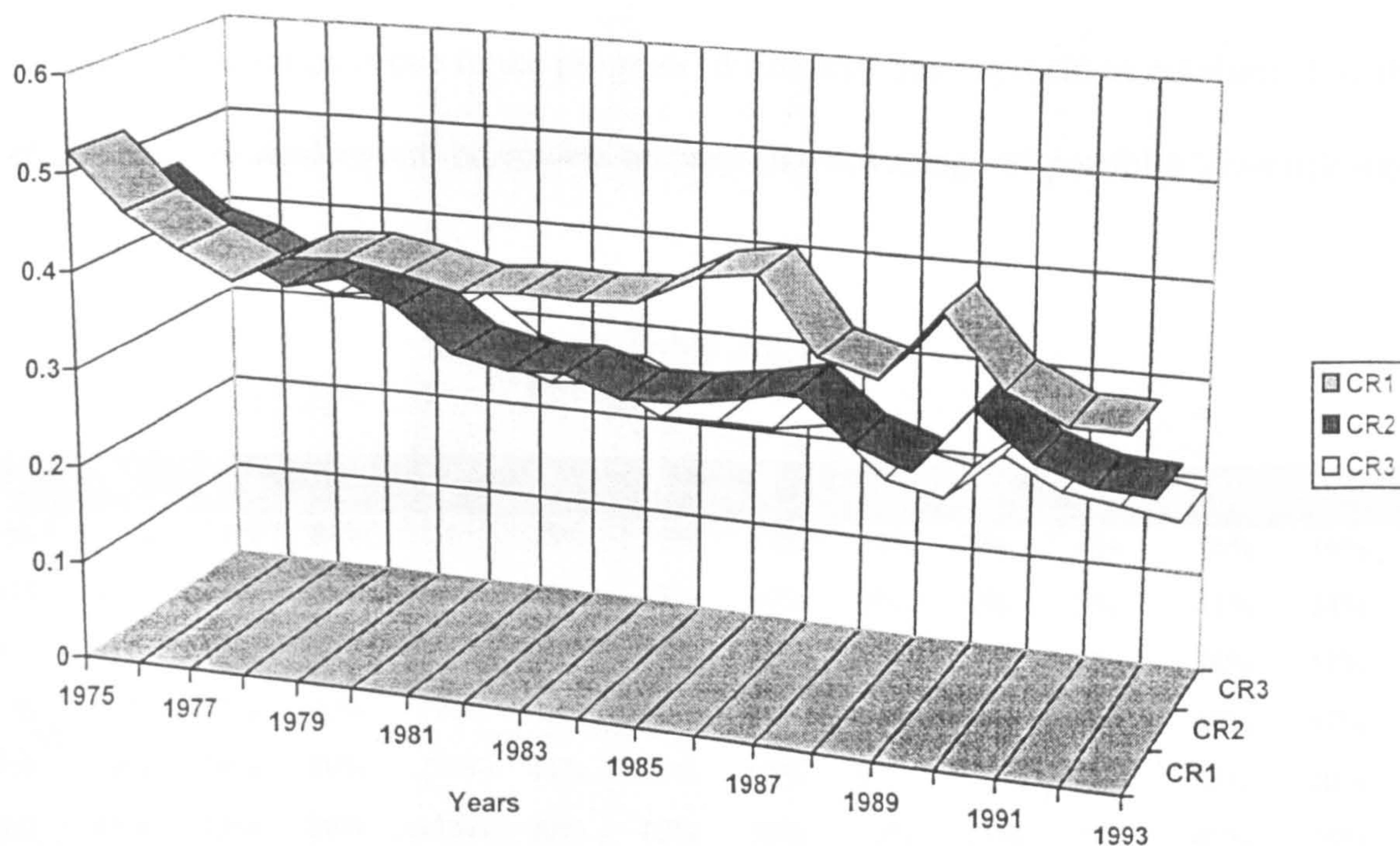
(billion Rivals)

Year	COB	M ₁	CR ₁	M ₂	CR ₂	M ₃	CR ₃
1975	4.147	7.963	0.521	8.982	0.462	10.736	0.386
1976	6.737	14.499	0.465	16.154	0.417	18.704	0.360
1977	10.846	25.138	0.431	27.053	0.401	30.859	0.351
1978	18.825	46.589	0.404	50.723	0.371	56.156	0.335
1979	22.837	53.035	0.431	59.427	0.384	66.801	0.342
1980	25.538	58.833	0.434	71.163	0.359	80.179	0.319
1981	28.763	67.827	0.424	90.627	0.317	103.509	0.278
1982	33.975	82.374	0.412	111.218	0.305	129.396	0.263
1983	35.924	86.381	0.416	117.027	0.307	134.473	0.267
1984	34.450	83.288	0.414	119.450	0.288	144.736	0.238
1985	34.831	83.394	0.418	120.015	0.290	145.398	0.240
1986	36.482	81.482	0.448	121.639	0.300	151.736	0.240
1987	40.166	87.799	0.457	128.042	0.313	160.901	0.250
1988	35.945	93.664	0.384	134.142	0.268	178.417	0.201
1989	33.877	91.751	0.369	136.413	0.248	180.180	0.188
1990	44.776	102.264	0.438	141.545	0.316	188.438	0.238
1991	44.620	120.470	0.370	165.093	0.269	215.842	0.207
1992	43.769	127.929	0.342	174.255	0.251	221.177	0.198
1993	42.622	124.891	0.341	172.783	0.247	225.972	0.189

CR₁ = COB/M₁ COB = Currency Outside Banks
 CR₂ = COB/M₂
 CR₃ = COB/M₃

Source: SAMA Annual Reports, 1975-1994

Figure 3.4
The behaviour of Currency Ratios: CR₁, CR₂, and CR₃



Source: Table 3.8

3.4.2 The Monetary Ratios

In spite of the high growth rates attained by the monetary aggregates in Saudi Arabia, it is important to study the composition of these aggregates. Monetary ratios (MR) capture the evolution of the financial system as the commercial banking system becomes and the banking habit takes hold among the population (Porter, 1966 and McKinnon, 1973). Table 3.9 is designed in such a way that the monetary ratios are classified into three categories.

1. The ratios of MR₁ to MR₄. The first three ratios MR₁, MR₂ and MR₃ (MR₁ = M₁/M₂, MR₂ = M₁/M₃, MR₃ = M₂/M₃) are expected to be high at the early stage of financial development and then start to decline as the financial system matures. This decline will be

accounted for by the rising importance of quasi-monetary deposits. Therefore, MR_4 ($MR_4 = BQM/M_3$) is expected to rise slowly as the preceding ratios declined. This asymmetrical movement of the ratios is due to the progress of financial development as manifested by the sophistication of lenders and borrowers as they take advantage of portfolio diversification opportunities (Al-Jasser, 1986).

Table 3.9
The Monetary Ratios

Year	MR_1	MR_2	MR_3	MR_4	MR_5	MR_6	MR_7	MR_8	MR_9	MR_{10}	MR_{11}	MR_{12}
1975	89%	74%	84%	-	28%	31%	37%	10%	9%	4%	36%	16%
1976	90%	78%	86%	-	30%	33%	39%	9%	9%	3%	41%	14%
1977	93%	81%	88%	-	36%	39%	45%	8%	6%	3%	46%	12%
1978	91%	83%	90%	10%	41%	44%	49%	8%	7%	3%	49%	17%
1979	89%	79%	89%	11%	44%	48%	53%	9%	10%	4%	45%	20%
1980	82%	73%	89%	11%	40%	45%	50%	10%	15%	5%	42%	26%
1981	74%	66%	88%	12%	38%	46%	52%	15%	22%	9%	38%	34%
1982	74%	64%	86%	14%	38%	50%	58%	20%	22%	13%	37%	43%
1983	74%	64%	87%	13%	40%	54%	63%	23%	23%	14%	38%	35%
1984	70%	58%	83%	18%	39%	55%	67%	11%	25%	16%	34%	43%
1985	69%	57%	83%	18%	38%	56%	67%	12%	26%	17%	33%	43%
1986	67%	54%	80%	20%	39%	58%	73%	14%	27%	19%	30%	46%
1987	69%	55%	80%	20%	41%	59%	75%	15%	25%	18%	30%	45%
1988	70%	53%	75%	25%	43%	61%	81%	20%	23%	18%	32%	48%
1989	67%	51%	76%	24%	41%	61%	81%	20%	25%	19%	32%	49%
1990	72%	54%	75%	25%	42%	59%	78%	19%	21%	18%	31%	46%
1991	73%	56%	77%	24%	48%	66%	86%	20%	21%	18%	35%	44%
1992	73%	58%	79%	23%	-	-	-	-	21%	-	38%	42%
1993	72%	55%	77%	24%	-	-	-	-	21%	-	-	45%

$MR_1 = M_1/M_2$

$MR_2 = M_1/M_3$

$MR_3 = M_2/M_3$

$MR_4 = BQM/M_3$

$MR_5 = M_1/VNNO$

$MR_6 = M_2/VNNO$

$MR_7 = M_3/VNNO$

$MR_8 = BQM/VNNO$

$MR_9 = TSD/M_3$

$MR_{10} = TSD/VNNO$

$MR_{11} = DD/M_3$

$MR_{12} = QM/M_3$

TSD = Time and Saving Deposits

QM = Quasi-Money

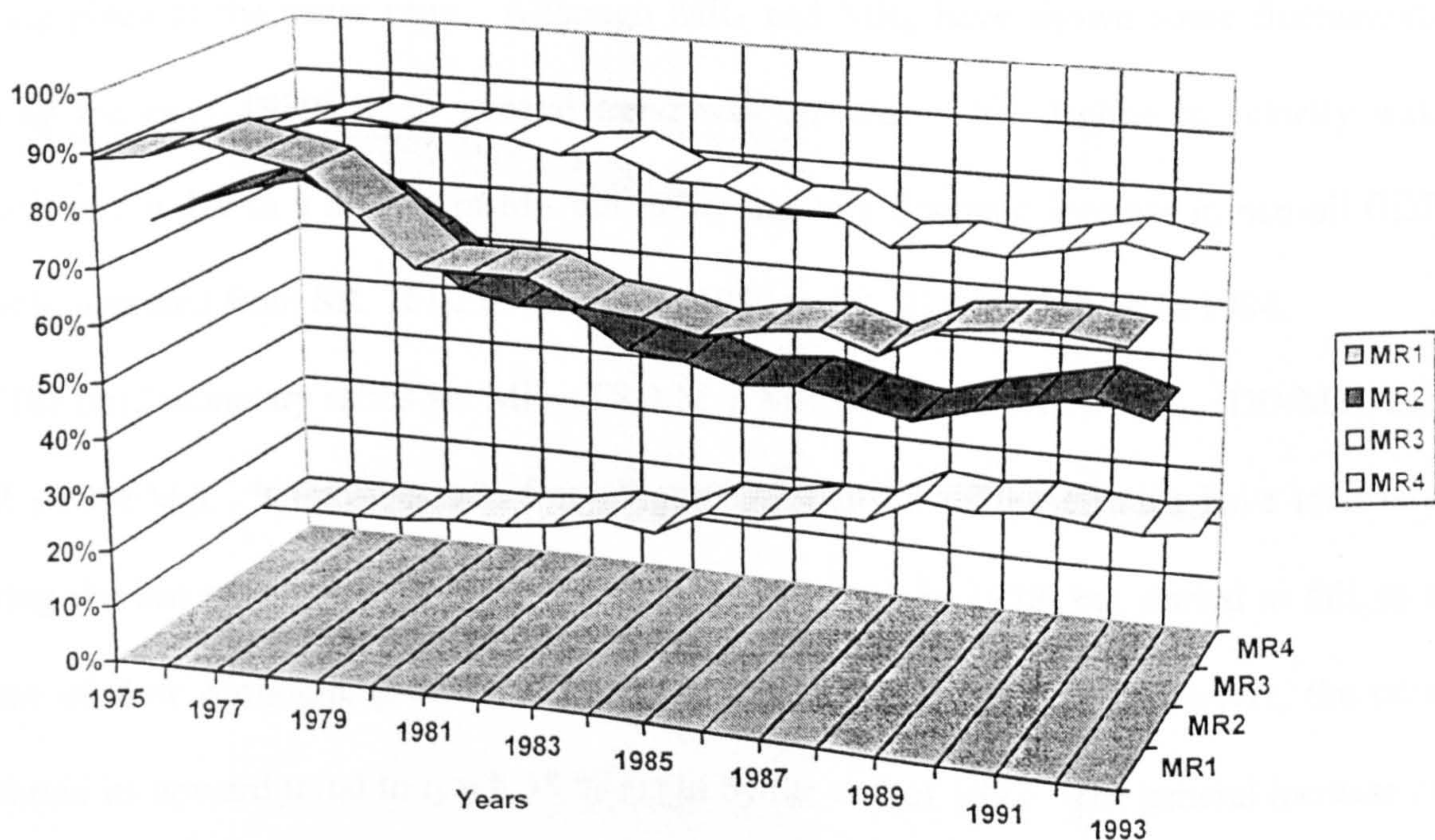
VNNO = Nominal non-oil GDP

DD = Demand deposits

Source: SAMA Annual Reports, 1985, 1992.

It can be seen from the Figure 3.5 that MR_1 (the ratio of M_1 to M_2) and MR_2 (the ratio of M_1 to M_3) both have decreased steadily from 1975 to 1993. At the same time, quasi-monetary deposits increased in importance, leading to a more than doubling of MR_4 (the ratio of broad quasi-money to M_3). MR_4 went up from 10 % in 1978 to 24 % in 1993. MR_3 (the ratio of M_2 to M_3), on the other, hand has witnessed a very low decline over the same period. This may be due to the gains in both time and saving deposits, and foreign currency deposits.

Figure 3.5
The Behaviour of the Monetary Ratios:
 MR_1 , MR_2 , MR_3 and MR_4



Source: Table 3.9

2. This category which includes MR_5 (M_1 /non-oil GDP), MR_6 (M_2 /non-oil GDP), MR_7 (M_3 /non-oil GDP), and MR_8 ($M_3 - M_1$ /non-oil GDP), can be used as an indication of the

velocities of circulation. These ratios should increase gradually as the development of financial system and the economy, at large, forges ahead. The rising trends of those ratios can be indicators of the development of the financial system and the increased specialisation within the economy at large, and especially within the financial and production spheres. It is also expected that these ratios eventually would level off. This is due to the fact that as the financial system develops and economic actors (individuals and institutions) become more sophisticated, demand is shifted to the more diversified quasi-monetary instruments which usually have higher returns (Al-Jasser, 1986).

As shown in Figure 3.6, all of these ratios have increased significantly over the past twenty years, which means a significant decline in the velocities of circulation has been taking place at the same time. Although MR_5 and MR_8 have shown some fluctuations during the early 1980s, their general trend was upward. This decline in velocity was, however, not due to a decline in M_1 , but rather due to a dramatic increase in non-oil GDP which increased from SR. 161,216 million in 1980 to SR. 214.869 billion in 1984.

3. The third monetary ratios are MR_9 (TSD/ M_3), MR_{10} (TSD/VNNO), MR_{11} (DD M_3), and MR_{12} (QM/ M_3). It may be seen from Figure 3.7 that all of these ratios have increased during the last twenty years. MR_{11} ratio reached its peak in 1978, but started to fall, as a result of slow economic growth, to levels as low as 30 % in 1986. However, the ratio restarted its upward trend to reach 38 % again by the end of 1992. The general increase of these ratios apparently reflects higher deposits or confidence in the financial system in general, and the improved safety of the banking sector in particular.

Figure 3.6
The Behaviour of the Monetary Ratios:
MR₅, MR₆, MR₇ and MR₈

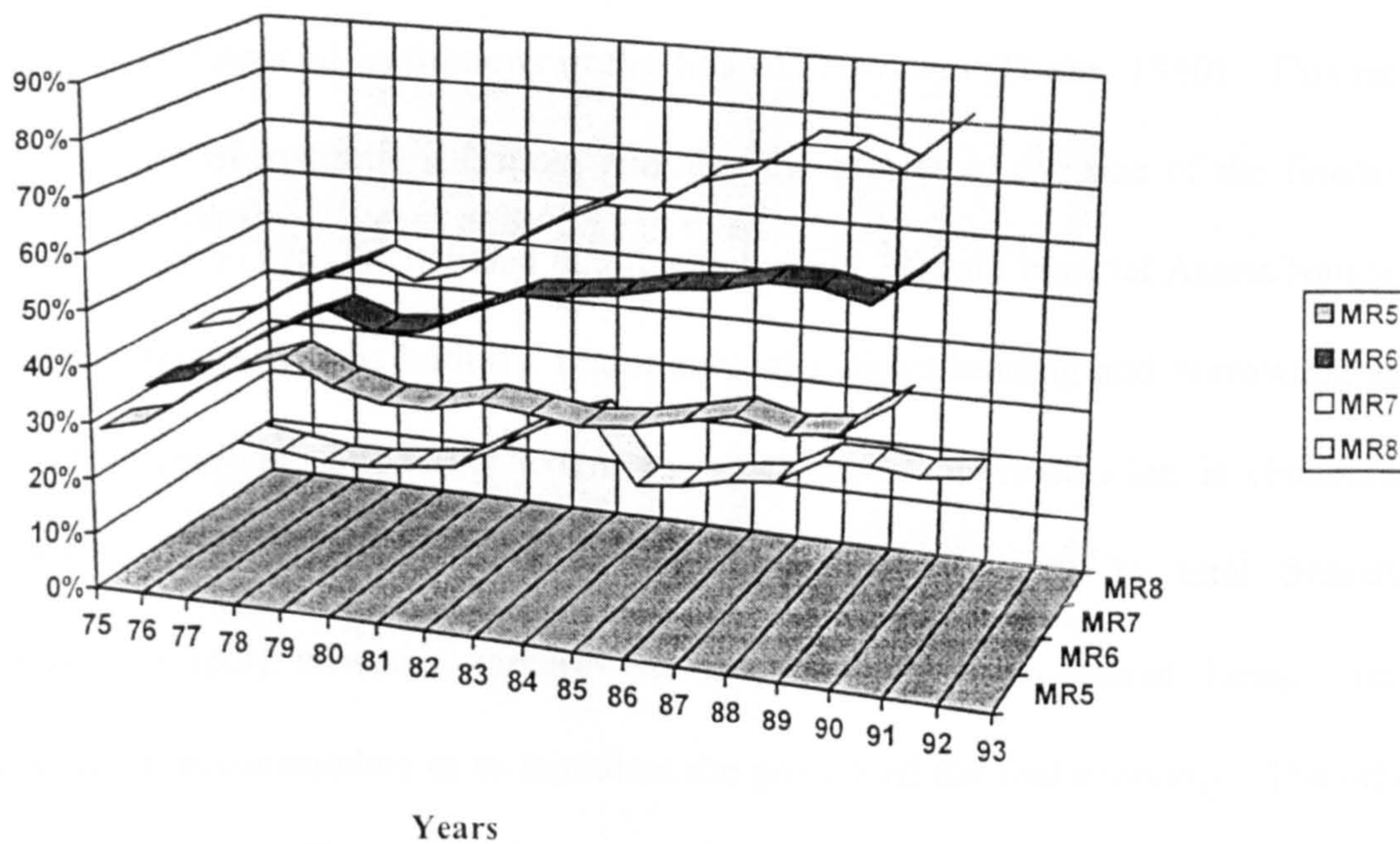
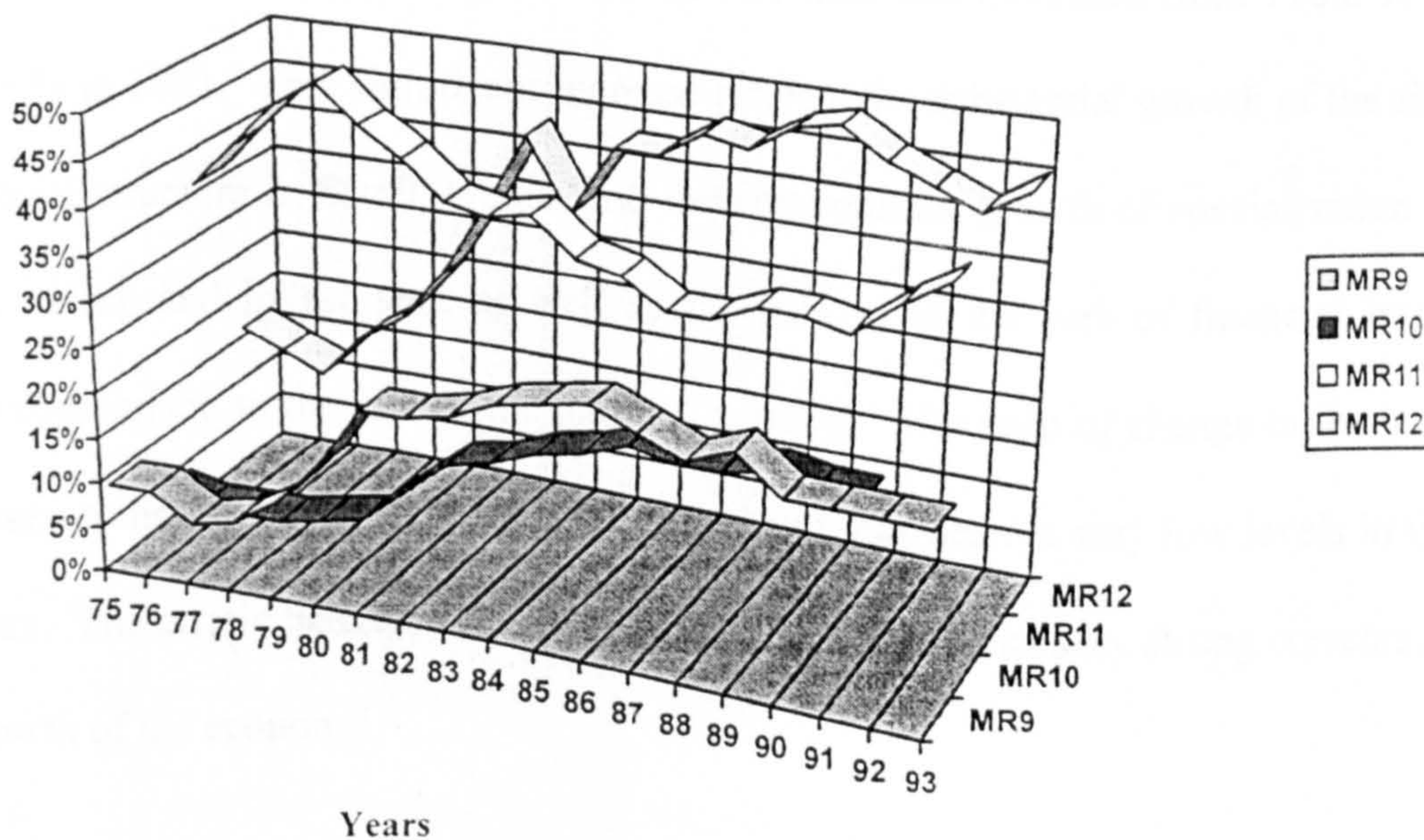


Figure 3.7
The Behaviour of the Monetary Ratios:
MR₉, MR₁₀, MR₁₁ and MR₁₂



Source: Table 3.9

3.4.3 Other Financial Ratios

The aggregate total financial assets to GDP is normally used as an indicator of the importance of the financial institutions in the financing process (Drake, 1980). This ratio reflects the degree of institutionalisation, and also the growth of the size of the financial structure. Goldsmith (1969) concluded that the higher FIR (Total Financial Assets/National Output) is, the greater will be both the importance of indirect lending and borrowing, and the level of institutionalisation (the extent to which credit intermediation is channelled through financial institutions). The second ratio NIR (Change in total financial assets/National Output), however, captures the new financial issues created during a time period in order to accommodate or to stimulate the growth of the real economy. The other ratios used in Table 3.10 (F₃ to F₈) reflect the composition of the financial structure. It is of considerable importance to know which of the financial institutions are gaining in importance within the Saudi financial structure relative to the rest of the financial system.

As shown in Table 3.10, and Figure 3.8, the FIR ratio has increased from 116.8 % in 1966 to 281 % in 1991. This significant increase reflects the substantial growth of the size of the financial structure in Saudi Arabia, and the concomitant growth of specialisation in production, saving and investment; as well as the density of the web of financial interrelations in comparison to the size of the national product. The ratio of change in the total financial assets to non-oil GDP (NIR), on the other hand, has been at very low levels in the last few years. The erratic behaviour of this ratio has been due to its very strong correlation with the growth of the economy.

Table 3.10
Other Financial Ratios

Year	FIR	NIR	F ₃	F ₄	F ₅	F ₆	F ₇	F ₈
1966	116.8	23.9	0.3	25.3	74.5	0.3	29.3	87.0
1969	101.1	-0.9	0.7	39.0	60.2	0.7	39.2	50.9
1972	137.7	36.8	0.5	28.9	70.6	0.7	39.7	97.2
1975	165.9	82.9	1.3	24.8	73.9	2.2	41.0	122.0
1978	230.0	70.4	22.1	23.7	55.3	50.9	57.2	133.7
1981	220.3	39.0	30.7	26.7	42.6	67.7	58.9	93.8
1984	231.0	10.7	33.9	29.4	36.7	78.3	67.8	84.8
1987	302.0	2.4	30.0	33.1	36.8	90.7	100.0	111.2
1990	285.1	1.5	29.5	34.0	36.5	84.2	96.8	104.1
1991	281.0	5.9	29.4	33.0	37.6	82.3	92.8	105.7

FIR = NTFA/VNNO

TFA = SAMASTS + CBASTS + SCIASTS

CBASTS = Commercial banks' assets

VNNO = Nominal non-oil GDP

F₃ = SCIASTS/NTFA

F₅ = SAMASTS/NTFA

F₇ = CBASTS/VNNO

NTFA = Net total financial assets

SAMAASTS = Total assets of SAMA

CIASTS = Total assets of the specialized credit institutions

NIR = DNTFA/VNNO

F₄ = CBASTS/NTFA

F₆ = SCIASTS/VNNO

F₈ = SAMASTS/VNNO

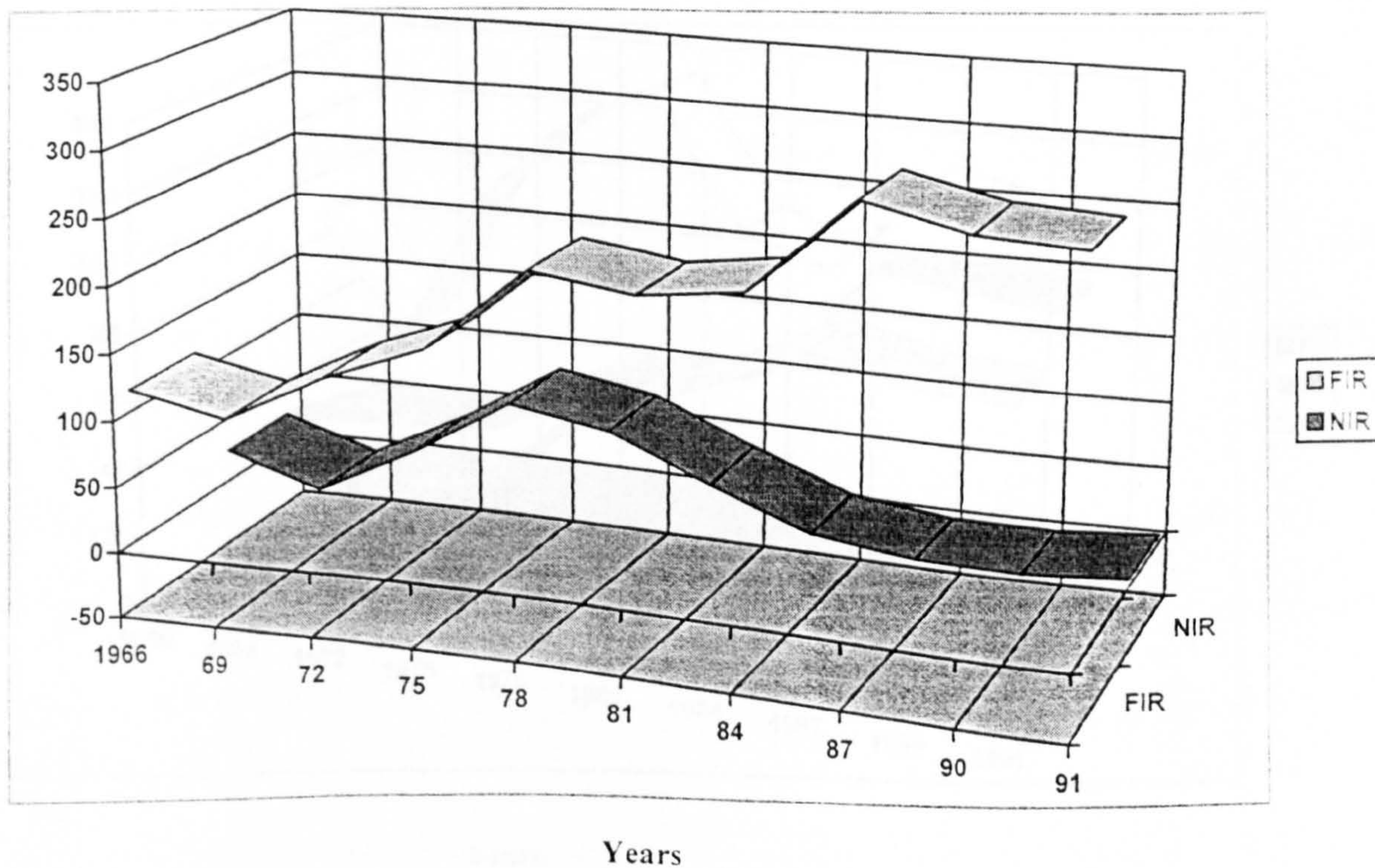
Source: Calculated from SAMA different annual reports

The buoyant conditions in the world oil market in the early 1970s resulted in raising total government expenditures and an attendant expansion in commercial banking and specialized lending which made the NIR reach levels as high as 82.9 % in 1975. Since the early part of the 1980s, there has been a significant decline in the NIR ratio. During this time, the world oil market witnessed significant changes which have adversely affected both the economic and financial activities of the government, thus resulting in a significant decline in the NIR ratio. Since the SAMA's assets are also affected by changes in the government's oil income and expenditure, the irregular fluctuating growth of the NIR ratio

was also more due to the fluctuating growth of the SAMA's assets rather than to the gradual growth of the assets of the commercial banks. From 1978, however, the size of the specialized lending institutions, and the commercial banking system both began to grow until they reached their high points in 1991 (see Figures 3.9 and 3.10). The ratio of the specialized credit institutions to the non-oil GDP (F_6) increased from 2.2 % in 1975 to 82.3 % in 1991. Moreover, in combination with commercial banks, their assets began to overtake those of the SAMA's assets. This provides a good indication of a decentralizing tendency in finance which is often correlated with more development.

Figure 3.8

The Behaviour of the FIR and NIR Ratios



Source: Table 3.10

Figure 3.9

The Behaviour of the F3, F4, and F5 Ratios

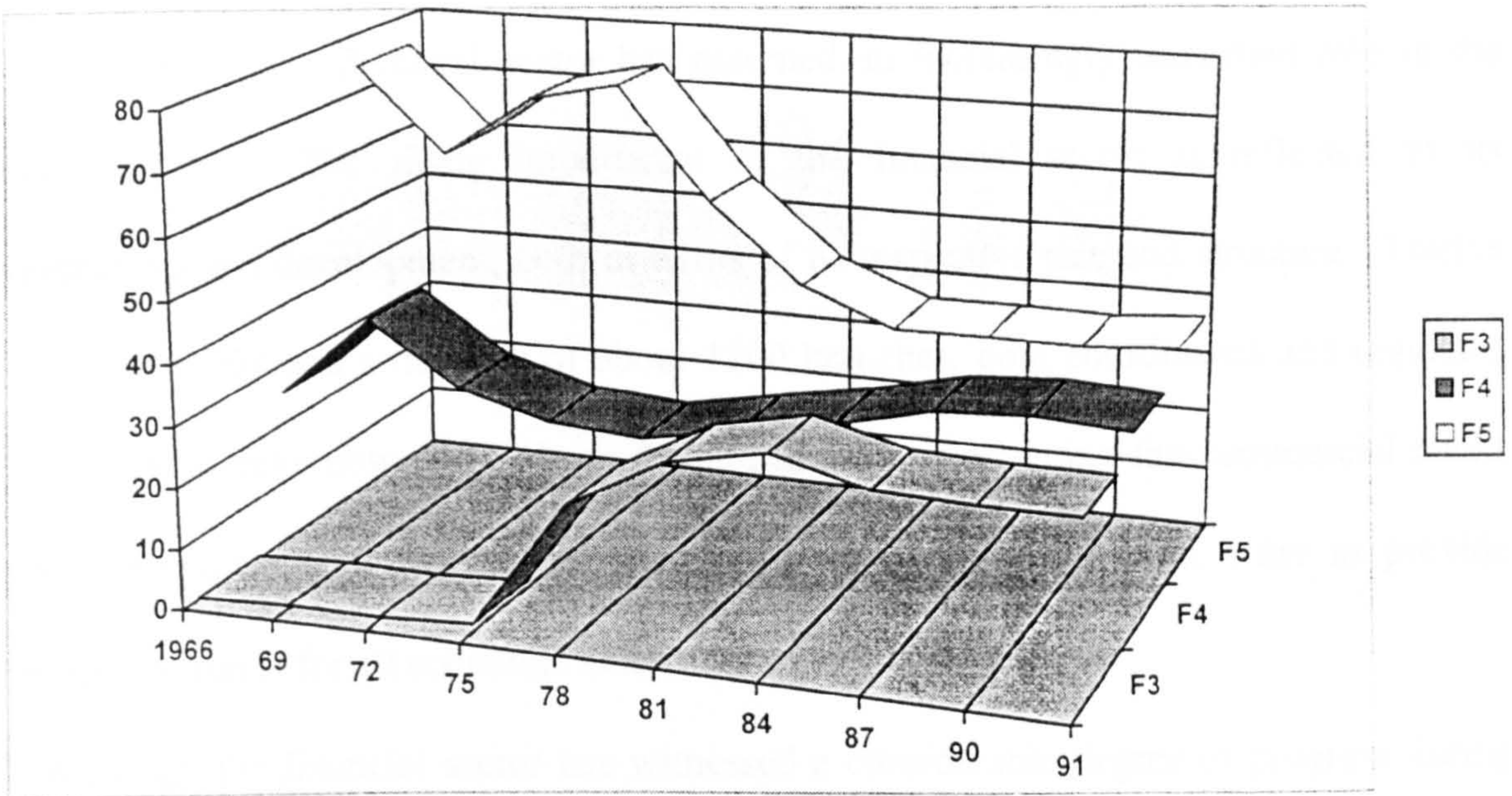
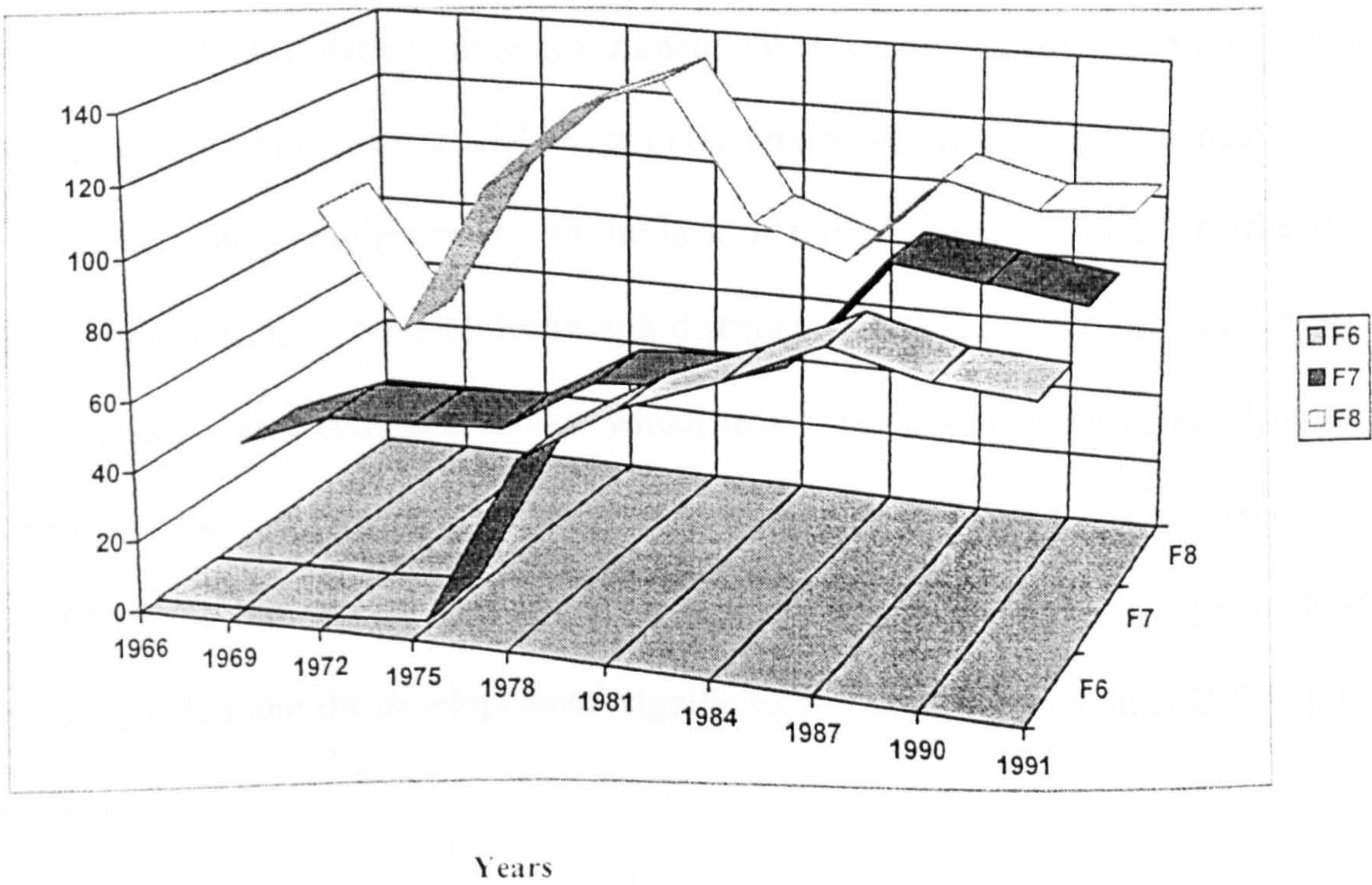


Figure 3.10

The Behaviour of F6, F7 and F8 Ratios



Source: Table 3.10

3.5 Conclusion

This chapter has sought to provide a survey and analysis of the Kingdom's financial sector. It illustrated that the financial sector has assumed an increasingly important role in the Saudi economy. The rising importance of the financial sector is reflected in its strengthening and development, both in terms of its respective size and structure. Twelve commercial banks and a network of about 1200 branches, both coordinated and regulated by the SAMA, have now (1996) been developed. Complementing the commercial banks are six specialist credit institutions established by the government in order to provide development funds for all economic activities.

Although the financial sector has witnessed a considerable degree of progress during the last twenty years, there are still major problems related to the development sector. With the recent (1995/96) cutbacks in the government's budget allocations combined lately with the increasing budget deficit, more government attention should be given to improving the involvement of the private financial sector in the process of financial development.

Another major problem relates to the lack of formal capital or money markets. The principal responsibility for mobilising and distributing domestic resources among sectors still rests with the commercial banks, which makes the development of efficient capital markets and more, particularly, an active and efficient equity market, an essential need.

All of the institutional and structural features of the SA financial system to date, however, underscore the developmental significance of the SIDF and other IDBs up to the present time.

Chapter Four

Science and Technology Policies and Systems in Saudi Arabia

4.1 Introduction

Technology may mean different things to different people; it is practically impossible to eliminate this diversity of meaning. However, it is widely accepted that technology and its related financing are important factors both in economic growth and in influencing changes in economic structure. Indeed, material standards of living, the character of social and cultural life, and the security of societies have always been closely correlated with the technologies used. It is not surprising, therefore, that technological progress has, since the end of the Second World War, been a major concern, if not an obsession, of the leaders and policy-makers of the developing countries.

The success of any program to promote technological change depends to a great extent on the science and technology (S&T) policies and systems that are responsible for managing or coordinating the technological change activities. This chapter is thus dedicated to describing and analysing the main characteristics of the S&T policies and systems of SA. Like the preceding two chapters, the present chapter provides some of the essential institutional policy for explaining the main research question addressed in this study: 'How effective has the SIDF been as an instrument of technological change?'

The chapter is organised in three parts. The first part examines the role of S&T in overall national development planning, the development of human resources, and the practices and modes of transferring foreign technology to SA. In this part, special attention will be given to some specific institutions which have been established in order to promote, finance and execute S&T activities. Among these key institutions is, of course, the SIDF. The role of the SIDF and how that role fits into government technology policies will be presented in the second main part of this chapter. In the third main part of the chapter we will attempt to discuss and analyse the present situation of the S&T policies and systems and the problems which confront S&T development in Saudi Arabia. This review, and the analysis of the S&T policies and systems in this chapter will thus provide us with a full background to the current situation in SA in regard to science and technological development. Perhaps a major point to bear in mind here is that a bank's ability and willingness to act as a technological institution is conditioned to a certain extent by the nature of these policies and systems. The more effective and coherent these policies and systems are, the more active the banks will tend to be from a technological point of view.

4.2 Review of Science and Technology Policies and Systems in SA

This section is dedicated to describing the main features of S&T policies and systems in SA. It will describe the place of S&T policies and systems in the overall national development plans, the development of human resources, and the technology acquisition and transfer in SA. The section will also review some specific institutions established in order to promote, finance and execute S&T activities. This review is necessary for a subsequent discussion and analysis of the present situation of the S&T system in SA.

4.2.1 Science and Technology Policy and the Overall National Development Plans

The drive to provide the conceptual framework for restructuring the Kingdom's productive resources, expanding its industrial sector, balancing and integrating regional development, developing human resources, and introducing modern technologies throughout the economy have all been at the core of Saudi development plans, beginning with the First Five-Year Plan in 1970.

S&T contributes to the development process in two ways: firstly, by helping to overcome or alleviate existing constraints, and secondly, by helping to utilise resources more effectively. In the past, the constraints facing the Kingdom included its severe climatic conditions, a very low technology base and the need to realize major development within a short period. The resources available to the country consisted largely of its vast petroleum reserves, and its land and its people, although a scarcity of trained and qualified manpower has been (and continues to be) a problem. With these constraints and available resources, it was recognized that the acceleration of the Kingdom's development would greatly depend upon the utilisation of advanced technology (MOP, Fifth Development Plan, 1990).

Like many developing countries, the Kingdom of Saudi Arabia has placed emphasis on the development of S&T activities. Within each development plan a separate section has been devoted specifically to S&T and its objectives, activities, expenditures, and the manpower needed for its development. When the early development plans were introduced, the national scientific and technological potential of SA was very weak. Therefore, high priority was given to the development of manpower in the field of natural

sciences, engineering, agriculture and medicine. Most of the aims set in the early development plans in this respect were achieved (MOP, Sixth Development Plan, 1995). However, the scientific and technological potential of SA is still far from being strong. The Kingdom still has a long way to go if it is to attain a high level of technological capability from its own people's talents and initiatives. The development strategies of S&T for Saudi Arabia were therefore set out in the Fifth Development Plan (1990-1995) to concentrate on the following issues:

- **Technology Gap:** Efforts must be made in order to reduce the gap between the level of technology used in various sectors of the economy and the ability to adapt this technology for the benefit of the national economy. In this regard, the decision-makers feel that there is a critical need for effective co-operation with international partners; by establishing a system for technology transfer that is attractive to both the owner and user of the new technology.
- **Human Resources in Science and Technology:** At present, human resources in S&T - scientists, engineers and technicians - are not sufficient in quality or quantity to ensure future technological development. It is essential that a strong S&T base be firmly established by upgrading the level and quality of education in related fields.
- **Science and Technology Infrastructure:** In addition to the improvement of the technical manpower needed for the development of S&T, upgrading the S&T infrastructure becomes vitally important.

- Technology Transfer and R&D Capabilities: Considering the mechanism for technology acquisition, diffusion and generation; boosting and stimulating R&D activities.

4.2.2 Basic Requisite: The Development of Human Resources

It is now generally agreed by decision-makers, as well as economists, that manpower development is the cornerstone of the development process (Al Rumaihi, 1986 and Abdul Rahman, 1987). The quality of human resources is the most important indicator of the level of development, and consequently, if there is a true will for development, human resources must receive sufficient attention. Moreover, human resources development may be a more realistic and reliable indicator of development than any other single factor. This is a necessary condition for all kinds of growth (Al-Kuwari, 1985).

The technological change of the country will require both financial and human resources. As far as the financial resources are concerned, this is not a major difficulty for Saudi Arabia. Obtaining a sufficient level of the qualified manpower for industrialisation and technological change is the problem that needs to be overcome through the development of better educational and training programmes.

The crucial importance of manpower development for SA, and any of the oil-producing countries of the Arabian Peninsula, derives from the dilemma which has been created by the combination of a small population, manpower shortages and the scarcity of trained labour in the face of a huge spending capacity and vast development programmes and projects (Abdul Rahman, 1987). It was inevitable, therefore, for SA to have imported most of the skilled and unskilled manpower needed for the development of various sectors of the

economy: to construct buildings and roads, to run hospitals and utilities, to build industrial plants and administer agriculture projects, and to staff schools and universities. This considerable dependency is expected to last for a long time (Al-Rumaihi, 1994). It has been indicated that the insistence of SA on accelerating economic and social development has led to an increase in the number of imported workers. On the other hand, it was not possible in the medium-term to train the national manpower faster than was actually done (Al-Hamar, 1982). The shortage of skilled and unskilled native manpower was, and still is, of great concern to many writers and officials in the Arab Gulf region. El-Kuwaiz (1987), the Associate Secretary-General for Economic Affairs in the Gulf Cooperation Council (GCC), has pointed out that the GCC countries, both as a group and individually, have a number of very real limitations to prolonged economic growth in which the chronic scarcity of human resources, both skilled and unskilled, is counted as the most important factor. In addition to the fact that the shortage of manpower is identified as the most important single factor hindering economic development in the GCC countries (see Table 4.1), the quality and the standard of native manpower is also responsible for the shortages in the labour force in the GCC countries.

Table 4.1
The Common Problems for Development According to their
Importance in the GCC Countries in 1984

Problem	Percentage (%)
- Shortage of manpower in general	63.9
- Shortage of technically trained labour	64.5
- Lack of supervision and management	37.2
- Shortage of equipment and capabilities	12.0
- Lack of local and regional coordination	47.5

Source: Al Sebab, A, Economic Integration and its Effect on Economic Development in the GCC Countries. Research and Development Centre, King Abdul Aziz University, Saudi Arabia, 1984.

The same study, as shown in Table 4.2, discovered that the poor use of national manpower and weaknesses of vocational training programmes for natives were the main causes of the shortages in the labour force in the GCC countries (Al-Sebab, 1984). It should be noted that the problem of quality within the manpower of SA do not apply only to the native labour force. About 70 % of the total labour force in SA is foreign and a high percentage of the foreign workers are unskilled.

As may be seen in Table 4.3 and Figure 4.1, the percentages of the native labour force within the total labour force number in SA were about 74.8 %, 41.7 %, 37.4 % and 33.7 % in 1970, 1980, 1985, and 1990, respectively. Officials and decisions-makers in SA predict that the size of the non-national labour force in SA will increase during the 1990s and the dependence on it will persist into the next century (Ministry of Planning, Sixth Development Plan, 1995).

Table 4.2
Causes of the Shortages in the Labour Force
in the GCC Countries

Item	Percentage (%)
- Poor use of national manpower	68.9
- Weakness of control on imported labour	37.7
- Restrictions imposed by the labour-exporting countries	10.9
- Weakness of vocational training programmes for natives	61.7
- Reliance on specific nationality proved to be incompetent	27.8
- Importation of undesirable characters	35.0

Source: Al Sebab. A. Economic Integration and its Effect on Economic Development in the GCC Countries, Research and Development Centre, King Abdul Aziz University, Saudi Arabia, 1984.

Table 4.3

Labour Force (Thousands) and Percentage of the Native Labour Force in SA

Year	Total Labour Force	Percentage of the Native Labour Force
1970	1923.7	74.8
1980	2630.0	41.7
1985	3873.5	37.4
1990	5771.8	33.7

Source: Al-Rumaihi, F.A, Scientific and Technological Cooperation among the Gulf Cooperation Council Countries, Ph.D. Thesis, University of Manchester, 1994.

Figure 4.1

Labour Force and Percentage of Native Labour Force in SA



Source: Table 4.3

The distribution of the total labour force by occupation in SA is illustrated in Table 4.4 and Figure 4.2. The data presented in the figure show that the total number of professional and technical workers in SA is very low. It constituted about 14 % of the total labour force in 1994. The share of workers in less skilled occupational groups such as; production, construction, transportation and service, on the other hand, is more than 56 % of the total employment in the same year. Herein, lies a fundamental question: Where are the Saudi indigenous personnel located among this distribution? Al-Rumaihi (1994), among others in the region, believes that foreign workers are generally concentrated in either the technical occupations or in the lowest skilled, manual occupations; while local personnel are concentrated either in the managerial positions or in the service occupations outside the production process, or as clerical workers.

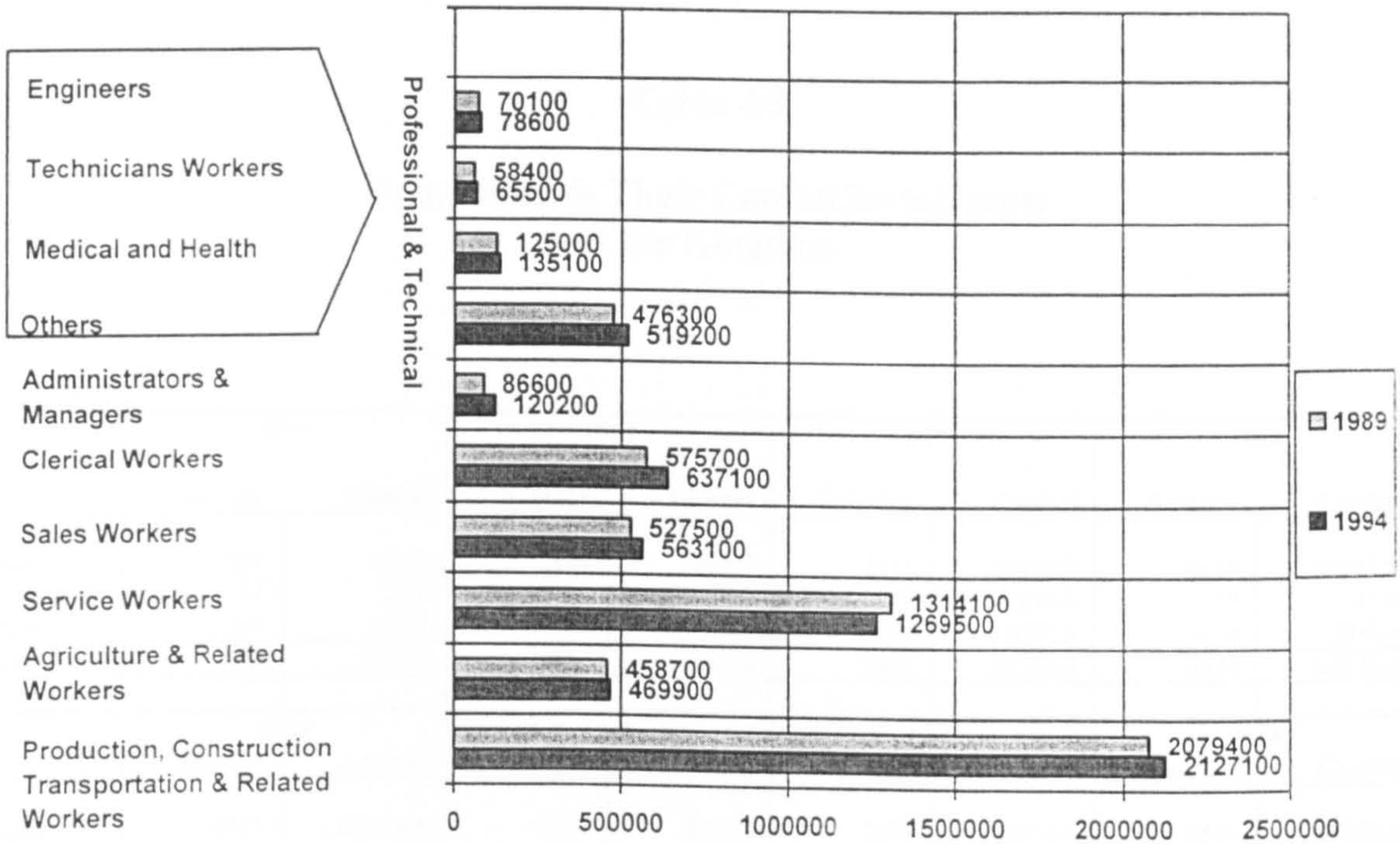
Table 4.4
Distribution of Labour Force by Occupation
in Saudi Arabia (1989 & 1994)

Occupation	1989	Percentage of the total number	1994	Percentage of the total number
Engineers	70100	1.2%	78600	1.3%
Technicians Workers	58400	1.0%	65500	1.1%
Medical & Health	125000	2.2%	135100	2.3%
Other Professional & Technical Occupations	476300	8.2%	519200	8.7%
Administrators & Managers	86600	1.5%	120200	2.0%
Clerical Workers	575700	10.0%	637100	10.7%
Sales Workers	527500	9.1%	563100	9.4%
Service Workers	1314100	22.8%	1269500	21.2%
Agriculture & Related Workers	458700	7.9%	469900	7.9%
Production Construction, Transportation & Related Workers	2079400	36.0%	2127100	35.5%

Source: Al-Rumaihi, F.A, Scientific and Technological Cooperation Among the Gulf Cooperation Council Countries. Ph.D. Thesis, University of Manchester, 1994

Figure 4.2

Distribution of Labour Force by Occupation in Saudi Arabia



Source: Table 4.4

4.2.3 Technology Acquisition and Transfer in Saudi Arabia

It is widely recognized that foreign direct investment, joint-ventures, management contracts, turnkey projects¹, and licensing play an active role in the transferring and

¹ In the early stages of a country's industrialisation, enterprises often enter into turnkey arrangements, whereby one party (usually from developed country) is responsible for setting up a plant and putting it into operation. Turnkey contracts usually involve the organisation of a package of embodied and disembodied knowledge of different kinds: feasibility studies, design of the plant, tenders and estimates, civil works, erection of plant, putting the plant on stream, quality control, automation, training, and general plant management (United Nations, 1973 and White, 1983).

influencing the quantity and quality of technology to developing countries (Fransman, 1985). Saudi Arabia, however, has pioneered the joint-venture mechanism as the most important pattern of technology transfer (see Table 4.5). The main reason for choosing this category of transfer of technology is the industrial condition prevailing in the Kingdom.

Table 4.5
Companies & Their Capital Investments
in the Kingdom

-Million Saudi Riyals-

	1972		1974		1977		1984	
	Number	Capital	Number	Capital	Number	Capital	Number	Capital
Saudi	781	894.1	884	967.7	2551	20409.9	4624	40897.8
Non-Saudi	34	268	36	269.1	39	270.0	15	21.6
Joint	108	133.8	130	406.4	870	11030.5	1456	21426
Total	923	1295.9	1050	1643.2	3460	31710.4	6095	62345.4
	1985		1986		1987		1988	
	Number	Capital	Number	Capital	Number	Capital	Number	Capital
Saudi	4737	62218.4	4994	63384	5293	64474.6	5551	64983.2
Non-Saudi	14	50.3	14	50.3	14	50.3	14	50.3
Joint	1218	15043.6	1260	15253	1297	15513.1	1326	15735.7
Total	5969	77312.3	6268	78687.3	6604	80038.0	6891	80769.2
	1989		1990		1991		1992	
	Number	Capital	Number	Capital	Number	Capital	Number	Capital
Saudi	5678	68065.4	5780	70567.4	5789	73270.6	6025	88264.2
Non-Saudi	18	65.8	24	84.6	21	91.3	24	102.6
Joint	1323	16129.2	1303	16185.3	1222	16090.2	1197	17216.4
Total	7019	84260.4	7107	86837.3	7032	89452.1	7246	105583.2

Note: The number of companies is subject to change from year to year due to capital modifications and change from one type to another.

Source: MOP, 1995.

Industrial development in SA is recent and can be classified into three categories:

1. Labour-intensive small workshops for repair and small-scale production activities;
2. A large number of factories, usually owned by individuals. Their products are geared primarily to the domestic market which is very open and competitive. Medium-size industries have been emerging in this category, based on raw materials made available from the Saudi Basic Industries Corporation;
3. The Saudi Basic Industries Corporation (SABIC). Under this condition, the critical elements for success are production skills and underlying technologies.

As far as new technologies from abroad are concerned, SA has tried to promote the joint-venture mechanism as a means of industrialisation. At the present, many Saudi companies have been established as joint-venture partnerships. Under this ownership, the foreign partner provides part of the finance and the whole technology needed for the project. The foreign partner is also committed to the management of the project under a management agreement.

In the case of SABIC, most of its companies are joint-ventures with SABIC's share being at least 50 % (see Table 4.6). The foreign partner provides all means of industrial technology transfer in all aspects of industry: process, design and construction of plants, management, marketing and research and development. Most of these companies are leading companies of the United States, Far East and Europe, namely: Hoechst-Celanese, Exxon, Lucky Goldstar, the Mitsubishi Group, Mobil, Shell, Texas Eastern, Ecofuel, DEG, Apicorp, Neste Oy, and Taiwan Fertilizer. The choice of the foreign partner for a particular joint-venture is a critical issue facing SABIC.

Table 4.6
Major Industrial Projects Implemented by the
Saudi Basic Industries Corporation (SABIC)

Company	Shareholders	Location	Date of Agreement	Products	Annual Capacity (000MT)	Capital Investment (Million SRIs)	Production Date
Metallurgical Saudi Iron & Steel Co. (HADEED)	SABIC:95 D.E.G.:5	Jubail	1979	Steel rods & bars	1100	3500	1983
Jiddah Steel Rolling Mill (SUBL)	HADEED: 100	Jiddah	1979	Steel rods & bars	140	150	1981
Fertilizer Industries Al Jubail Fertilizer Co. (SAMAD)	SABIC:50% Taiwan:50%	Jubail	4.12.79	Urea	600	940	1985
Saudi Arabia Fertilizer Co. (SAFCO)	SABIC:41 Employee:10	Dammam	1965	Urea Sulphuric Acid Malamin	330 100 20	364	1970
Petrochemical Industries Saudi Petrochemical Co. (SADAF)	SABIC:50 Pecten(Shell Oil of US):50	Jubail	20.9.80	Ethylene Ethylene dichloride Styrene Ethanol Caustic Soda	760 560 360 300 450	9600	1984
Saudi Yanbu Petrochemical Co. (YANPET)	SABIC:50 Mobil Oil of US:50	Yanbu	19.4.80	Ethylene Ethylene glycol Polyethelene	560 250 430	5625	1985
Al-Jubail Petrochemical Co. (KEMYA)	SABIC:50 Exxon of US:50	Jubail	26.4.80	LLDPE	300	4000	1985
National Methanol Co. (Ibn Sina)	SABIC:50 Celanese & Texas Eastern:50	Jubail	3.2.81	Chemical grade methanol	770	1390	1984
Saudi Methanol Co. (Ar Razi)	SABIC:50 Mitsubishi Co.:50	Jubail	24.11.79	Chemical grade	640	800	1985
Arabian Petrochemical Co. (PETROKEMYA)	SABIC:100	Jubail	20.3.81	Ethlene Polystyrene Butane-1	650 100 50	3000	1985
Eastern Petrochemical Co. (SHARQ)	SABIC:50 Mitsubishi Gas Co.:50	Jubail	23.5.81	LLDPE Ethylene glycol	140 330	3560	1985
Supporting & Downstream Industries	SABIC:70 Saudi Partners:30	Jubail	14.2.83	Nitrogen Oxygen	146 438	335	1985
National Industrial Gas Co.(GAS)							
National Plastic Co. (Ibn Hayyan)	SABIC:85 South Korea:15			Vinyl chloride monomer Polyvinyl chloride	300 200	1365	1985
Saudi European Petrochemical Co. (Ibn Zahn)	SABIC:70 Erichem:10 Nestesy:10 Apicorp:10	Jubail	16.12.84	MTBE	500	1143	1987
National Chemical Fertilizer Co. (Ibn Al-Baytar)	SABIC:50 SAFCO:50	Jubail	10.4.85	Ammonia Compound fertilizer Phosphate	500 800	608	1988

Source: Ministry of Industry and Electricity, 1992.

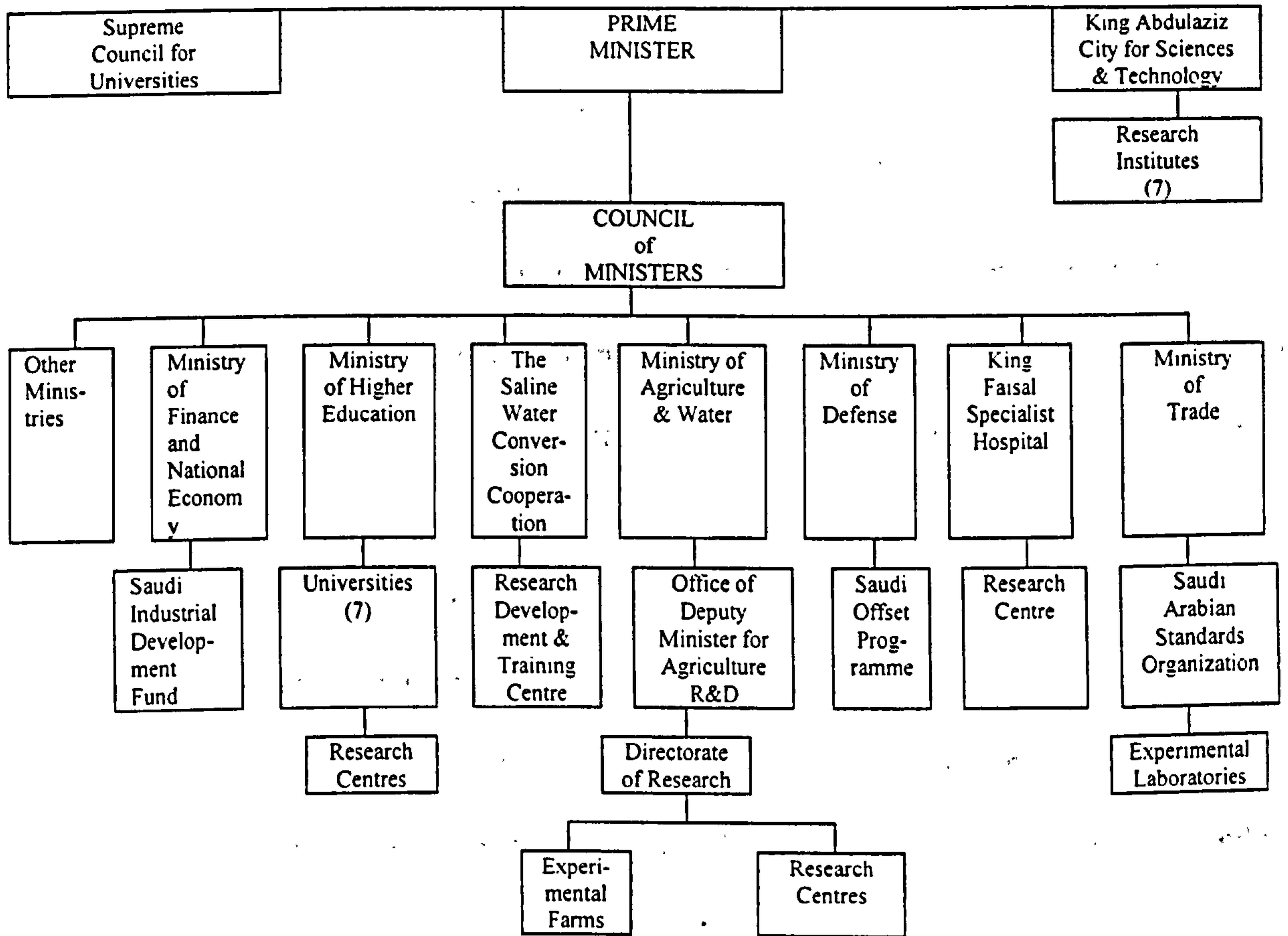
Among the qualifications that SABIC looks for are the following (Tayim et al, 1988):

- proven experience in the field of the venture as evidenced by technological strength, strong research and development organisation, marketing ability and respectable financial reputation;
- ability and willingness to train Saudis during the period of planning, design and installation. Such training is to be undergone in the foreign partner's already existing modern installations similar to those of the planned joint-venture;
- the foreign partner should undertake to market part of the production of the joint-venture through his already existing marketing organisation. The partner's share of the market shall be determined by SABIC.
- the foreign partner shall undertake to provide for state-of-the-art technology for the venture and should have research and development facilities to support the proposed technology;

4.2.4 Technological Institutions for Promoting, Financing and Executing S&T Activities

In its efforts to accelerate technological change and increase economic diversity and independence, the government of Saudi Arabia undertook the duty of establishing some technological institutions. The inception and implementation of these institutions are basic prerequisites for the success of the national development plans. They are varied in size and organisation. Some are linked to ministries, others are autonomous, and several others are linked to universities (see Figure 4.3). Some of the most important of the institutions are discussed below:

Figure 4.3
The Links Between Various Ministries and Government Departments in Regard to S&T in Saudi Arabia



Source: Constructed by the author.

4.2.4.1 King Abdulaziz City for Science and Technology

In an attempt to organise, coordinate, and enhance the scientific research and technology in SA, the government has formalized advice on science and technology by creating “King Abdulaziz City for Science and Technology” (KACST), formerly known as the Saudi Arabian National Centre for Science and Technology (SANCST). KACST is an autonomous government organisation governed by a board of directors which is composed of the ministers of the main ministries to which science and technology are of greatest

relevance. It is headed by a president who is a member of its governing board of directors, which, in turn, is chaired by the Prime Minister (the King). The following objectives have been allocated for KACST (Al-Athel 1991):

1. conduct applied scientific research programs in the fields that serve the economic and social development objectives of the Kingdom;
2. establish and manage an information centre which collects and disseminates data on the scientific and technological manpower resources in the Kingdom in order to utilize this labour force in implementing scientific and technological development policies;
3. establish and operate laboratories for applied scientific research in areas of importance to the Kingdom;
4. provide assistance to the private sector in the development of productive agricultural and industrial research that will help increase the Gross National Product (GNP);
5. support joint research programs between the Kingdom and international scientific institutions in an effort to keep pace with scientific developments in the world by awarding research grants and undertaking joint research projects;
6. establish and manage an information centre maintaining data on national and international scientific institutions. It will also organise seminars and publish research papers as a means of furthering KACST's objectives;
7. formulate a scientific research plan which will specify national objectives for achieving scientific advancement;

8. award scholarships to develop the necessary skills for conducting research work;
9. award grants to individuals and scientific organisations to undertake applied research work;
10. coordinate with government agencies, scientific organisations and research centres in the Kingdom to enhance research, information and expertise exchange, and to avoid duplication of effort. To achieve this goal, a liaison committee shall be formed, consisting of experts from government agencies and organisations associated with KACST's activities. This Committee will provide KACST with advice in developing the framework of the national scientific plan.

KACST's responsibilities, among others, include the establishment of national research institutes and assuming their proper interface with researchers at universities and other research institutions. Among the institutes are the Institute for Petroleum and Petrochemicals Research, the Institute for Energy Research, the Institute for Natural Resources and Environmental Research, the Institute for Arid Lands Research, the Institute of Astronomy, and the Institute of Space Research.

4.2.4.2 Saudi Arabian Standards Organisation

The establishment of a national system of standardisation is one of the most successful means of coordinating and integrating development plans. With the intention of having a diversified economy, it is essential for the country to have an adequate system of standards and specifications to be used as a technical instrument for controlling the quality of products not only at the level of a certain city, or even country level, but at national and international levels as well. A standardisation system is very important for both consumers

and producers. It seeks information about methods and means of production, supervision of quality control, requirements suitable for local and foreign markets, standards of local and imported commodities, and means of developing the level of local production quality. This information is very important for selecting the appropriate technology required for the manufacturing of various products. For this reason, national standardisation bodies are considered specialised centres which offer their expertise in the transfer of development of technology. In response to this reality, the Saudi Arabian Standards Organisation, known as SASO, was established in 1972 to develop standardised quality control specifications for both imported and locally produced goods in order to introduce a system of quality marks and conformity certificates, and to enhance cooperation with Arab and other international organisations on matters relating to standards and specifications.

The most important achievement by SASO since its inception was the establishment of the Saudi measurements system. SASO had to face problems resulting from changing old industries from the imperial system to the new system with the entailed additional costs and expenses. These problems began to diminish gradually and the new system is now applicable in the different sectors of Saudi Arabia. Accordingly, the responsible person for new projects needs to select the suitable technology that matches with the Saudi standards. SASO decided that Saudi standards should be mandatory, which means that choosing technology which did not conform to the requirements of the standards would be a costly mistake. In this regard, an agreement has been established between the SASO and the Ministry of Industry and Electricity (which is responsible for issuing industrial licences), that industrial licences will stipulate that the applicant should consult with SASO before

starting his project. This gives SASO a chance to offer its views on the appropriate technology which can meet standard requirements and achieve the desired quality control.

SASO's influence in the field of technology development was increased by the application of the quality mark and certificates of conformity systems. These enabled SASO to follow up the work more closely inside the industrial plants. It can participate more in offering advice for better processes and selection of appropriate technology to meet the requirements of Saudi standards.

4.2.4.3 The Saudi Offset Programme

In their efforts to promote industrial development and accelerate economic diversity and independence, the policy-makers in Saudi Arabia have initiated an interesting example of a new approach to technology transfer in the country by establishing the Saudi Offset Programme. In this programme, the foreign major contractors winning contracts in the billion dollars range in SA have to invest in high technology projects a capital sum equal to at least 30 % of the value of the contract. These projects have to be in the form of joint-ventures with interested Saudi business organisations. The Offset Programme was developed as a tool of economic policy by the Saudi Offset Committee. It is part of the government's commitment to reduce reliance on oil revenues and to promote the transfer of high technology and develop manufacturing capability and services in the country.

The Saudi Fifth Development has indicated that the transfer of technology has been recently enhanced by the Offset Programme. The Plan, therefore, has stated that:

The universities and the KACST have established a basic scientific research infrastructure, and the transfer of technology has been recently enhanced by the Offset Programme. This extensive long-term industrial Investment Programme by Saudi and foreign joint-venture companies is designed to link together many

individual projects utilizing the high technology of the foreign partner. The Offset Programme thus makes an important contribution to economic diversification and to the development of an indigenous technological capability, through the cumulative transfer of technology and the synergy generated by linking together individual projects.

The Boeing Group, operating through Boeing Industrial Technology Group (BITG), was the first entrant of the Offset Programme. BITG has to make an equity investment in each venture to be matched by an equal equity investment by Saudi partners. Each venture receives initial technical and management resources and technology updates from the Boeing Group Member. The ventures have to achieve (Tayim 1988):

- high technology transfer;
- economic expansion and diversification;
- import substitution;
- profitable export enterprises;

The Group has formulated five high-technology joint-ventures comprising:

- advanced Electronics Centre;
- international Systems Engineering Centre;
- aircraft Modification Centre;
- aerospace Helicopters;
- middle East Engines Centre.

4.2.4.4 Other Technological Institutions

In addition to KACST, SASO and the Saudi Offset Programme, there are several institutions established in the country to be involved in technology transfer, adaptation,

generation and development. These institutions include the research centres, which were established in the beginning outside universities, in order to conduct research towards solving economic and social problems. It did not take a long time to recognise that the role of the universities should not be limited to teaching only, but should be extended to include all research that might serve economic and social development objectives. Among these institutions carrying out R&D activities are the Palm Research Centre in Hofuf, King Faisal Medical Centre in Riyadh, the Regional Agriculture and Water Research Centre in Riyadh, and several agriculture extension and development stations scattered all over the country. There are seven universities in the Kingdom besides the technical schools and vocational training centres. All of these universities and schools are public and relatively new, except King Saud University, which was established in 1957. Some of these universities offer Bachelors' Degrees, and some offer Masters' Degrees. The University of King Fahad for Petroleum and Minerals and King Saud University offer Doctoral Degrees in the fields of S&T, but to a very limited extent.

Many argue that the universities in SA should organise, support and promote technological change (Abdul Rahman, 1987 and Al-Rumaihi, 1994). They should participate in drawing up plans for research activities to be implemented by the different academic departments within the universities. Universities should also provide the major R&D base by generating the quantity and quality of scientific research manpower needed for social and economic development.

The Saudi Consulting House was established first as an affiliation to the Ministry of Commerce and Industry under the name of "Industrial Studies and Development Centre".

Since then it continued to provide consultancy services in all aspects of the industrial sector, beginning from preliminary studies, marketing studies and economic feasibility studies, and culminating with preparation of engineering designs for new factories or expansion of existing ones. It also aims at providing technical assistance to solve any technical problem related to operation, improvement of productivity, and development of national industrial products to ensure their compliance with the national and international standards specifications in force, as well as providing technical consultancy to government agencies. This made it one of the most effective government organisations in the field of technical and industrial consultancy services.

The Saudi Industrial Development Fund ought to play a very important technological role in the Kingdom of Saudi Arabia. It has, as one of its functions, the responsibility of advising prospective investors in industry on the choice of proper process technology. The place of SIDF in S&T policies and systems in SA will be discussed in more detail in the Section 4.3.

4.2.5 Financial Resources Devoted to S&T Activities

It is well recognised that one of the most crucial indicators of a successful S&T policy is the national commitment to finance these activities. In general, the research activities in any country can be supported in many ways such as: government; industrial firms; universities and foreign sources. In Saudi Arabia, the sole supplier of funds is the government. Millions of Saudi Riyals are being spent on all aspects of socio-economic development of the country. However, it is difficult to find out exactly how much of it has been spent on

S&T activities, and how much on research and development. The difficulty comes from the budgeting system of SA. The national budget of the country is composed as follows:

- Chapter One is devoted to salaries and related expenditure;
- Chapter Two is devoted to general expenditure;
- Chapter Three to other expenditure not included in Chapter Two;
- Chapter Four is devoted to future projects.

Furthermore, the publication of data on funding of S&T activities in SA is rare and incomplete. Any figures related to funds are considered by many related departments as confidential. According to the Saudi Fifth Development Plan, the total budget allocated to the country's national science organisations, KACST and SASO, was 2,711.3 million Riyal (see Table 4.7). In contrast, in the Fourth Development Plan (1985-1990), the government has allocated to these two organisations a sum of 2,323.0 million Riyal.

Table 4.7

Fifth Plan Financial Allocation Devoted to Both KACST and SASO (SR million)

Agency	Salaries and Supplies	Operation and Maintenance	Projects	Total
KACST	678.4	191.7	1517.2	2387.3
SASO	182.0	32.0	110.0	324.0

Source: MOP, Fifth Development Plan, 1990.

A consensus has emerged on the general evaluation of systems working under the following ratios (Daghestani 1989):

1. ratio of R&D expenditure to GDP of less than 1 percent: the R&D system is very weak and is below the critical level needed for effective performance.

2. ratio of R&D expenditure to GDP of around 1 percent: the R&D system is at the critical level needed for normal development sectors. This is considered as the threshold level at which R&D systems become effective.
3. ratio of R&D expenditure to GDP of 1.6 to 2 percent: the R&D system is performing optimally to serve industrial and other production and service sectors.
4. ratio of R&D expenditure to GDP of above 2 percent: the R&D system is not only producing optimal output for traditional industries, agriculture and other service sectors but also output in new and advanced technology areas.

In the case of SA, the percentage of the total expenditure on R&D to the GDP in 1990 was 0.03 % only (Al Rumaihi 1994). This level of spending is relatively low compared to some other developing and developed countries (see Table 4.8).

Table 4.8
Expenditure on R&D in Some
Developing and Developed Countries

Country	Year	Expenditure on R&D/GDP(%)
Kuwait	1989	0.21
Oman	1988	0.001
Bahrain	1990	0.025
Qatar	1988	0.015
Saudi Arabia	1990	0.03
United Arab Emirate	1988	0.001
Argentina	1988	0.06
Australia	1987	1.3
Belgium	1987	1.7
Cyprus	1984	0.1
Denmark	1987	1.5
Jamaica	1987	0.6
Jordan	1986	0.4
Portugal	1986	0.5
Singapore	1987	0.9

Source: Al-Rumaihi, F.A, Scientific and Technological Cooperation Among the Gulf Cooperation Council Countries. Ph.D. Thesis, University of Manchester, 1994.

4.3 The Place of the SIDF in S&T Policies and Systems in Saudi Arabia

In spite of the very little attention that has been given to the direct and indirect role of financial institutions and particularly of development banks in promoting the process of technological change, the technological role or involvement of such institutions can be very substantial. They often act as the chief initiator, designer and coordinator of projects. Thus, the decisions they take which seem in the beginning to be only financial ones, are invariably technology-related decisions and have a very direct effect on the development of the country's technological capability.

Every national S&T policy, in order to achieve its goal, has to focus on the development of the national educational systems, human resources, information services, a patent protection system, popular awareness and understanding of science and technology, and finally, financing and supporting the specialised institutions and R&D centres.

In Saudi Arabia, the SIDF was established in 1974 with the aim of supporting the national industrial development sector of the Kingdom's economy by offering interest-free medium or long-term loans to the newly established and existing private industrial institutions within the Kingdom. The fund's participation in the expansion and diversification of the industrial base of the Kingdom has not only been through the provision of financial support, but also through the provision of miscellaneous advisory services in the financial, administrative, marketing and technical fields. These consultations cover all stages of project implementation. The financial and administrative consultancies assist project management in designing systems which monitor and control the performance of the business. The marketing consultancies help to define the products

and their target markets. The technical consultancies, however, evaluate alternative methods of manufacturing, quality control systems and levels of production efficiency, and they offer solutions to technical problems encountered by clients.

These consultancy services ought to provide solutions to problems faced by SIDF clients and also help in raising the standards of performance, productivity and quality levels of manufacturing.

4.3.1 The SIDF and the Technical Consultancy

The SIDF was established to support the national industrial development sector of the Kingdom. Therefore, the fund has formed its own Technical Consultants Division (TCD). As part of the operation of the fund, each and every loan application is investigated by TCD to ensure that:

- the fixed capital costs of the proposed projects, including allowable pre-operating expenses, have been accurately assessed;
- the plant and equipment selected are suitable for their intended purposes and will be acquired at suitable prices;
- the technology on which the project is based is the most appropriate and best for the job;
- its working capital requirements have been accurately established;
- the costs of manufacture of the product have been evaluated correctly;
- the sponsor of the project understands what organisational structures and manpower resources will be most effective;

- any agreement covering a license or technical assistance is clear, fair, and will ultimately result in the transfer of useful technology to the Kingdom.

It is the primary purpose of the TCD to determine and confirm these details against a background of the project objectives (SIDF, Annual Reports 1986-1988).

In addition to the feasibility study that needs to be done by the applicants, the officers of TCD have to carry out their own studies and produce comprehensive reports in order to assist the less technically sophisticated clients to assemble viable ventures. The TCD consultants are also involved in the implementation process. They guide sponsors in areas which have been identified by the fund as crucial to the success of their projects and approve activities critical to the satisfactory outcomes. In the case where difficulties are met in the operational phases, individual consultants in this division provide timely advice and carry out detailed investment reviews. Additionally, TCD officers contribute to fund-wide industry studies, ad hoc working parties, and, in conjunction with SASO, the standard specifications being adopted by the Kingdom.

The Division, therefore, ensures that its Saudi officers are constantly being professionally developed and updated through carefully planned and progressive programs. These include participation on courses, seminars and conferences, together with attendance at trade exhibitions, either in the Kingdom or abroad. Thus, TCD's human resources, backed by the fund's facilities, such as its computer-based technical information systems, have been an essential instrument in the success of SIDF.

4.3.2 The SIDF and the Manpower Development

All projects that have been financially supported by the SIDF have to lead to technological change in one way or another. Even when these projects include a technology that already exists, the establishment of new projects will lead to more experience and a substantial growth to the Saudi professionals abilities, especially if these technologies are modern technologies.

Since most of these projects contain a new technology, the technological effect on the country's technological capability will be very substantial. It is obvious that, even when the country has to rely on imported manpower, the experience of foreign technicians and specialists will have a positive effect on the local manpower development.

In this regard, the SIDF tries to place a strong emphasis on participating in creating the developed Saudi professionals to function in all administrative and technical activities in all industrial fields, particularly the high technology, petrochemical and oil-based industries. Local personnel were involved in many projects. In spite of the fact they were in minor and subsidiary roles, they, at the very least, could acquire experience and on-the-job learning from participation in some activities with the foreign erectors.

Some projects have involved advanced, capital-intensive and automated technology, and hence they have required a highly qualified workforce for their efficient operation. In many cases, the needed domestic skills cannot be found. The technology-supplying companies, therefore, are requested that some of the employees should obtain training abroad in order to be able to handle the high technology activities in the fields of

electronics, mechanics, chemistry, computer science and maintenance. At the same time, some employees can be trained locally by foreign staff.

A strong emphasis is also placed by the fund on developing a cadre of Saudi professionals within the fund itself. Special importance is attached to the training of young Saudis, on whom the future of national industry will depend. The fund has experienced a substantial growth in its responsibilities which, in turn, has necessitated a flexible approach to its organisation, to its administrative structure and to the training of its staff. Management's emphasis on the training of its Saudi personnel, in both general and specialist subjects, has ensured that appropriately qualified and experienced Saudi professionals have always been available to meet the high managerial and technical requirements of the fund (SIDF, Annual Report, 1994).

4.3.3 The SIDF and The Industrial Joint-Venture Projects

The fund has continuously placed strong emphasis on encouraging the establishment of joint-venture projects in order to enable foreign partners, particularly well-established international companies, to transfer modern technology to the Kingdom. During 1994, the fund approved 16 loans to joint-venture projects: eight in the chemical product sector; five in the consumer product sector; two in the engineered products sector and one in the other industrial sector. The total amount of loans granted to these projects amounted to SR. 711 million. The foreign partners' equity in these projects was 122 million (SIDF, Annual Report, 1994).

According to the fund's statistics, the number of joint-venture projects approved by the fund since its inception up to the end of 1995 reached 417 projects, representing 31 % of all

fund-financed industrial projects. The amount of loans granted to these projects totalled SR. 10,456 million, representing 40 % of the value of commitments to industrial projects; foreign participation represented 33 % of the total equity in these projects. The engineered products sector has continued to lead other manufacturing sectors in terms of loan commitments to approved joint-venture projects with a share of 31 %. It is followed in second place by the chemical products sector with a share of 27 % of the total value of loans committed. The US has been the leading partner, accounting for about 29 % of the total foreign capital invested (SIDF, Annual Report, 1995).

It should be noted here that the SIDF is planning to promote investment and technological development in the private sector through joint-venture projects. It has been shown that the form of joint-venture projects is counted as the most common pattern of technology transfer in the operation of the SIDF. This indicated that the fund has assigned a central role to the issues of technological development in SA.

4.4 Analysis of the Present Situation of the Science and Technology Policies and Systems in Saudi Arabia

The importance of science and technology as a main factor determining the rate of growth of the national economy of SA has been recognised over the last few decades. With the improvement of the planning system in the Kingdom, scientific and technological change have become important issues in all development plans. The active participation of research institutes and relevant state bodies responsible for the goal of technological change began with the approval of Saudi's First Development Plan in 1970. Since then, the plans

have often underlined the necessity of using scientific technological knowledge to achieve the long-term strategic goals of the Kingdom's development.

Under these plans the infrastructure of the national economy and the establishment of many industries were accomplished. As planned, new plants were built incorporating the most modern technology in the world. Much attention has been given to the development of technology and science under which a number of technological institutions and research centres have been established. When the First Development Plan was inaugurated, SA had not had a national science and technology policy-making machinery. Research in SA was conducted without overall planning and co-ordination. Research and experimental development activities were still insignificant at that time. The public sector did not have an indigenous scientific and technological capability and the participation of the private sector was very weak. Science and technology, therefore, was given an important place in the Second Development Plan. The first step in this respect was the establishment of the Saudi Arabian National Centre for Science and Technology (SANCST) as the most important body liable to science and technology.

Recently, the bodies responsible for planning and promoting science and technology in SA are: KACST; SABIC; The Offset Program; SASO; the Saudi Consulting House; the Ministries concerned, and several institutions involved in technology transfer, adaptation, generation and development.

Great importance has also been attached to training the Saudi workforce to operate and maintain the infrastructure which is now in place. The Kingdom's Third, Fourth, Fifth and Sixth Five-Year Plans emphasized the important role of human-resources on the

development of the economy. On the domestic level; thirteen universities and four female colleges have been established to educate and train Saudi manpower in all different fields. On the international level, many Saudi students are attending universities and colleges throughout Europe and the US to obtain the needed specialized skills not available in the Kingdom. The financial allocation for human-resource development shows a steady increase since the First Plan. The First Plan, which encompassed the years 1970-1975, allocated some SR. 11.3 billion for this purpose. The Second Plan, covering the years 1975-1980, allocated SR. 85.3 billion for human-resource development; this allocation was almost eight times the amount devoted to the First Plan. The Third Plan offers a detailed analysis of the advances made under the First and Second Plans. Some areas were recommended for more attention than others, such as science and engineering, and other programs will be implemented for more thorough manpower training within the Kingdom. The financial allocation for the human-resources development during the Third Plan, 1980-1985, reached SR. 216 billion.

With the recognition of the important role played by the country in order to accelerate and improve the technological change, there are still several obstacles in front of the Saudi decision-makers that have to be overcome in order that such technological advancement becomes more efficient. Technology transfer does not only mean purchasing new machinery and equipment, it should include, in addition to operating and maintaining these machineries by Saudi expertise, an attempt to acquire the knowledge of how they were made and how they function (Abdul Rahman, 1987). It is true that capital is normally available in SA, but capital alone cannot do the job without enough support from existing

institutions and facilities. Co-ordination among the technological institutions and centres is absolutely essential. The improvement of the Saudi educational system is an increasingly essential need. The existing educational system suffers from too much concentration on theoretical studies rather than on technological and practically-oriented science and education. All these obstacles need to be overcome if SA technological capability is to be improved.

4.4.1 S&T Decision-Making Process

It is fairly evident that following the practice of developed countries, most developing countries have a national decision-making system in which the legislators guide the direction of development through the establishment of policies, while the civil servants give real profile to the development process through formulating and executing Plans and Programmes (Sharif, 1986). Those legislators should be domestically and internationally recognised as distinguished scientists, economists, lawyers, etc. Also a large number of under-developed countries have National Science Councils or similar institutions, part of whose function is to relate local science and technology to production - often with the more specific objective of generating appropriate technologies (Cooper, 1974).

Thus, such decision-making bodies are an essential part of development and technology policies. They have to be functionally linked with all related technological institutions. Without such an organic functional link, they would become obsolete and most technological activities irrelevant. In this context, it is worth mentioning that three separate levels of decision-making in national S&T policy activities can be distinguished (United Nations, 1976).

- 1) The overall policy and planning level. Here national objectives are formulated, priorities are determined, and broad lines of allocation are decided between the main competitors for R&D funds.
- 2) The programming level. Through Research Councils, Ministry Planning Groups, the Boards of Industrial Research Institutes, etc, the board allocations and priorities are transformed into detailed programmes and projects.
- 3) The implementation level. The work is carried out here, i.e. in Research Council Institutes, or Government Research Centres, or Industrial Enterprises or Universities.

In the case of SA, some argue that the vast majority of the professional population, who are not represented among the political leaders, have practically no direct involvement on the political decision-making in general and decisions related to S&T in particular (Abe, 1987). The preceding discussion shows that there is no specific science and technology policy-making body in SA; at present, it does not exist. Therefore, the organisation of research policy and the technological activities are not coordinated. It should be underlined, however, that a process of administrative decentralisation has started, but formal relations between various ministries and Government departments do not exist at present. The organisation of the research activities is sectorial. Each ministry has responsibility for research related to its functions (sectors). S&T activities are formulated independently and individually by each separate government department, with a negligible degree of interrelation and coordination. There has never been a ministry with direct authority over all S&T affairs (Al Rumaihi, 1994). The Ministry of Agriculture and Water, for example, through its agricultural research centres and experimental farms provides

research and development services to farmers. The Colleges of Agriculture in all Saudi universities are active in the solutions of similar problems.

The common interest of all technological institutions and centres of the country requires from them integrated co-ordination in the field of technology and science. This co-ordination cannot be accomplished from an individual perspective. There appear to be a strong prima facie case that there should be one organisation with direct authority over all S&T policy, which would include representatives from all related institutions.

4.4.2 Science and Technology Information

Information plays a very important role in the process of technology transfer. Most developed countries and many developing countries have realised that S&T information is a cornerstone of any technological development. They have started a systematic collection of statistics on S&T in order to enable decision-makers to evaluate successfully the national S&T capabilities and to assess the national S&T needs.

An efficient information system can provide national decision-makers with several beneficial services in the technology transfer process (Bamakhramah, 1981). First, it facilitates the search for the location of sources of appropriate technology. Second, information widens the scope of alternative sources of a specific, needed technology. This not only helps the buyer of the technology to choose the best among the available types of technology based on his needs and budget, but also provides him with bargaining leverage vis-à-vis the technology seller. Third, information on the existing state of art of science and technology as well as research and development activities is desirable for the development of indigenous scientific and technological infrastructure. Science and technology policy-

making could be made more efficient through the collection of information on these activities as well as on local science and technology inventories, including research and development manpower and facilities.

Unfortunately, Saudi Arabia faces an acute shortage of informational infrastructure in terms of institutions which are specialised in gathering, storing, disseminating and retrieving information on science and technology matters. The S&T information system is treated at present as a secondary goal with very low priority; national policies with regard to this goal are either absent or incomplete. There is a need to improve the awareness of the decision-makers in SA of the requirement for a S&T information system.

The lack of an adequate information system has led to a serious problem in regard to data needed on scientific and technological activities as well as on technology transfer. Data on S&T are essential tools for measuring S&T capability. Therefore, the objective of evaluating technological programs in SA is very difficult to achieve in practice. Also, studies of the contribution of technology to the goals of the SA national plan regarding employment generation, exploitation and control of natural resources, social impact and the quality of life are very scarce.

4.4.3 Human Resources Development

The need for manpower development is essential with the increasing pace of economic and technological development. Manpower development is the most important of all the requirements on which development depends. Development is basically a human effort. People initiate, direct and benefit from development; they are responsible for all

development activities and tasks; they are needed to invest capital, to utilise natural resources, to produce and create markets and commercial enterprise (Abdul Rahman, 1987).

In this regard education and manpower development serves two purposes (Bamakhramah, 1981):

- a) assisting in gaining new skills and knowledge necessary to assimilate and absorb new technologies and;
- b) creating more favorable environment for the introduction of new technologies in the society by changing the attitudes of people, upgrading the labour force and improving the social mobility of the individual.

If there is true will for economic and technological development, the quality development of human resources must receive close attention. Technological objectives should form an important part of the comprehensive national Development Plans. The educational system should aim to provide correspondingly the needed technicians and engineers who can become the efficient servants of technological development.

With the available data introduced in the first part of this chapter, one can get an idea of the status of the educational system in SA. The government is now placing massive financial input into the development of its educational systems. The importance of science and engineering in the education system has also received the same emphasis. The Saudi Fifth Development Plan (1990-1995) stated that:

“it will not be possible to close the technology gap between the level of technology used in the Kingdom and that which Saudi Arabia can adapt or produce within a short period, but efforts must be made to reduce it as much as possible. through several measures such as the greater concentration on science and engineering subjects in the education system.”

A study has been done on the development of level of education between 1960 and 1990 for different regions of the world. The study illustrates that the enrollment in the GCC Countries (Saudi Arabia, Bahrain, Kuwait, Oman, Qatar, UAE), in primary education increased by 2.5 million over the study period (1960-1990) or 1488 %; that of secondary by 1.4 million; and that for higher education level by 0.3 million. Overall, the three levels of education involvement grew from 0.20 million in 1960 to 4.4 million in 1990, or by 2100 % (Al Rumaihi, 1994). According to the study, the GCC countries have the highest respective annual growth rates of education enrollment in the world.

Some, however, argue that, in spite of the fact that the people of the GCC countries have benefited from their education systems, the figures given by GCC educational establishments to substantiate their accomplishments are usually impressive and can be misleading in as much as they do not specify the kind and quality of education the citizens receive (Khasawrih, 1986). Stressing the same point, some also argue that the education systems in the GCC countries are markedly failing to provide personnel to fill even the relative gaps in some professions since most local students are oriented towards higher education and to the humanities in particular (Al Rumaihi, 1986).

The Arab Bureau of Education for the Gulf States (ABEGS) experts were also concerned about the education systems in the GCC countries. They, in their study presented to the First Intellectual Symposium for the Rectors and Presidents of Gulf Universities, criticised the education system in general, and higher education in particular, when they argued that the system lacked quality, and that there was a need to find new

fields of specialisation to harmonise with the future needs of development plans in the region (ABEGS, 1985).

The education system in the region is characterised by many educational researchers as incompetent. In addition to the lack of technological and practically-orientated science and education, there is also the problem of disproportionality, a dominance of general education over technical education. The number of students enrolled in technical and vocational schools is very small, despite incentives that have been introduced by these schools, such as financial incentives and the provision of modern equipment and new tools. The percentage of students in the secondary, technical and vocational schools in the GCC countries ranged between 1.5 % and 3.6 % of the total number of students in all types of secondary schools (Government of Bahrain, 1981). This percentage is very low compared with the percentage in some developed countries where it sometimes reaches 30 %.

At the university level, the picture is exactly the same. University graduates do not fulfill the technological development needs. On the one hand there is a surplus of university students studying humanities and social science subjects, and on the other hand, a shortage of students who study other highly specialised technical subjects (Abdul Rahman, 1987). Such an imbalance is the obvious outcome since the secondary education is the base on which higher education rests.

4.4.3.1 Women's Participation

The women's role in the S&T activities in SA is extremely limited. Although women's education has witnessed considerable expansion in terms of schools and students, and although female students at university level constitute a high percentage (49 % in 1995) of

the total number of students , their contribution to the Saudi economic development is still secondary.

It has been mentioned by the decision-makers in SA that university programs for females are still in their preliminary stage and are not sufficiently developed, either qualitatively or quantitatively to cope with the increased flow of secondary level graduates. They argue that comprehensive planning for the development of Saudi human resources requires that this issue should receive immediate attention (MOP, The Fifth Development Plan, 1990).

Some Gulf intellectuals believe that the most important reasons why women's contribution to economic activities is very small is that women may be given the opportunity for education, but the opportunity to work is controlled by cultural and social restrictions. They believe that women in Gulf societies as well as in other Arab countries have reached a stage of contradiction. Previously, they were not educated or aware of the world around them. Now, they have been given some education, but are devoid of content and essence (Abdul Rahman, 1987).

Evidently, the case in SA as well as in many other Arab countries is totally different. There are many fields of work open to women and they can be trained and qualified in most productive fields, which are not in contradiction with Islamic law, so as to participate effectively to the building and development of their societies.

4.5 Conclusion

The Kingdom of Saudi Arabia has accomplished various objectives on the way to economic and technological development. There is no doubt that there has been considerable

development in the S&T system in the last two decades, and that the majority of the physical infrastructure has now been completed and provides an outstanding base for future economic and technological development. Considerable increase has also been achieved with the number of higher education institutions and technological and research centres.

The present situation of the S&T system in SA, however, is typical of most Third World countries. SA is still facing many deficiencies and inadequacies which affect the achievement of technological change objectives. Some of the main problems facing the country are: an insufficient commitment for S&T; an insufficient commitment toward attaining self-reliance in S&T; a shortage of trained manpower and improper planning for the best possible use of human resources; problems of determining priorities and evaluating research; a lack of coordination mechanisms between technological institutions, universities, research centres and related official departments; an excessive reliance on imported technologies; and a lack of information resources.

In comparison with other countries seeking technological change, technological change for SA is a matter of survival in which great efforts must be made in order to build up the S&T capacity and develop and strengthen its S&T capabilities. Technological objectives must be clearly defined. Intrinsic changes are needed in the areas of decision-making, R&D and its applications, and co-ordinating the efforts in the formulation and implementation of technological development objectives and S&T development programmes.

In this chapter we have also tried to study the pattern of technology transfer in SA and the role of the SIDF in this regard. We have found that the bulk of technology transferred in SA is basically directed toward petroleum-related industries (e.g. petrochemical and

heavy industries such as iron and steel). The predominant method of technology transfer in these industries is joint-venture between foreign companies on one side and government-owned and private corporations on the other side. Because of the capital-intensity and the uncertain marketability of these projects, local private participation in these industries is very limited. The SIDF has also aimed at working in harmony with the government technology transfer policy. It has continued, since its inception, to encourage the establishment of joint-venture projects in order to participate in transferring modern technology to the Kingdom.

**Part Three: Technological Change And The
Respective Roles of Development Banks:
Select Theoretical and Empirical
Literature Review**

Chapter Five

Development Banks and Technological Change: A Literature and Policy Review

5.1 Introduction

The historical experiences of industrialised countries, as well as the contemporary experiences of many developing countries suggest that banks and particularly development banks can play a crucial role in promoting and influencing the processes of technological change. Our central concern is with the development banking role of the SIDF in promoting technological change within SA. As a result, the main purpose of this chapter is to survey the body of literature on the role of the banking system and, particularly, the role of development banks in promoting and influencing a country's technological change. Relevant theoretical and empirical work which relates to the main research objectives of this thesis will then be discussed.

This chapter is divided into three main sections. First, a review of definitions, concepts, and elements of technological change is presented. The relationships between technological change and productivity growth and the role of government in promoting the rate and direction of technological change are also discussed. In Section Two, some preliminary background on development banks is presented; this section also deals with the role of development banks in stimulating and inhibiting technological change. The third section analyses the ways in which development banks can play an important technological role within an economy.

5.2 Technological Change: Analysis and Discussion

Many researchers have recognised the central importance of scientific and technological change in the process of economic development (Cooper, 1974; David, 1975; Steward, 1978; Kim, 1980; Bhatt, 1980; Lall, 1982 and 1984; Moore, 1983; Fransman and King, 1984; Katz, 1984 and 1987; Porter, 1990; Bell and Pavitt, 1992; and Griesgraber and Gunter, 1996). It is not surprising, therefore, that technological change has been a key concern of the leaders of the independence movements of many developing countries, who see rapid technological change in their countries as one of the cornerstones of both the fight for freedom and the later efforts to build nations.

Technology is an important factor within production function modeling in contemporary economic theory. Several empirical studies have focused on the relationship between the outputs and inputs of various factors of production. Technological change is one of the important factors which have shifted production functional relationship so as to increase productivity.

In accordance with this line of economic reasoning and development policy thought, the specific objective of this section is to consider the conceptualisation of technology, the relationship between technological change and productivity growth, the basic factors influencing the level of technological change, and the respective empirical models of technological change.

5.2.1 Basic Concepts of Technology

The term "technology" is a broad one. Various definitions of technology have been suggested, many of which offer different theoretical and historical approaches; the simplest version views technology as the set of technical processes for production (Abi-Saab, 1969)

or as the body of knowledge that is applicable to the production of goods and the creation of new goods (Root, 1968). A more sophisticated approach adds technical processes, labour, and managerial skills to this production model: According to this approach, technology may be defined as “all skills, knowledge and procedures for making, using and doing useful things” (Merril, 1968). This approach facilitates aggregate analysis, and economic theorists and historians have made wide use of it.

In a broader sense, technology may be viewed as a “socio-technological” phenomenon; that is, besides involving material and artifact improvements, technology is considered to incorporate cultural, social, and psychological processes as well (Foster, 1962). Taking this view into account, any aspect of change to be effective must be related to the central values of the culture. Most economists reject this approach on the assumption that, for their tasks, cultural variables can normally be taken as constant. However, there are some economists, such as Hagen (1962), who have made such a cultural approach essential to their theory of development.

While every one of the above approaches can be beneficial for certain lines of investigation, a more meaningful and practical approach is likely to be that which falls between reliance upon technology as a total cultural determinant and reliance upon technology as merely a set of technical processes (Spencer and Woroniak, 1967). Therefore, the concept of technology may include a group of elements and managerial skills that are directly involved in production in addition to the basic technical processes.

5.2.2 The Definition and Elements of Technological Change

It is difficult, if not practically impossible, to present a neat and comprehensive definition of technological change that will satisfy all conditions or all people. Schmookler (1972)

stated that the technological capacity of any economy can be defined as the accumulated body of technological knowledge weighted by the number of persons who have access to this knowledge. Technological change can, therefore, come about through an increase in the body of knowledge or changes in the number of people who have access to it, or a combination of both.

In the neoclassical literature, Mansfield's (1968) important study stressed the production function approach in defining the concept of technological change. He argued that technological change results in a change in the production function. If the production function were readily observable, a comparison of its position at two points in time would provide the economist with a simple measure of the effect of technological change during the intervening period. Stoneman (1983) argued along the same lines when he defined a production function, $Q = F (K; L; t)$ where Q is output, K and L are capital and labour inputs, and t is time. Technological change is the process justifying t in this function. More specifically, technological change is a change in an economy's production function detailing the relationships between inputs and outputs in the economy or, in other words, technological change is the process by which economies change over time in respect of the products they produce and the processes used to produce them. Stoneman (1983) argues that if technology is so represented, then a technological advance enables the economy to obtain greater outputs from the same inputs as time proceeds.

Of course, changes in the production function may originate from various sources- a new piece of equipment, improved material inputs, better principles of organisation, and so on. Morroni (1992) asserted that technological change includes, on the one hand, a series of small improvements in machines and the organisation of labour arising from slow processes of learning by doing and learning by using; and, on the other, the application to

production of the results of systematic planned research carried out by firms or by university research institutions, laboratories, private and public bodies, and so on. Indeed, the relevance and number of these disciplines affect the rate and the direction of technological change. Heimler, Malerba, and Peretto (1993) stressed the same point by stating that technological change may originate from various sources which may be internal to the firm (such as R&D), external to the firm but internal to the industry (such as other firms in the industry), or external to the industry (such as suppliers, users, and universities).

All of these types of knowledge should affect, in one way or another, the rate and direction of technological change at the firm or industry levels (Nelson and Winter, 1982; Kline and Rosenberg, 1986; Anderson, A. E. -- [et al.], 1989).

In this study, the working definition of "technological change" refers to a change in available knowledge which can not only be used effectively in industrial operations, but also has a positive effect on cost, product quality, level of output, and other ancillary operations of the firm.

Several elements of this definition are worth making explicit as they have a particular bearing on the empirical part of this thesis. The first is that technological change may involve the acquisition of new information or knowledge that affects production and sales of the product. This knowledge may be manifested in the introduction of a new piece of machinery, or it may take the form of a change in the social organisation of the production and labour processes, or it may be disembodied as consulting services and technical assistance. Although most changes are associated with production processes, the definition of technological change according to Fransman (1985) and Kirim (1990) may also include the following forms:

- the search for new products and processes;

- the adaptation, improving, or modifying of products and processes to local conditions;
- the development and building up new products and processes;
- the conducting of basic R&D; and
- improvements in quality and cost reduction.

5.2.3 The Relationship Between Technological Change and Growth of Productivity

Most contemporary analyses of economic growth focus on the relationship between the outputs and inputs of various factors of production. Total factor productivity is influenced by a number of changes in the characteristics of inputs, and the economic literature contains a large number of studies which have attempted to analyse the relationship between technological change and productivity growth. The results of Schmookler (1952); Schultz (1953); Leontief (1953); Valavanis-Vail (1955); Kendrick (1956); Solow (1957); Massell (1960); Denison (1962); Nelson and Winter (1974); Nishimizu and Hulten (1978); Fraumeni and Jorgenson (1980); and Parthasarathi (1990) *inter alia* indicate that the extent of the input decomposition varies widely among the studies, but the importance of technological change is common to all of them. All of these studies showed that the aggregate growth over time significantly has been influenced by technological change.

Solow (1957) was the first to formalise the study of productivity growth within the context of an aggregate production function. Examining the US economy for the period from 1909 to 1949, he concluded, like earlier writers, that between 10-15 % of growth could be attributed to increased capital per staff hour and 85-90 % to technological change. Solow (1957) acknowledged that his conclusions compared closely with those of

Schmookler (1952) and Valavanis-Vail (1955). He also demonstrated that technology actually improves the productivity of the other factors of production (namely, land, labour, and capital) by increasing their efficiency.

A number of other studies have confirmed the importance of technological change to productivity growth. Massell (1960) made a similar analysis for the US manufacturing industry between 1919 and 1955, and estimated that the annual rate of growth attributable to technological change was nearly the same as Solow's estimate. Denison (1962) decomposed the sources of growth into a number of elements, but he concluded that about 40 % of the increase in output per capita between 1929 and 1957 in the US was attributable to technological change. For Japan, Nishimizu and Hulten (1978) arrived at a similar pattern. They estimated that technological change accounted for 25-32 % of growth in value added between 1955-71.

On the basis of extensive analysis, Nelson and Winter (1974) emphasised that "the essential forces of growth are innovation and selection, with augmentation of capital stocks more or less tied to these processes." Kuznets (1973) stated that a country's economic growth may be defined as a long-term rise in capacity to supply increasingly diverse economic goods to its population. This growth capacity is based on advancing technology and the institutional and ideological adjustments. He stressed the importance of all three components of his definition.

It thus can be clearly seen that technology will continue to be pervasive as all sectors of the economy use it and all segments of society are influenced and affected by it (Parthasarathi, 1990).

5.2.4 The Role of Government in Promoting Technological Change

Few would disagree that in all market economies, the government has intervened at various times to influence and inhibit various forms of technological change. A major governmental contribution to technological change has been to establish, both directly and indirectly, an environment that will stimulate firms and specialised technological agents to engage in ongoing technological efforts and also to develop added technological capabilities in order to improve productivity and overall economic performance (Mansfield, 1973; Nelson, 1981; Link, 1987; and Dahlman, Larson and Westphal, 1987).

One example of such a contribution is the attempt that has been made by some of the more industrialised Third World countries to encourage the development of a local capital goods sector. In South Korea (Amsden and Kime, 1982 and Westphal, 1984) tariff exemptions on imported machinery and equipment is subject to the conditions that the imported capital goods be essential to the manufacturing process, embody the latest technology, and not be domestically produced. In addition, medium and long-term credits have been provided for the production or purchase of locally produced machinery. The establishment of specialised development banks in order to promote technological change is another example of the government input. These banks provide medium and long-term finance to encourage the development of human science and technology skill, the adaptation and improvement of foreign technology and to stimulate the other forms of local R&D (Fransman, 1985).

The choice of appropriate technology depends on the information available and the ability to use that information effectively. Because of large economies of scale in the collection and organisation of information, governments can participate in improving technology and information flow among industries: for example, Brazil and Mexico have

established technological information centres that provide private users with the data they need for only a small fee..

A major government contribution to technological change is the investment in education and training (Bell and Pavitt, 1992). As seen earlier, (Chapter Four) education policy has a strong influence on the rate and direction of technological change. Therefore, an effective government intervention policy might take the form of inducement for firms to invest more substantially in training in order to create change-generating human resources.

5.3 Background of Development Banks

Development banks have received a great deal of attention in the literature on economic growth and development. At the time of the Industrial Revolution, it was necessary for industrialised countries to establish development banks whose primary task was to finance and promote investment projects (Edwards, 1987). After World War II, and especially in the last few decades, many development banks were also founded in the developing countries (Diamond,1957 and Perera,1968). These banks continue to be the subject of detailed commentary and heated debate. Some of the questions that have arisen include:

1. Is there a unified understanding of the criteria that makes a financial institution a development bank?
2. Should a development bank be government-owned, privately owned or have a mixed ownership structure?
3. To what extent can a development bank be used as a tool for promoting and stimulating economic and technological change?

The theme of this section, therefore, is to examine the above aspects and to develop a broad, but coherent perspective which is practical in nature and which encompasses the

objectives and operations of development banks. This will serve as a background to more detailed discussion in subsequent sections.

5.3.1 The Definition, Functions and Activities of Development Banks

Differences of opinion exist regarding the definition, functions, and activities of development banks. At one extreme, there are those who believe that a development bank is merely a commercial bank with one difference: that is, its lending activities include a higher proportion of medium and long-term financing. At the other extreme are those who see a development bank as a major promoter of projects, and believe that its responsibilities should include the entire spectrum of activities involved in the promotion of a project.

Many developing countries have established development banks (variously referred to as special financing institutions and development finance companies) to initiate investment activities in both the public and the private sectors. Because of their success and unique responsibility in development, these banks have become the largest component of the miscellaneous group of financial institutions that provide long-term credit to industry and agriculture (Goldsmith, 1969). Since World War II they became an integral part of the financial system of most developing countries because they can attract foreign resources, mobilize domestic services and can allocate investment funds efficiently (Fry, 1988). During the 1950s, these institutions were seen as organisations whose main goals were long-term development of domestic capital markets (in particular by introducing term lending for industrial projects) and mobilising of domestic resources for capital formation. However, over time, these objectives have broadened and modified and development banks are now seen as useful vehicles for economic development in all sectors (Cassen and Associates, 1994; Arestis and Chick, 1995; Kasa and Murinde, 1995; and Murinde, 1996).

What exactly are development banks? According to Diamond (1957), they are financial institutions whose primary function is to promote and to finance enterprises in the private sector. Others, however, argue that development banks are intended not only to provide capital for the private industrial sector, but also to mobilise savings and skills for productive investment in that sector (Boskey, 1959). To ensure that the developmental and catalytic functions can be effectively performed by development banks, Kane (1975, pp.14-15) suggests that a development bank, in addition to providing medium and long-term funds for bankable projects, should simultaneously provide other services connected with development. Their activities, some argue, might encompass a broad spectrum including:

- undertaking surveys and feasibility studies for potential investment;
- providing technical assistance to local entrepreneurs;
- broadening public ownership through underwriting and issuing their own securities;
and
- promoting new economic ideas to stimulate the economy (Khan, 1973).

Thus, it can be seen that development banks are relatively modern financial institutions set up primarily to finance the development of specific sectors in an attempt to promote wider industrialisation and economic development.

Diamond (1981, pp. 3-4) points out that development banks should be defined according to their principal functions which he describes as follows:

“The principal function of a development bank is the provision of medium and long-term finance for fixed assets. It also helps to provide, in addition to finance, such other essentials of productive investment as entrepreneurship, technical skills and managerial experience. It relies on the success of the enterprises it finances for recovery of its investment rather than on the security of collateral, and it does so in a manner that balances commercial standards of operation with economic benefit. Promotional activity is crucial to its role special assistance to particular groups or regions in the country, and pursuits of broad national economic objectives by filling perceived gaps or inadequacies in the elements required for productive investment”

Because of these considerations and the belief that only a 'functional' approach; i.e., according to type of business rather than any precise 'institutional' definition of the term "development bank" is possible, some authors offer a "functional" definition. Houk (1967) suggests that to determine whether an institution is a development bank or not one needs to return to the functions (i.e. activities, roles or operations) it performs. He argues that an institution has to perform both banking and development functions to be defined as a development bank. The financial function of a development bank lies in its provision of medium and long-term capital for economic development projects. The developmental function, however, has been considerably extended and varies from one country to another. It ranges from overcoming the so-called critical shortage of viable projects presented to the development bank and the lack of management and technical skills by the respective economic units to the fostering of a capital market.

The scope of activities of development banks varies considerably: some are mainly financial institutions, whereas for others, providing finance is of less significance. Some are expected to finance industrial and manufacturing projects while others are only prepared to finance the projects of specific sectors like agriculture. Many development banks provide various kinds of assistance such as engineering, marketing, accounting and management advice to the projects they finance; other offer no assistance whatsoever.

The World Bank (1985), the leading supporter of development banks in developing countries, has stated that in the 1970s development banks were increasingly viewed and used as tools of development policy to channel resources to publicly promoted or publicly owned enterprises and to priority sectors which commercial lenders were unwilling to finance.

The definition of development banks, therefore, should be drawn up in the light of their purposes, their related operations (activities) and the economic, social, and political environment in which they operate. This review leads us to the conclusion that the primary task of the development bank should not by any means be restricted to providing medium and long-term financing for productive investment -- a need that was originally not met by commercial banks in many developing countries-- The development bank should also ensure that this financial allocation is in line with the defined economic, social, and political contradiction between the aim of profit maximisation and the goals of development.

5.3.2 The Ownership of Development Banks

As previously mentioned, many development banks were established during the last few decades to engage specifically in development financing. There is no ownership standard model for a development bank: it can be government-owned, privately owned or have a mixed ownership structure (Gordon,1983). However the view that most development banks are state-owned or, at least, influenced by the state was corroborated by an analysis of 95 development banks by Harlander and Mezger (1971). In their preliminary survey in 1969, Harlander and Mezger (1971) screened 95 development banks in 39 African countries and found the following ownership structures:

- 2 were multi-national banks; viz. The African Development Bank, whose capital was subscribed by 31 African governments, and The East Development African Bank, which is equally financed by Kenya, Tanzania, and Uganda;
- 3 were international partnerships with the national government holding 25 percent or 33.3 percent of the equity;
- 47 were wholly state-owned;

- 35 had at least 50 percent government participation or a majority of either the local or foreign governments; and
- 8 were privately owned or had a private majority.

A later study included other development banks, but reached the same conclusion (Leembruggen, 1980). In an analysis of 139 development banks from many developing countries, Leembruggen found that 67 % of these banks had more than 50 % government ownership and 46 % were entirely government-owned (see Table 5.1).

Table 5.1
Profile of Development Finance Institutions by
Government Ownership in Developing countries

Percentage of Government Ownership	Number of DFI's	Percentage of Total
0-	23	17
1-10	5	4
11-20	-	-
21-30	4	3
31-40	4	3
41-50	9	6
51-60	9	6
61-70	3	2
71-80	5	4
81-90	1	1
91-99	10	7
100	64	46
unknown	2	1
Total	139	100

Source: Leembruggen, 1980.

From the results of these two studies, one can clearly see the domination of state-owned development banks. Most of these banks were established in the late 1960s and in the early 1970s. According to Mathew (1982), the main factors responsible for the rapid growth in the number of government-owned development banks during this period appear to have been the emergence in the late 1950s and early 1960s of many new sovereign

countries with undeveloped private sectors, the political popularity of governmental agencies as the means of promoting rapid growth, and a decline of faith in foreign and private initiatives as pacemakers of economic development.

In the late 1970s, however, new types of development banks were established (Ligeti, 1985). These banks were domestic public institutions, mainly in the oil-exporting countries or in other countries supported by them. Typically, they were charged with promoting rapid industrialisation using low cost funds. Government participation in the ownership of these banks, especially in the oil exploring countries, not only provided the necessary capital, but also ensured that these banks fit their operating policies more accurately into the national economic development.

A staff member of the World Bank at the Zurich Symposium in 1979, organized by the UNDO and the World Bank, stated that (Ligeti, 1985, p.306):

“there was need for greater co-operation between government and development banks regarding identification, preparation and implementation of viable projects of all sizes and of relevance to the economy of the country. Development banks in the 1980s would be called upon to diversify their activities, they might be called upon to engage, to a greater extent than today, in project identification and development of feasibility studies and to specialize in financing specific sectors, which had neglected until then. In that process, the World Bank realised that the contact points of development banks within the government were likely to enlarge and might include, in addition to ministries of finance, industry and planning, those concerned with public works, construction, and education”

The continued co-operation of governments with development banks is essential in order for any development bank to perform its role effectively.

5.3.3 The Financial Sources of Development Banks

The level of capital of a development bank is usually determined by the ideological, political, and economic environment prevailing in the country where that bank operates.

The absorptive capacity that is, the total amount of capital a country can employ productively in a given period of time, plays a very important role in determining the own resources that a development bank ought to have. When the proper capital structure is being determined, there is always a risk of over-capitalisation or under-capitalisation. A development bank needs to have sufficient capital in order to make an impact on economic development, and to earn enough for expenses, the accumulation of adequate reserves and, in the case of private development banks, the payment of an acceptable dividend. On the other hand, capital resources should not be so large that they exceed, by a significant margin, what appears to be necessary for the fulfillment of the bank's purposes (Boskey: 1959). Over-capitalisation puts a strong pressure on the banks to do too much, too early and too fast.

According to Houk (1967), when assessing the availability of a development bank's capital for investment the amount committed to sound projects within two years should be the upper limit of a bank's capital requirements. However, there are no standard techniques for making such an evaluation and, naturally, estimates of this upper limit are likely to differ.

The lower limit should be the total resources required to achieve an earning capacity which is sufficient to maintain the administration of the bank and to yield a reasonable surplus for use by the bank, which can be set aside as reserves used to increase services to customers, or be distributed to the owners or patrons. It is of primary importance that the level of capital of a development bank be adequate for its requirements. Unlike a commercial bank, a development bank does not create money and generally does not accept deposits. It can be seen as a sort of "transfer agent", receiving funds from various sources and distributing them among different users.

In general, the types of financial sources of development banks are as follows (Harlander and Mezger, 1971) :

- a) **Equity Capital:** Equity capital is defined as paid-in-capital that may be subscribed either totally or in part by local government.
- b) **Government Allocations:** There are many ways by which governments can finance development banks. The initial governments contribution may come through granting the development bank an initial lump sum which is supposed to revolve with the repayments of loans and revenues from interest payments on loans and thus supply fresh funds for new investments. The government contribution may also consist of the transfer of hitherto state-owned enterprises or other fixed assets to the development bank. In the absence of equity capital, the annual budget allocations by the local government will be a highly desirable resource of finance for development banks. Government can also direct further financial resources to development banks by means of compulsory saving, the levying of additional profits tax, or by the issue of bonds that have to be purchased by financing institutions.
- c) **Foreign Multilateral or Bilateral Grants:** Recently there has been a growing tendency among foreign governments and their agencies to allocate some grants to development banks in connection with technical aid: viz, for the cost of expert consultants, research and project appraisal, initial operating expenses and so on.
- d) **Quasi-Equity:** Long-term, interest-free or low interest government loans, subordinate to the share capital and other debts, with a significant grace period, have the character of subsidies and are termed quasi-equity.

- e) **Borrowing:** For many development banks, borrowing from the international financial agencies such as the World Bank is one of the most important sources of finance. Borrowing from some international financing agencies is often subject to a number of strict conditions, for example, The World Bank, when granting a loan, requires a debt-equity ratio of no more than 3:1 from the development banks.
- f) **Private Capital:** Private domestic capital can be mobilised by development banks through the selling of shares. Some argue that this option is of limited possibility because of the low level of domestic savings in many developing countries.

5.3.4 Development Banks and Technological Change

The viewpoint that the role of banks is not merely to provide finance, but also to influence and promote technological change and to help build a base for indigenous technological capacity may seem, at first sight, somewhat unconventional. However, as was discussed earlier, the history of the past century affirms that commercial and development banks were a basic prerequisite of sustained technological change. In fact, throughout the Industrial Revolution, innovative banks in Europe, the United States, and Japan were closely associated with the growth of industrialisation and with the process of technological change (Edwards, 1987). The German, the Austrian and Italian banks, established the closest possible relations with industrial enterprises (Gerschenkron, 1962).

In spite of the historical evidence, the role of banks in influencing and promoting technological change has often been underestimated or even ignored. Jequier and Hu (1989) stated that some 300 books, articles, mimeographed papers and internal bank documents have been identified as potentially important sources of information on the technological role of banks. A closer look indicates, however, that over three-quarters of

this literature does not discuss the subject directly. This lack of interest or concern about the contribution of the banking system to a country's industrial and technological change can be attributed to a number of factors, the most important of which is probably that banks are viewed, and tend to view themselves, primarily as financial intermediaries. Another reason may be the fact that the causal relations between a bank's policies and decisions, on the one hand, and their effects on a country's technological change, on the other, are rather complex and often take several years to come to light; moreover, they tend to be somewhat unpredictable (Jequier, 1981). The different impacts and consequently interactions between economic, regulatory and social factors are also a very important reasons for the different level of interest or concern of the contribution of the banking system to a country's industrial and technological change (Rybczynski, 1996).

In some cases, banks can act as technological institutions by financing research and development activities, sponsoring the establishment of technological institutions and research centres as well as helping to introduce new products to the market. The World Bank, in the course of its activities as a financing institution and development agency, has acted at the international level in very much the same way as a ministry of science and technology would act at the national level. The World Bank has taken on the roles of fund mobiliser, financial sponsor and institution-builder in the same manner as a technological institution. It has developed in such a way because all the projects it finances involve technology in some way or another; for instance, machinery has to be purchased from industrial suppliers; people have to be trained in new skills to operate productive units efficiently; and new products and new ways of operating have to be diffused (Weiss and Jequier, 1984). A recent study found that significant information technology components were present in over 90 percent of all World Bank lending operations in Africa in the fiscal

year 1990. More significantly, since 1981 the volume of the bank's lending for information technology has been growing at an average annual rate of nearly 30 percent (Moussa and Schwabe, 1992) and since that time the goals of technological change and the transfer of technology from industrialised to developing countries and, to a lesser extent, between developing countries themselves, has been one of the central objects of the bank (Kirpich, 1984; Sheehan and Ramachandran, 1984; and Pratt, 1984).

Such a similar technological role has also been undertaken by many banks such as:

- Brazil's Banco Nacional de Desenvolvimento Economico (BNDE) when it set up a national fund for scientific and technological development;
- Banco do Nordeste do Brasil (BND) when it allocated up to 5 % of its profits to a fund for the support of R&D activities and the training of technical personnel in the north-eastern region of the country;
- Development Finance Corporation of New Zealand (DFCNZ) when it set up an Applied Technology Programme to help raise the technological level of New Zealand enterprises;
- Inter-American Development Bank when it made loans for agricultural research in Honduras, Brazil or Bolivia (Jequier and Hu, 1989); and recently
- Korea Development Finance Corporation (KDFC) when it associated with Korea Institute of Science and Technology (KIST) in order to adopt, absorb, adapt, diffuse and improve upon borrowed technology (Bhatt, 1993).

The experience of this sample of development banks suggests that other development banks in other countries may also be able to play a similar technological role and that banks could become more active players in the process of technological change.

The involvement of a bank in technological change, however, depends on many factors. Among them is the economic system surrounding the bank and the direct and indirect macro-economic policies that, in one way or another, affect the operations of the bank. The technological sophistication of the country in which a bank is operating and the technological and scientific policies necessary to create the appropriate climate for technological advance are also important factors influencing the ability of banks to finance and promote technological change (Jequier and Hu, 1989 and United Nations, 1992).

Another important factor, if not the most important, is the bank's ability and willingness to influence national technological change. One of the important determinants of this ability and willingness is the technological capability of the bank itself and of its staff.

The final important factor is the nature of the project being financed by the bank. A project using a simple and well-tested technology will need less active technological involvement on the part of the bank than a project using an entirely new type of technology which will require a much closer involvement beginning with the identification of the project itself and continuing as the project develops through all of its stages (Kanan et al. 1992). Such a close involvement of a bank in a project requires much greater awareness and skillful deployment of the bank's own technological role.

5.3.4.1 The Technological Role of Development Banks: A Survey

As discussed previously, the contribution of the banking system to the process of development, industrialisation, and technological change is not new. European industrial banking, for example, both at the time of the Industrial Revolution and in the period following World War II focused essentially on the development of the industrial sectors of

these countries (Bhatt, 1993; Griffith, 1996). During the 19th Century, the banking system's involvement in the industrialisation of Europe spread to other European countries such as Switzerland and Austria, to the Scandinavian countries and subsequently to Italy and Japan (Cameron, 1953; Diamond, 1957; and Hu, 1984).

Fully aware of the catalytic leadership role that financial institutions may perform in financing and promoting technological change, many development banks have successfully functioned as catalysts of technological change during recent years just as their counterparts did in Europe during the Nineteenth Century. For example, Swedish financial institutions at the beginning of this century played a very important technological role; performing the tasks of identification, design, and formulation of projects in an attempt to adapt, modify and improve both traditional and modern technologies. As Drucker (1971, p.71) states:

“Yet Swedish technological strategy had not been formulated by technologists. It seems to have come mostly from the industrial development bankers who head the country's three large banks. Not one of them is a scientist or an engineer; all of them, however, apparently understand the need for technological strategy that is appropriate to a small country where available resources have to be concentrated on filling gaps in a few areas rather than in providing the main advance. When World War II ended, Sweden was still largely a mining and lumbering economy. Now she has become, in terms of per capita output, Europe's leading industrial economy and has attained a standard of living second only to that of the United States.”

Another example is India which is served by over 66 development banks with a wide network of branches supported by technical consultancy organisations and with the Industrial Development Bank of India (IDBI) acting as an apex institution to coordinate their diverse financing and promotional activities (Singh et al, 1991). The IDBI has initiated action in the field of technology by coordinating the functioning of the financial institutions and by establishing links with the Technical Consultancy Service Centres (TCSC) established in every state of the country. The IDBI clearly noticed the need, in the

Indian context, to establish TCSC in order to perform the various tasks related to project design work and to establish close and direct links with the banking system so that the latter could carry out its promotional role and stimulate a viable yet diffused process of industrialisation in the backward parts of the country (Bhatt, 1982).

The IDBI's role in promoting technological change can be illustrated by the cases of the Swaraj tractor and the Bagasse-based Newsprint projects. In the case of the Swaraj tractor project (Bhatt, 1978), Indian small farms were in need of a low-horsepower, multipurpose tractor as well as financial resources. Foreign assistance was therefore sought in 1965, but this necessitated a large foreign exchange cost and a large number of foreign experts. The director in charge of the Central Mechanical Engineering Research Institute convinced the Indian officials that India had the capacity to design, engineer, and manufacture the tractor. The Swaraj tractor was thus devised and passed the tests of the Tractor Testing and Training Station (TTTS). The Ministry of Agriculture and the public sector Hindustan Machine Tools (HMT) still favoured the Zeteor, a 20-horsepower tractor of Czech design, on the grounds that Zeteor was a production model, while Swaraj was still a prototype. HMT decided to produce Zeteor on a turnkey contract with Czechoslovakia. The Swaraj tractor thus was left without a promoter.

The financing problem was solved by the IDBI, which appraised the project and was attracted by the fact that the tractor was locally designed and that its manufacture was based on indigenous skills, materials, and equipment. This project has been successfully implemented, and the firm has already introduced two new designs of tractors based on its own research and development. The success of this experiment was primarily attributed to the organic and sequential relations and the critical functions performed by the TCSC and

the IDBI that identified relevant problems, embodied the research results meaningfully into a concrete project, and facilitated its implementation (Bhatt, 1982).

The technological role of Indian development banks can also be seen from the case of the Bagasse-based Newsprint Project. In this case the TCSC and the financial institutions have played an important role in stimulating and accelerating the process of technological change in India. The role of the TCSC and the financial institutions, including the World Bank, was very crucial in providing a vital link between modern technology on the one hand and the production system on the other (Bhatt, 1988).

The vital importance of these banks is again borne out by the Korean experience. Korea is one of the few countries that has wholeheartedly adopted technological change. In the early 1960s, the Korean government initiated an intensive development policy designed to industrialise the nation. Since industrialisation can only be successful by the effective utilisation of science and technology, the government planned a comprehensive policy for the development of science and technology (Choi, 1975). In addition to the establishment of the Ministry of Science and Technology to serve as a central planning and coordinating agent of government in science and technology, several technological institutions were established by the Korean government to act as catalysts in the creation of the needed infrastructures and to help in stimulating the development of science and technology. These technological institutions were closely coordinated with the Korean financial institutions. With the support of the government and the World Bank, the performance of these financial institutions, such as the Korea Technology Development Corporation, has been very satisfactory and they have had a significant technological impact on the Korean economy.

By and large, these comments apply to many other institutions such as the Industrial and Mining Development Bank of Iran (until the 1978-79 Revolution and the establishment of the Islamic Republic), the Development Bank of Singapore, Ecuatoriana de Desarrolla SA Companie Financiera (Ecuador), Societe Nationale d'Investissement (Tunisia), and Banque Nationale Pour Le Developpement Economique (Morocco). These development banks have all served their country well: helping to build infrastructure; stimulating latent entrepreneurial resources, providing virtually every type of technical assistance to domestic enterprises, and rescuing many important, but failing industries (Boreham, 1986). These countries have well understood the vital role of development banks in promoting technological change and they have thus goaded the banks they supported to adopt, absorb, adapt, diffuse and improve upon the technology borrowed from advanced countries and, in many cases, to introduce new technology that has not yet been adopted elsewhere.

5.3.5 A Working Model for a Development Bank

As previously mentioned, a large number of development banks have been established over the last few decades. These banks differ widely in terms of functions, activities, ownership, financial sources, policy orientation, the specific interests of sponsors or owners, and other characteristics. It is therefore quite difficult to set forth a precise definitive model of a development bank: such a model does not really exist. The working model used in this thesis reflects an attempt to incorporate the observable differences which exist.

A development bank is defined here as a financial institution which has been established with the intention of promoting national, economic and social development through the provision of medium and long-term finance to various specific economic fields. Its principal sources of funds are equity capital subscribed either in part or totally by the

local government, contracted foreign multilateral or bilateral grants, private capital through the sale of selling new shares, as well as the recovery of loans (Cacerec and Gonzalez, 1985). A development bank, whether industrial, agricultural or multilateral, is part and parcel of the financial superstructure of the country where it operates. It is created in significant part to fill a serious gap in the indigenous capital market (Bhatt, 1993).

The ability and willingness of this bank to perform its objectives effectively - or to fail to do so - are influenced by the general context of the relationship between the bank and the government and by the position of the bank in a country's national development policies (Jaquier and Hu, 1989). One of the most important determinants of the bank's involvement in the processes of economic development in general, and technological change in particular, is the general quality of political leadership (Okazaki, 1995). This helps to explain in many instances why the development banks in countries such as India and Korea seem to be so much more effective in their developmental roles than comparable banks in other countries. A development bank should ideally have a close relationship with government at the policy level and be independent and autonomous at the operational level. A bank's general attitude towards industry and its willingness to influence the country's technological change is also affected by the background, experience, and orientation of the bank's management (Diamond, 1981). A development bank also needs to have close relations with local or outside scientists, industrialists, experts and research centres which will enable it to obtain the best advice about new products, new production processes, the development of high-technology industries or the solution of specific technical problems (Bhatt, 1982 and Jequier and Hu, 1989). The bank will then be able to make sounder lending and investment decisions, which will be both to its own advantage and to that of the national economy.

In the absence of these essential factors, it is only natural that a bank will focus merely on the profitability and security of its investments, rather than on its respective developmental and technological impact.

5.4 Analysing the Role of Development Banks in Financing and Promoting Technological Change

As we have seen development banks differ widely in terms of ownership, capital structure, policy orientation, the specific interests of sponsors, and more importantly their objectives and field of operations. It is thus rather difficult to make a general assessment of the effectiveness of these banks and to evaluate their performance or impact as a group of institutions. The task of evaluation is even more difficult when we attempt to answer the kind of more specific questions posed in this study; namely,

1. How effective have development banks been as instruments of national technological change?
2. Have they effectively contributed to building up the country's technological capabilities and promoting technological change or have they been merely a source of subsidised medium and long-term credit?

Jequier and Hu (1989) argue that a development bank's technological role can be analysed at three different levels:

- the level of the bank's ability to promote technological change;
- the level of the bank's relations with government and science and technology institutions; and
- the level of the projects and the bank's respective project cycle.

5.4.1 A Bank's Ability to Promote Technological Change

The inclination of development banks to promote and support technological change can be analysed in terms of five main determinants: industrial and technological knowledge, equity participation in assisted enterprises, the bank's institutional culture, competition between banks and finally the external environment, notably government policies (Jequier and Hu, 1989).

Industrial and technological expertise is essential if a bank is to take an active role in assisting clients and their projects. The background, experience and orientation of the Chief Executive and the Board undoubtedly affects the thinking of senior managers within the bank and, through them, the entire organisation. In the 19th Century, the employment of staff with practical, technical knowledge was considered great important by European industrial banks (Diamond, 1957 and Diamond and Raghavan, 1982). The World Bank, as a development bank, has traditionally given this factor top priority and has employed hundreds of engineers and other technically qualified people (Mason and Asher, 1973). The mutual relations between a development bank on one hand and the outside scientists, industrialists, experts and research centres on the other are also an important dimension of a development bank's technical resources, providing the bank with information about new products, new production processes, the development of high-technology industries and the solutions to specific technical problems. The technical resources of a bank will obviously affect its ability and willingness to support technological change. A commitment in this direction will introduce industrial logic into the bank's decision-making and this will result in sounder lending and investment decisions and also enable the bank to offer technical advice to borrowers during any stage of the project cycle.

Another component or determinant that may affect a bank's ability and willingness to promote technological change is the bank's participation in the equity of the borrowing company. This may positively affect the bank's attitude towards risk-taking and if things go well the company will compensate the bank for the risk taken. It is true that there are corresponding risks to banks taking equity stakes, but this is why development banks have to charge a higher interest rate for more risky loans. This should be an incentive for the bank to take an interest in the company's managerial succession rather than simply being concerned with the value of its loans. This kind of arrangement will make the bank "a partner that is interested in offering technical and managerial advice and assistance and taking a long-term view of the company's performance" and this is not only in the interest of the bank and the firm, but also of the national economy (Jequier and Hu, 1989). In many advanced developing countries, and especially in the newly industrialised countries, such as the Republic of Korea, Singapore, and India, development banks often participate in the equity of the borrowing company.

While industrial and technological knowledge and equity participation may be thought to affect directly a bank's ability to promote technological change, the bank's institutional culture affects its willingness to do so. One aspect of a development bank's institutional culture is its sense of mission as a development bank which may be assessed by the extent to which it satisfies the following criteria:

- Is the bank truly committed to act as a development agency; or does it only pay lip service to this mission?
- Is it more concerned about its loans, or about the institutions to which it makes loans?

- Does it pride itself essentially on having a good portfolio and a high rate of return, or is it more concerned about its technological role and fostering technological development?
- Does it commit itself directly or indirectly to finance or carry out research, transfer technology, promote better choices and uses of technology, encourage innovation and contribute to building up technological capabilities?

All these questions are difficult to answer but it is possible to get an indirect idea of a bank's culture through personal contacts with the staff of the bank in question.

One of the important determinants of a development bank's ability and willingness to promote technological change is the extent of competition between specialised financial institutions. Creating a multiplicity of such lending institutions will help to serve the financial needs of industrial enterprises and particularly small and medium-scale enterprises. In spite of the importance of small and medium-scale enterprises in promoting a country's technological change, banks are traditionally reluctant to lend to these enterprises (Bhatt, 1982; Kamaluddin, 1982; Raghavan and Timberg, 1982). But encouraging competition between specialised institutions has overcome the reluctance that has been traditionally exercised by many development banks in Germany, France and Japan to lend to this direction (Jequier and Hu, 1989).

The last important determinant of a bank's ability and willingness to support industrial and technological change is the quality of political leadership and government systems and policies on technology and this factor explains the difference in quality between development banks in respect to their technological role. In order for development banks to fulfill their technological role, they should have close relationships with the government at the policy level and maintain independence and autonomy at the operational level in order

to minimise political interference and bureaucratic delays (Okazaki, 1995). Without this autonomy and independence, the bank will be unable to reject projects of doubtful quality presented by one or another political constituency (Jequier and Hu, 1989).

5.4.2 A Bank's Relations with the Government and its Science and Technology Institutions

A bank's technological role is not only determined by its ability and willingness to act in such a capacity, but also by broader environmental factors, the most important of which is perhaps the relations with government and science and technology institutions. Diamond and Raghavan (1982, p. 275) put it clearly:

“Virtually in all developing countries, the government stands in the position of father, mother, midwife, or godfather to development banks - or has several of these roles played at the same time. To say that the relationship between them is close is an understatement”.

In many developing countries these banks have, in fact, been established to pursue national development objectives. As a result, it is impossible to discuss the technological role of a development bank without recognising the associated and important role of respective government policies and relations.

For a development bank to play an active technological role, the national government needs to have a clear policy on the technological role of financial institutions; thus the involvement of such institutions in the processes of technological change is usually influenced - positively or negatively - by the government's science and technology policy. The more effective and more coherent this policy, the more active financial institutions are likely to be in playing their technological roles. In the absence of such a policy, it is likely that the bank will abandon or at least downgrade its technological role. Many development banks have not played a technological role as a result of the absence of a coherent national

policy with regard to economic development in general, and technological change in particular (Thornberry and Sagasti, 1981).

A close relationship between banks and the government and its science and technology institutions should assist a development bank to become a more active and effective technological institution (Mathew, 1982) and in turn, enable it to arrive at, to induce and to enforce the right technological choices.

A development bank should build up or have access to, a database of critical technological information, not only to reduce its own risk, but also to help it play its proper role in promoting the process of technological change (Diamond and Raghavan, 1982). Information is a major production factor as well as an important resource. It is important because it will enable the development bank to be satisfied that the technology or the process chosen by clients is suitable and that the term and conditions agreed between the buyer and seller of technology are reasonable and equitable, especially if the investment is large and the technology or production process are sophisticated.

This is where a development bank can play its technological role most effectively. Today, technology transfer is a one-way road: information usually moves from the industrialised countries to the developing countries. Access to information technology and the cost of its acquisition have often been described as major difficulties for developing countries (Osman, 1980). Many, therefore, believe that the problems of indigenously developing technology cannot be left to development banks alone (Bhatt, 1982). Many developing countries have attempted to solve this problem by establishing research and technological institutions, which cooperate with development banks. This means that development banks should have very close links with the related technological institutions: for example, development banks in Brazil and India, which exemplify what are probably

some of the most advanced forms of a bank's role as a technological institution, have gone furthest in this direction by creating the closest relationship with the agencies responsible for science and technology policies in their countries (Bhatt, 1982 and Jequier and Hu, 1989).

5.4.3 The Development Bank and the Project's Cycle

The impact of development banks on the processes of economic and social development, and particularly on the process of technological change can be analysed at different levels. This section focuses on the level of the projects and the bank's respective project cycle. Every project financed by a development bank goes through a certain number of stages, which can be defined as the set of procedures whereby projects are identified, prepared, appraised and approved, implemented, operated, and evaluated. Each stage can serve as a means of bringing the technological role of a development bank to light (Baum, 1978 and 1982 and Weiss and Jequier, 1984).

5.4.3.1 The Identification Stage

At the project identification stage, the development bank works closely with planning agencies, government industries, public firms and utilities or private enterprises. This process of interaction will eventually lead to new project ideas. Another source of project ideas is the country's economic policy and its national development plan which lists projects which are to be carried out in the next few years, and which could be financed by the development bank. In this process of project identification, the bank can play an active technological role in defining the broad framework for a project through its discussions with the potential local partners. Moreover, when a development bank establishes its long-term lending targets for specific sectors, it can not only encourage its staff to identify the

types of projects that will help to meet these targets, but can also influence the size and the technological parameters of these projects (Jequier and Hu, 1989 and Kanan et al, 1992).

In spite of the fact that the identification stage can be seen as the stage where the decisions about a project's potential contribution to the development of the country's technological capabilities are broad and usually implicit, lessons from several developing countries suggest that if a development bank is to influence the process of technological change in a country, it is important for it to take a much closer look at the way in which projects are conceived from the very beginning (Bhatt, 1982; Moore, 1984; and United Nations, 1992).

5.4.3.2 The Preparation Stage

In contrast to the identification stage where a number of broad and implicit technological decisions are taken, the preparation stage includes more specific and explicit technological decisions necessitating that the bank consider a wide range of technological alternatives and evaluates their technological impact on local technological capabilities. It is assumed that a development bank, in coordination with the domestic research and technological institutions, will try to make the most rational choice among the various possible technological options. At this stage the bank does not simply aim at identifying the right or the best technology choice, but also at building up a certain body of knowledge and experience about new types of technology through its own research and detailed literature surveys (Kanan et al, 1992). The investigation of the various possible technological options can thus be very hard work.

The experiences of many developing countries suggest that if a development bank is to play an active technological role at the project preparation stage, it needs to have sufficient

indigenous technical capability. For example, the bank needs a certain number of staff members with a broad scientific or engineering background as such technical capability will contribute towards improving the ability of the bank to promote technological change. The bank can also use outside engineering consulting firms or establish its own consulting subsidiaries in order to obtain the technical assistance needed. The Industrial Development Bank of India, for instance, has set up some ten such subsidiaries. Other engineering consulting firms have also been established by the Industrial Credit and Investment Corporation of India (United Nations, 1992).

5.4.3.3 The Appraisal Stage

From the point of view of a development bank, the appraisal stage is the most important stage in the project cycle. Its purpose is to provide a careful and considered judgment of the project's overall soundness and is the most important stage as far as technology is concerned. In this stage, the project's technical dimension is evaluated to ensure that alternatives have been adequately considered and that the final solution is the optimum from the point of view of technical soundness (Weiss and Jequier, 1984). Despite the fact that assessing a project's technological dimension at this stage is a fairly recent development, the appraisal reports of most development banks now contain a fairly detailed presentation of the project's technical features, and this report governs the bank's decision whether to finance the project or not.

The appraisal stage is the only stage which includes a discussion of the project's technological features. A development bank can play a major technological role in this stage by encouraging the owners of potential projects to promote the development and accumulation of local technical and managerial skills and expertise. In the case of Joint

Venture projects, the role of foreign experts in adding to the skills and expertise of the country can also be determined in this stage as well (United Nations, 1983).

5.4.3.4 The Implementation Stage

The involvement of a development bank in the implementation stage of the project cycle is closely associated with its general role as promoter, supporter and supervisor of the project (Jequier and Hu, 1989). At this stage, a development bank can help to solve technical, organisational and managerial problems by giving advice or making suggestions although in very difficult cases the bank may have to call on outside experts. Another important way in which a development bank can influence the process of technological change is by helping the project's sponsors to obtain the equipment and services needed in the project at lower prices than would be the case if they were acting alone.

5.5 Synthesis and Layout of the Empirical Research

Technological change is central to the process of economic growth; it brings about production efficiencies, which in turn lead to productivity growth. A major theme running through this chapter deals with the role of development banks in promoting and shaping technological change. This emerges as clearly in the literature on the industrialised countries as it does in that pertaining to the third world. The chapter focused particularly on the argument that development banks, far from being only financial institutions, are also important technological institutions which can play a major direct or indirect role in the process of technological change. The chapter provided a clear picture on the different ways in which development banks could contribute positively to a country's technological change.

The chapter also looked at the issue of measuring the effectiveness of development banks to act as technological institutions and examined some of the major internal and external factors which influence those banks' ability. From this analysis we have seen that setting forth a precise method for measuring the influence and the role of a development bank in promoting technological change in a respective economy is very difficult if not practically impossible. The principal reason is that evaluating a development bank's attitude towards industry and technological change requires a detailed investigation into its mode of operation, its culture, its traditions, and its perception of itself. These factors cannot be measured solely or even mainly in quantitative terms; nor do the available statistics allow such a comprehensive approach. Jaquier and Hu (1989, p.106) point out that:

In order to understand the ways in which banking institutions in general, and development banks in particular, influence the processes of technological development, it is not sufficient to look at the type of financing they provide, their choice of customers, their treatment of the different phases in the project cycle, or their internal financial efficiency. In fact, a purely statistical approach to these issues generally fails to shed much light on a bank's developmental role or its technological role. The operations and activities of a bank take place in a specific context of relations between the banking system and industry, and between the banks as instruments of national policy and the government. The provision of finance, the supply of supporting services, the project cycle, the bank's ability and willingness to promote industrial and technological development or a country's industrial policy should not be viewed as distinct and discrete phenomena, but rather as the different angles of vision from which to examine the impact of banking system on the processes of industrial and technological development.

Because of the lack of universally accepted methods of measuring a development bank's technological role, three different approaches will be applied in this study in order to triangulate our investigation of the SIDF's role in influencing the rate and direction of technological change in Saudi Arabia. Case study work, econometric analysis, and a field survey will all be used to enable us to approach our research questions from different

angles. As a research strategy, triangulation has the benefit of overcoming the deficiencies that flow from employing one investigator or one method. If the findings yielded by the different data collection methods are consistent, the validity of those findings is increased (Nachmias, 1996).

The first part of our empirical research, the case study work (in Chapter 7), will examine the ability and propensity of the SIDF to promote and support technological change in SA. It will focus on how and when the SIDF can affect technological change through looking at all incentives and penalties that might promote and support such change. The case study will cover the SIDF officials as the supply side, and a wide range of Saudi industrial firms as the corresponding demand side. Two main methodologies will be used: structured interviews and questionnaires. This study will enable us to develop some initial views about the technological role of the SIDF and will help us to examine some of the major internal and external factors that affect the ability and willingness of the SIDF in this respect.

Because the SIDF aims to promote and support the national industrial development sector of the Kingdom's economy by offering interest free medium and long-term loans to private industrial firms to enable them to expand their activities, replace their equipment and introduce new, modern technology, our econometric analysis (in Chapter 8) will investigate the relationship between the amount of money distributed by the SIDF and the level of technological change in SA. Our analysis will explore whether there is a statistically significant relationship between the level of technological change in SA and the financial assistance provided by the SIDF

The third part of our empirical research (Chapter 9) will examine, using a field survey, the possible influences of the SIDF on the rate and direction of technological change

activities in Saudi firms. In order to capture both qualitative and quantitative aspects of this influence, a cross-tabulation analysis of the technological behaviour of Saudi industrial firms will be undertaken. In addition to this investigation, the chapter will also test empirically the effect of some selected variables on technological change activities undertaken by those firms.

5.6 Conclusion

The purpose of this chapter was to review the literature on the issues that appear to be related to the role of financial institutions and, notably, development banks in the processes of technological change. Two central points have emerged. Firstly, development banks can play an important role in the processes of innovation and technological change. Secondly, there is no universally accepted empirical approach that can be used to measure the role of a development bank in influencing and promoting technological change.

Scholars working on this issue have found that the role of development banks in promoting technological change can be measured from different perspectives. No single approach is capable of capturing all the aspects of a development bank's role in promoting technological change. In order to approach our research questions, therefore, a triangulation methodology will be deployed to evaluate the technological role of the SIDF. Case study work, econometric analysis, and field survey analysis will all be used to enable us to investigate the SIDF's role in influencing and promoting the rate and direction of technological change in Saudi Arabia.

Part Four: Empirical Research and Main Findings

Chapter Six

The Saudi Industrial Development Fund

6.1 Introduction

The Saudi Industrial Development Fund (SIDF) is the main focus of concern of this thesis, and this chapter provides greater detail about some important features of the Fund. This is an essential prelude to the case study and other empirical work in the next three chapters. This chapter begins by reviewing the organisational structure of the SIDF which is followed by a summary survey of the Fund's general lending record to date.

6.2 The Establishment of the SIDF

The idea of establishing an industrial development bank came first in 1966 when the Saudi government asked Arthur D. Little Inc. to make a comprehensive survey of the industrial situation in the Kingdom at that time and to establish a policy for industrial development in SA. In April 1968, Arthur D. Little Inc. submitted a full report to the Ministry of Commerce and Industry, suggesting a basic industrial strategy that the government should follow in order to attain the necessary degree of industrial development in the Kingdom. One of the recommendations of the report was the establishment of an industrial development bank in order to finance the Saudi industrial sector.

This report became the basis for the establishment of the SIDF by Royal Decree No M/3 on 20th March 1974. The decree spelled out the objectives and functions of the

Fund. The primary purpose of the SIDF is to provide medium and long-term loans to suitable private sector industrial projects with a view to establishing an industrial and technological base in the Kingdom of Saudi Arabia. In addition to finance, the Fund also helps to provide a wider range of consultancy services for project sponsors in order to assist them in improving the performance and profitability of their projects.

The Fund is 100 % government-owned. There are two important rationales for state ownership. First, the Fund was established during the early years of the 1970s at a time when government revenues in the Kingdom were strongly affected by the conditions prevailing in the world oil market. Thus the government was able to support financially the operations of the Fund. Secondly, in addition to its financial ability, the Saudi government wanted to ensure that the SIDF would act in line with government interests and the national economic plans. This clarifies why the SIDF is affiliated to the Ministry of Finance and National Economy. (For more details about the statute of the SIDF, see Appendix 1).

6.3 The Objectives and Functions of the SIDF

The objectives and functions of the SIDF are stated in the statute and the early annual reports (1976 and 1977) of the Fund. The Fund was established with the objective of supporting industrial development in the Kingdom through the provision of medium and long-term loans and advisory services which would encourage Saudi companies to take advantage of the new industrial opportunities and to upgrade existing projects. The Fund can achieve this objective by any means that the Board of Directors deemed appropriate within the framework of the laws and statute of the Fund. Among the

particular means set down in the SIDF's annual reports were the discharging of the following functions:

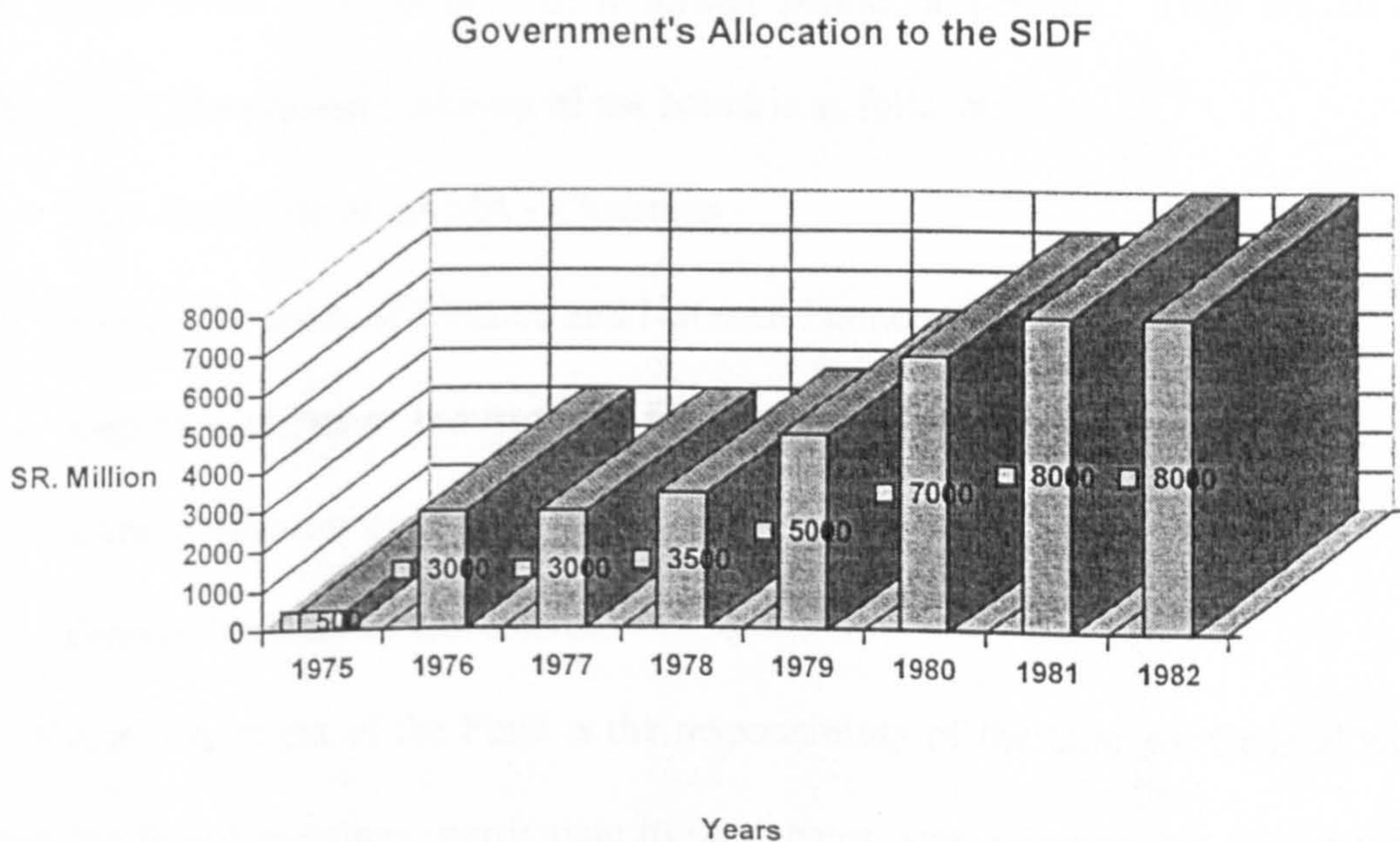
1. Offering interest free medium or long-term loans to the newly established industrial institutions within the Kingdom. In this regard, it is important to recall that the Fund charges pre-determined evaluation charges to cover the costs of studying and evaluating an application, and also follow-up costs, which are billed by the Fund every six months during its relationship with the project;
2. Offering interest free medium and long-term loans to existing private industrial institutions to enable them to expand their activities, replace their equipment and introduce new modern technology;
3. Offering, if necessary and when possible, marketing, financial, technical and administrative advice to industrial establishments within the Kingdom;
4. Improving the efficiency and balance of the industrial sector through:
 - carrying out industrial sector studies;
 - devoting more resources and experience to consulting with loan applicants on those issues of design, equipment and markets which can influence the success of any project;
 - working more closely with other responsible government agencies to shape a more efficient industrial policy;
 - encouraging the growth of a pool of Saudi trained professionals in the technical, financial, marketing, and administrative fields to ensure that projects can be appraised effectively which will result in rewarding returns for investors and a positive contribution to development.

6.4 The Fund's Resources

Despite the fact that most of the objectives and functions mentioned above are similar to the objectives of many development banks throughout the world, the SIDF is different from the majority of those banks in terms of its source of funds. The SIDF depends totally upon Saudi government financial support and does not look to any external financial participators.

According to Article Five of its statute (1974), the SIDF received a total of SR. 500 million in 1975 paid by the Ministry of Finance and National Economy. This Article also indicated that the capital could be increased from time to time according to the needs of the Fund and the recommendation of the Minister of Finance and National Economy. Between 1975-1982, the government increased its financial support to the Fund on several occasions (see Figure 6.1).

Figure 6.1



Source: SIDF, Annual Reports 1975-1982.

The total government allocation increased from SR. 500 million in 1975 to SR. 38 billion in 1982 when the Fund became reliant on its own resources to finance its operations. Since then, outstanding loan repayments have been the only resource to meet its new lending to industrial establishments. The Fund's statute also provides the SIDF with the power to invest its surplus funds in short-term investments inside or outside the Kingdom and states that the income resulting from these investments shall be added to the Fund's resources.

6.5 The Organisation and Management of the SIDF

The SIDF is a public financial institution which reports to the Ministry of Finance and National Economy. It is administrated by a Board of Directors whose members are appointed by the Council of Ministers, following recommendation by the Minister of Finance and National Economy for a period of no more than four years. The members can, however, be re-appointed for a further period or periods. They are all public officials and the present make-up of the board is as follows:

- Vice Governor of SAMA - Chairman.
- Deputy Minister of Finance and National Economy for Economic Affairs.
- Deputy Minister of Industry and Electricity for Industrial Affairs.
- Deputy Minister of Planning.
- Deputy Minister of Commerce.

The management of the Fund is the responsibility of the Director General who can attend the Board meetings, participate in its debates, sign minutes, but does not have a vote during the deliberations. The Director General is the legal representative of the Fund and one Assistant Director General assists him in the management of the Fund.

Work within the Fund is based on the "task force" approach of the various departments which include, at present, the Project and Portfolio Department, the Administrative Affairs and Operations Department, the Planning, Manpower and Control Department, the Electric Utilities Lending Departments, and the Legal Department (see Figure 6.2).

6.5.1 The Projects and Portfolio Department

The Project and Portfolio Department includes three main divisions and another three assistance divisions. The main divisions are called Lending Divisions, and these are responsible for all the activity concerning the evaluation industrial projects from the receipt of applications to the point when the final decision is made. If the project is approved, each division will take part in overseeing that project. The main three divisions, according to type of industry, are as follows:

Division one

Team A - pipes and tanks of all materials
gas
miscellaneous construction materials

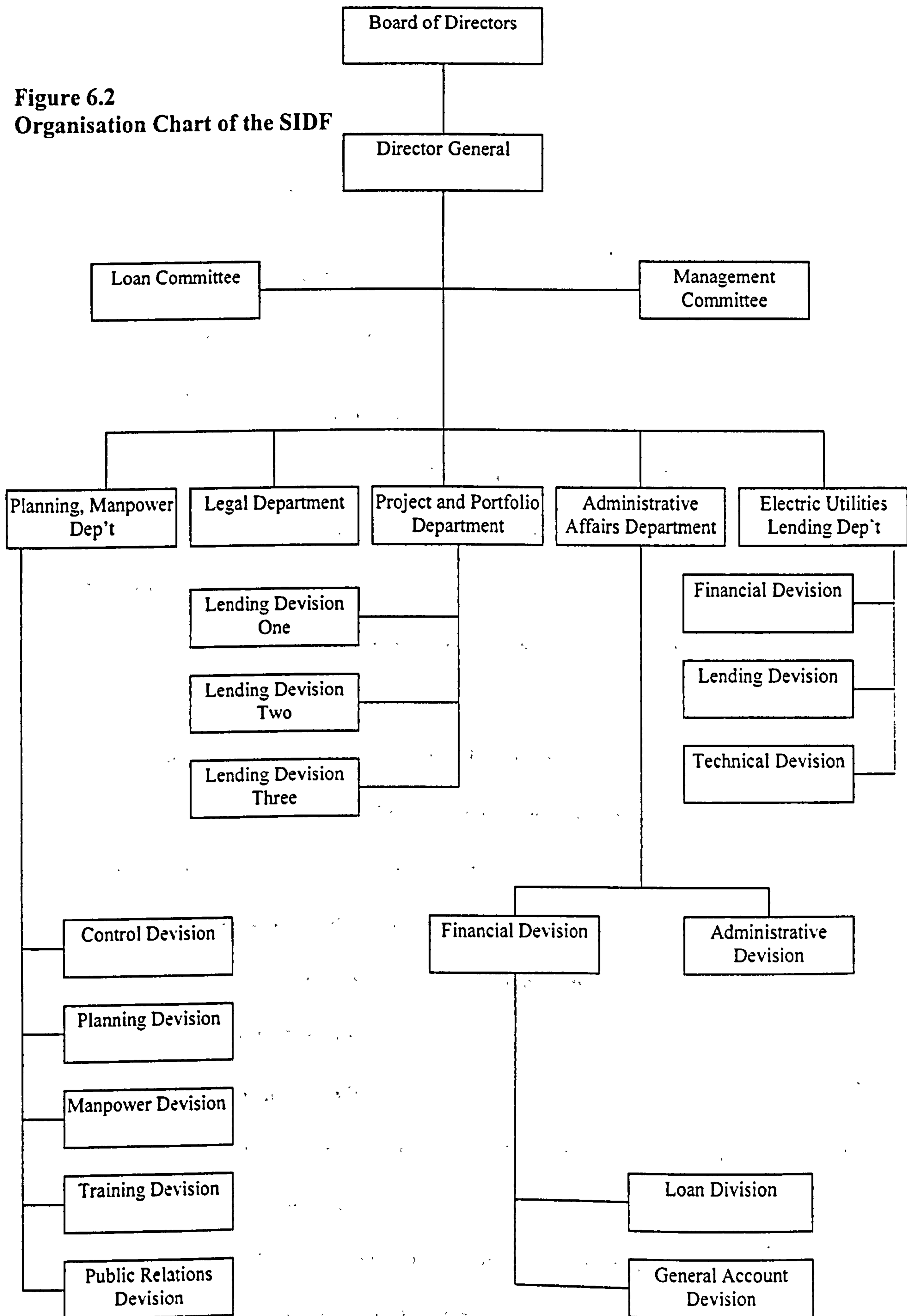
Team B - cement plants
furniture
paper and printing
automotive and tyres

Division two

Team A - foodstuffs
soft drinks
ice plants

Team B - steel fabrication sheet metal, ducting and air conditioning
foundries and pumps
metal packing
batteries and lamps
motors and generators
transformers and switchgear
electrical application

Figure 6.2
Organisation Chart of the SIDF



Division three

Team A - plastics
textiles
chemical and fertilizers
pharmaceuticals

Team B - precuts and prefab
redbricks
lime and sand lime bricks
paint
steel wire and mesh
steel building manufacturing

The three assistance divisions are the Financial Assistance Division, the Technical Consultants Division and the Marketing Division and these are described below.

1) Financial Assistance Division

The principal duties of this division can be classified as follows:

a) Scope of Practice:

1. Auditing project costs during the disbursement of loans;
2. Advising in the area of finance, accounting and auditing;

b) Quality control and policy development

1. Accounting and auditing practices and procedures;
2. Development of the accounting and auditing profession in SA;
3. Professional education.

2) Technical Consultants Division

The function of the Technical Consultants Division is to investigate all technical aspects of the projects to ensure that:

- the fixed capital costs of the proposed project have been accurately assessed;
- the plant and equipment selected are suitable and will be acquired at suitable prices;
- the technology on which the project is based is the most appropriate for the job;

- the costs of manufacture of the products have been evaluated correctly;
- any agreement covering a license or technical assistance is clear, fair and will ultimately result in the transfer of useful technology to the Kingdom.

3) Marketing Division

The major function of the Marketing Division is to assist the project officers in the Lending Division to ensure that project applications submitted to the Fund for finance are viable from a marketing point of view and that the marketing methods adopted by operational projects are appropriate.

6.5.2 The Administrative Affairs and Operations Department

The Administrative Affairs and Operations Department includes two important divisions:

1) Administrative Division

This division is responsible for the overall administration of the Fund and for areas such as translation, maintenance and other general services.

2) Financial Division

Under the Financial Division are the Loan Division and the General Accounting Division. The function of the Loan Division is to monitor and administer on a day-to-day basis all financial transactions and documentations related to approved loans. This division is also in charge of billing and receiving all fees and principal repayments. The function of the General Accounting Division, however, is to look after all accounting transactions of the Fund and to prepare a quarterly income statement and a balance sheet of the SIDF.

6.5.3 The Planning, Manpower and Control Department

This department has four functions:

- the researching of potential needs and the planning of major aspects of the Fund for short and long-term purposes;
- the recruiting of the Fund's personnel in co-ordination with all departments and the supervision of training of all personnel in corporation with other SIDF departments;
- the maintaining of an up-to-date management information system and the arranging of external audits for the Fund; and
- the generating of economic data and the preparation of economic studies.

6.5.4 The Electric Utilities Lending Department

Because the Ministry of Finance and National Economy have entrusted the Fund with the responsibility of managing a lending program to support development in the electricity sector, this department is responsible for loans to electric utility companies for the development of their power generation, transmission, and distribution facilities.

In this department, there is one Lending Division and two Financial and Technical Assistance Divisions.

6.5.5 The Legal Department

The objective of this department is to protect the assets of the SIDF, by providing legal support and expertise. The legal department offers legal consultation, drafts and controls all documents of a legal nature, co-operates with government agencies on legal matters and follows-up on mortgage procedures and court cases.

6.6 Human Resources and Training

In order to ensure that the Fund's personnel are properly trained, the Fund has placed strong emphasis on creating a cadre of Saudi professionals to function in many of the Fund's administrative and technical activities (SIDF, Annual report, 1984). The fund staff has grown from a total of 56 employees in 1975 to 421 in 1996. The proportion of Saudi employees has similarly increased from 43 % to 70 % over the same period.

The Fund's training programs cover a wide range of subjects, which according to the SIDF's annual report, 1982, include:

- a ten month course on lending, fiscal analysis, and supplementary financial studies at one of the largest international banks in the U.S., namely the Chase Manhattan Bank;
- a two year course on accounting and auditing prepared and implemented by an internationally known accounting company;
- a seven month course on the management and appraisal of electrical projects with a major specialised engineering company in New York;
- a one year technical course on electric power with one of the major U.S. power companies;
- a one year course on marketing at a British University; namely, Strathclyde;
- a one year course in economics and statistics at a U.S. Government Training Centre; and
- specialised courses, as and when required, giving training in academic and practical skills.

As a result of these training programmes, most of the senior positions in the Fund which were initially filled by expatriates, are now occupied by Saudi nationals (Bashikh, 1985).

6.7 Investment and Loan Policy

As indicated in Article Four of the SIDF's statute, the government's industrial policy constitutes the broad guidelines for Fund activities regarding the support and encouragement of industry in the Kingdom. To achieve this goal, the SIDF has to cooperate and coordinate with specialised government agencies and institutions. The Fund's policies, procedures and lending criteria can be summarized below (SIDF, Annual Report, 1993):

- Any Saudi registered company or establishment with an industrial license to engage in manufacturing within the Kingdom is eligible to apply for an industrial loan. Companies with foreign shareholders are also eligible, but if the Saudi shareholding is less than 50 % then the Fund financing will be granted at a proportionately reduced level.
- Projects which apply for loans from the Fund must be viable from marketing, technical, and financial points of view.
- Loans are provided for a maximum term of 15 years with a repayment schedule designed to match the projected cash flow of the project.
- The Fund finances up to 50 % of the cost of fixed assets, pre-operating expenses, and start-up working capital. The Fund does not finance the purchase of used machinery or equipment.

- The Fund requires owners' equity to represent a minimum of 25 % of the project cost. As security, the Fund takes a mortgage on the fixed assets, plus personal or corporate guarantees from the shareholders of limited liability companies, and possibly outside security in the case of more risky projects.
- The Fund charges pre-determined evaluation charges to cover its costs of studying and evaluating the application, and another levies charge for the cost of administering disbursements, and all follow-up until the final repayment of the loan.
- The Fund stipulates that the borrower for any industrial establishment must carry out the following:
 - a) utilise locally manufactured materials in the construction of the factory and its utilities. The Fund specifies which materials this involves at the time of appraisal.
 - b) use a Saudi engineering consultant firm, individually or with the participation of a foreign engineering firm, in completing the required technical studies and in supervising the erection of the factory, wholly or partially. Exceptions will be made in cases where the project is highly complex and the required expertise is not available in the Kingdom.
 - c) Enter into a contract with a Saudi auditor to audit the project accounts from the beginning of its erection and after its operation until the Fund's loan is fully settled.

6.7.1 Loan Approval Procedures

A project is formally registered by the SIDF once investors have provided a completed loan application, a copy of the industrial license and the feasibility study and no analysis

will be made until these three elements have been provided (SIDF, Guide to Industrial Loans, 1995). Once all necessary documents are provided, the investor's loan application is officially registered and given a number. Then it is assigned for analysis to one of the Fund's project officers who will call for technical and marketing support from the Fund's specialists to assist in the evaluation. The lending recommendation will then be sent to the Management Committee (for loans equal to or under SR. 5 million) or to the Board of Directors (for loans over SR. 5 million) after which the investor will be notified of the final decision.

During the loan application evaluation process, the Fund will determine the project's evaluation cost and prepare an agreement in this regard to be signed by the sponsor prior to the loan approval. When the Fund has approved the loan, the concerned project officer will send a commitment letter to the sponsor informing him of the loan's terms and conditions. Upon the sponsor's acceptance, the loan agreement will then be signed. Following the signing of the loan agreement, the borrower will register a mortgage in favor of the SIDF. Documents necessary for signing the loan agreement are as follows:

- the original industrial license or a copy stamped by the Ministry of Industry;
- the original commercial registration or a copy stamped by the Ministry of Commerce;
- a copy of the articles of association;
- a copy of the land lease agreement;
- an authorisation of the company's board or a power of attorney for the individual who will sign the loan agreement, the related agreements and order notes; and

- a list of fixed assets of the project that will be registered to include building, machinery & equipment, vehicles, furniture and any other fixed assets to be mortgaged.

The loan disbursement takes place after the loan agreement has been signed, the mortgage has been registered, the required guarantee has been obtained, and all the conditions relating to disbursement have been fulfilled. For the Fund to facilitate and hasten the disbursement, the borrower has to take the following steps:

- open a separate and independent bank account for the project;
- maintain a basic accounting record of the project;
- establish and maintain a proper filing system for all documents supporting recorded costs;
- employ a qualified accountant for the project, who, once the SIDF approves the loan, must visit the Fund and meet with one of the officers in the Audit Division who will explain the format and how to prepare a disbursement request file to the SIDF; and
- avoid payment of cash for any part of the project cost.

The loan is then repayable according to a schedule shown in the loan agreement and the borrower must repay the loan installments according to that agreement. The Fund will monitor the project's performance by means of the financial information supplied by the borrower as well as through periodic site visits and contacts with the project until the loan has been fully repaid.

6.7.2 The Feasibility Study

When preparing the feasibility study, guidelines on certain specific information are required and essential in order to evaluate the project and these must be followed by

Saudi potential investors (SIDF, Guide to Industrial Loans, 1995). These guidelines are briefly described below:

1. Marketing information.

The SIDF requests that Saudi investors provide a brief statement of the sponsor's rationale for the project which should include a definition of target markets, perceived strength of the project, and principal competitive advantages. The feasibility study must also include a full and clear description of the product or products produced including size, packaging as sold to customer and packing for wholesale, brand and trade name and uses, plus a brief description of the raw materials. If more than one product is to be produced, then details of the planned product mix are needed. With regard to the supply of the product, details of the current sources of supply for the proposed products in the Saudi market and also in other markets if exports are intended, must also be provided. This includes determining the capacity to supply companies, the expected range of the product and the estimated market share.

In order to paint the fullest possible picture of the current demand of products produced by Saudi firms, data such as the historical demand of the product, the sales history of the sponsor and/or the foreign partner (if there is one) both in the Kingdom and in other markets, if exports are envisaged, as well as the future market size over the period covered by the feasibility study, should all be estimated and provided in the feasibility study.

2. Technical information.

The guidelines on technical information which needs to be supplied by Saudi investors relate to the product, the process, the installed capacity, necessary machinery

& equipment, buildings, transport, furniture, labour, raw materials, etc. As an example, we look at some of the required information on machinery & equipment:

- a complete detailed list of machinery and equipment must be provided
- each item must be specified by manufacturer, type, model, weight, and whether or not it is being obtained through a third party.
- each item must be priced either by direct invoice if already purchased or by pro-forma invoice.
- where a final choice of an item has still to be made, information about the various alternatives should be given.
- three competitive quotations for the machinery and equipment with detailed information and technical specification must be included. Catalogs of the machinery must also be included. Of the three quotations, the selected quotation must be identified and reasons for selection must be explained.

Labour is another important area for which information needs to be included in the feasibility study. The SIDF asks for the following:

- in addition to the layout plan showing the work places of the factory's labour, a complete list of all people employed by the company is required. This must give the job title, the basic monthly salary and all additional expenses for social security, home travel, accommodation, bonuses, etc.
- the source of factory labour should be stated.
- procedures for training people must be described and a plan for recruiting Saudi must be provided.

3. Financial information.

The financial information required by the SIDF includes the following:

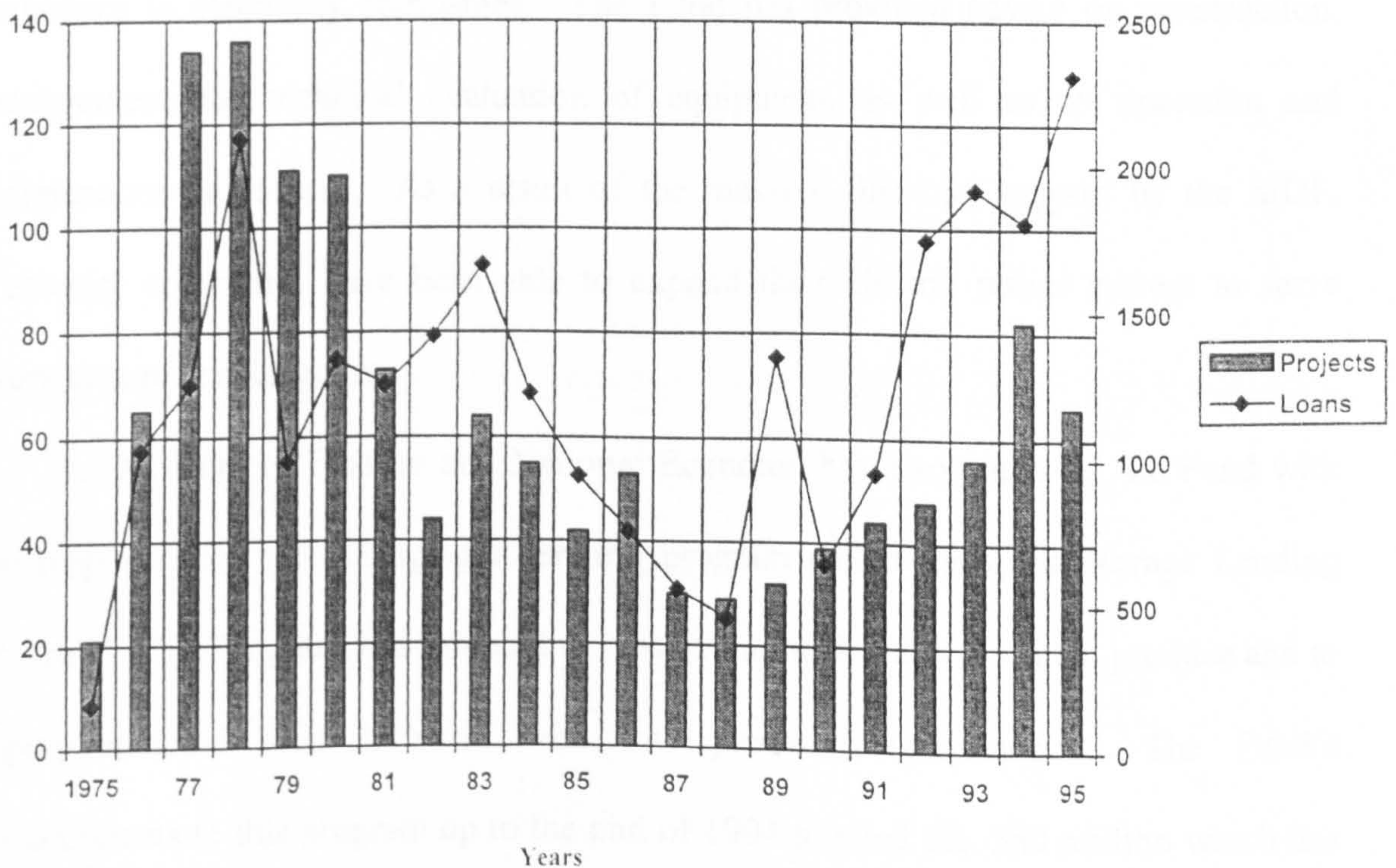
- a summary of the total project cost.
- the source of funding of the project cost.
- a detailed financial statement projection to include balance sheet, profit and loss, and cash flow statement. The projection should cover the tenure of the SIDF loan and should not be less than five years.
- financial indicators such as financial ratios, break-even analysis, internal rate of return, value added and etc.
- in preparing the financial projections, potential borrowers should bear in mind that the Fund:
 - will not allow dividends to be paid before the first year of the Fund's loan repayment.
 - will require owners' capital to represent no less than 25% of the project's cost.
 - requires projections to be done on a current cost basis and these projections should not include any element of inflation in costs or prices in future years.
 - requires the assumptions on profit and loss account and balance sheet items to be spelled out clearly.
 - the project should be viable on its own merit with no reliance on government subsidy or tariff protection.
 - accounting method and percentages for calculating the depreciation, maintenance and amortisation must be stated clearly.
 - any other costs required to run the operation must be stated clearly.

6.8 Achievements of the SIDF

Over the past twenty-two years (up to 1995), the SIDF has been one of the Kingdom's leading institutions, playing a major role in promoting industrial development in Saudi Arabia. Figure 6.3 provides information on the number and value of loans provided by SIDF. By the end of 1995, the Fund had approved a total of 1745 loans to 1365 industrial projects throughout the Kingdom. Commitments to these projects totalled SR. 25.8 billion, of which SR. 17.5 billion has been disbursed (SIDF Annual Report, 1995). In addition to its principal role as a lending agency, the Fund has encouraged industrial development by providing technical and managerial advice to private investors.

Figure 6.3

Number of Projects and Value of Industrial Loans Approved by the SIDF (SR Millions)



Source: SIDF, Annual Reports, 1975-1995.

During the early years of the Fund's operations, the Ministry of Finance and National Economy entrusted the Fund with the responsibility of managing a lending program to support the development of important industries in SA. In 1975, the Fund confirmed its responsibility for managing a lending program to support development in the electricity sector. The purpose of this program was to control and expedite investment by privately owned electricity companies towards achieving government objectives for the electrification of the Kingdom. This special lending program was initiated with an allocation of SR. 750 million and was subsequently increased to its final value of SR. 39.9 billion. By the end of the year 1984, the Fund had fully committed this allocation, approving 422 loans (SIDF Annual Report, 1984).

In addition to providing finance, the Fund has contributed substantially to the implementation of the Kingdom's electrification program by providing technical assistance to electricity companies. The Fund has provided advice on construction, management and technical evaluation of equipment, as well as on operation and maintenance procedures. As a result of the massive financial support by the SIDF, electricity companies have been able to expand their electric power system to serve every area of the Kingdom.

The Ministry of Finance and National Economy has also entrusted the Fund with the responsibility for managing a lending program called the Cold Storage Lending Program. This Program was initiated to preserve agricultural and animal produce and to supply national food factories with raw produce requirements. The Fund's commitments to this program up to the end of 1994 totalled SR. 380 million which has financed the establishment of 74 cold storage units throughout the Kingdom. Disbursements of SR. 170 million were made. At the end of 1994 this program was

transferred to the Ministry of Finance and National Economy (SIDF Annual Report, 1994).

The Date Packaging Lending Program is another link aimed at improving the level of integration between the agricultural and industrial sector. The Fund approved eight loans for this Program with a total value of SR. 95 million of which SR. 45 million was disbursed. At the end of 1994, this Program was also transferred to the Ministry of Finance and National Economy.

6.9 The Lending Record of the SIDF

By 1995, twenty-one years had elapsed since the Saudi Industrial Development Fund commenced the provision of medium and long-term loans and advisory services to private sector manufacturers within the Kingdom. All the industrial sectors in Saudi Arabia have benefited financially from the Fund (see Table 6.1 and Figure 6.4).

Table 6.1

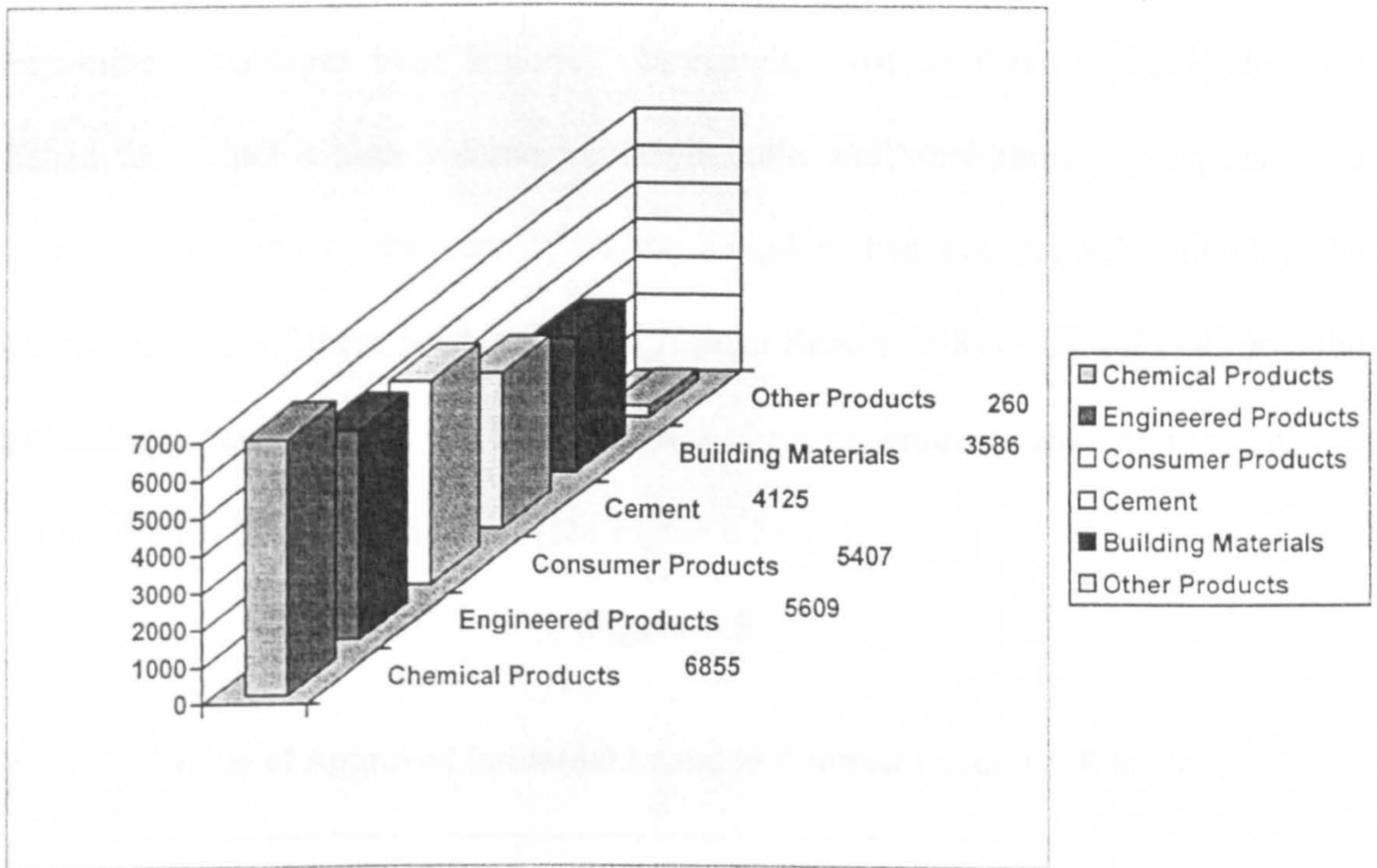
**Number and Value of SIDF Approved Industrial Projects
by Major Sectors up to the End of 1995 (SR.Million)**

Sector	Number of Projects	Value of Loans
Chemical Products	283	6855
Engineered Products	394	5609
Consumer Products	390	5407
Cement	14	4125
Building Materials	261	3586
Other Products	23	260
Total	1365	25842

Source: SIDF, Annual Report, 1995

Figure 6.4

Value of SIDF Approved Industrial Projects by Major Sectors up to the End of 1995 (SR Million)



Source: Table 6.1

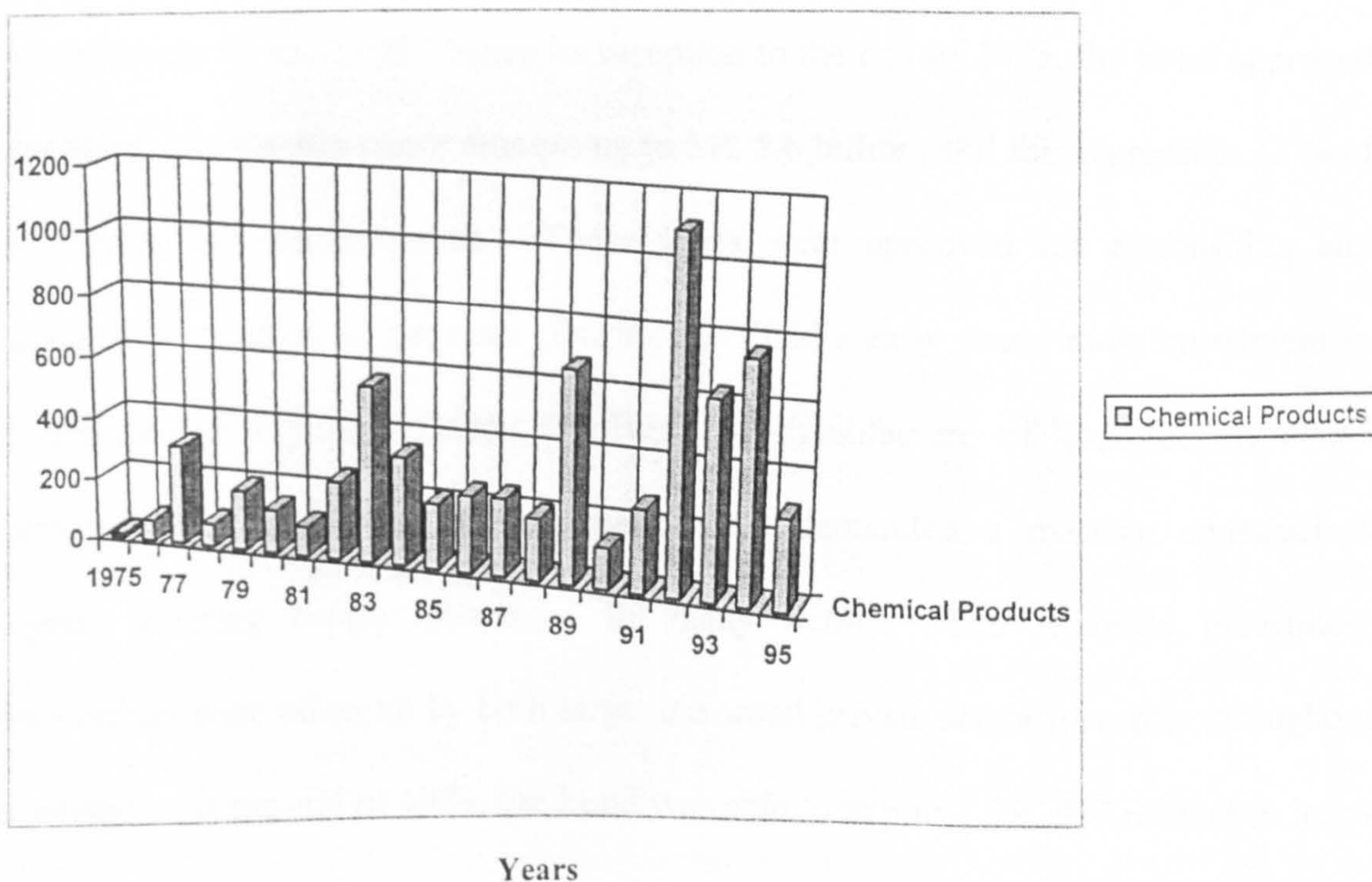
6.9.1 Chemical Products

The Chemical Products Sector has always been one of the most interesting sectors to private investors and, in terms of new investment, has been the Kingdom's most rapidly growing sector during the last two decades. Total commitments to the Chemical Products Sector since the establishment of the SIDF and up to the end of 1995 show that this sector has achieved the highest percentage share of total loan approvals. Commitments to the sector reached SR. 6855 million by the end of 1995, representing approximately 27 % of the total loans value. These loans were approved for establishing and expanding 283 industrial projects.

During the early years of the Fund's operations, most investment in the chemical industry was confined to the manufacture of polyethylene bags, molded plastics, fiberglass products and flexible foam. All of these products involved relatively simple manufacturing processes and most provided local manufacturers with strong competitive advantages over imports. Moreover, most of these products, in their finished form, had a high volume to weight ratio and were therefore expensive to import. By the end of the year 1979, the Kingdom had become substantially self-sufficient in most of these products (SIDF Annual Report, 1984). Up till that time, the Fund had approved loans of SR. 829 million to chemical products amounting to only 15 % of the Fund's total commitments (see Figure 6.5).

Figure 6.5

Value of Approved Industrial Loans to Chemical Sector (SR Million)



Source: SIDF, Annual Reports, 1975-1995.

The plastics conversion industry undoubtedly presented a good opportunity for local investment and, at a late stage, industrial chemical projects were developed. Industrial chemical facilities need a much larger capital investment, more sophisticated technology and a more highly developed industrial base. It was only quite recently that private sector investors in SA gained the confidence to invest in such industries, and when they did the Fund's lending rose significantly. Since 1985 the Chemical Products Sector has been the leading SIDF borrower, measured according to the size of outstanding loans.

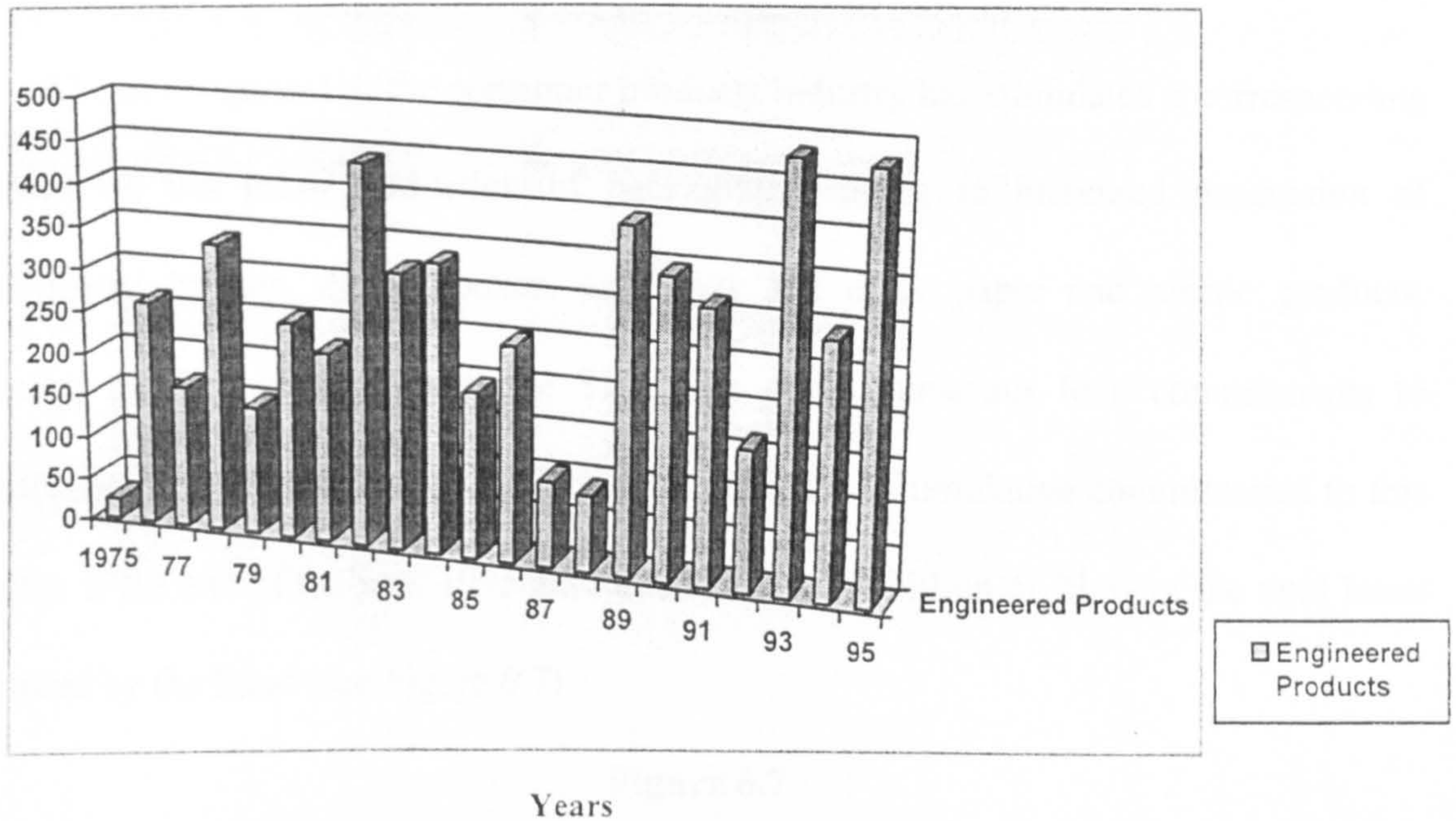
6.9.2 Engineered Products

The Engineered Products Sector, more than any other, reflects the degree of industrialisation which has taken place in Saudi Arabia over the past two decades. This sector is second after the Chemical Products Sector in terms of the percentage share of loan approvals by the SIDF. Since its inception to the end of 1995, the Fund approved loans to projects in this sector amounting to SR. 5.6 billion, and this represents 22 % of the Fund's loan commitments. These loans were approved for establishing and expanding 394 industrial projects. During the Fund's early years, most investment in the Engineered Products Sector involved the manufacture of construction-related products. The Kingdom's development plans demanded a massive construction program creating supply shortages in many items. The resultant investment opportunities were taken up by both large and small private sector investors throughout the country. At the end of 1979, the Fund was able to approve SR. 937 million in loans to 105 new and existing private industrial projects (see Figure 6.6). In addition to construction related products, a wide range of household appliances are now also

produced in Saudi Arabia by factories established since then and engineered products are now available from local manufacturers.

Figure 6.6

Value of Approved Industrial Loans to Engineered Sector (SR Million)



Source: SIDF, Annual Reports, 1975-1995.

6.9.3 Consumer Products

The Consumer Products Sector is the third largest, after the Chemical and Engineered Products Sectors, in terms of the size of loans approved since the inception of the SIDF up to the end of 1995. At the time of the SIDF's establishment, the supply of consumer products was virtually 100 % import dominated. As personal income rose, Saudi families established preferences for internationally available products and virtually none of these were produced within the Kingdom (SIDF, Annual Report, 1984).

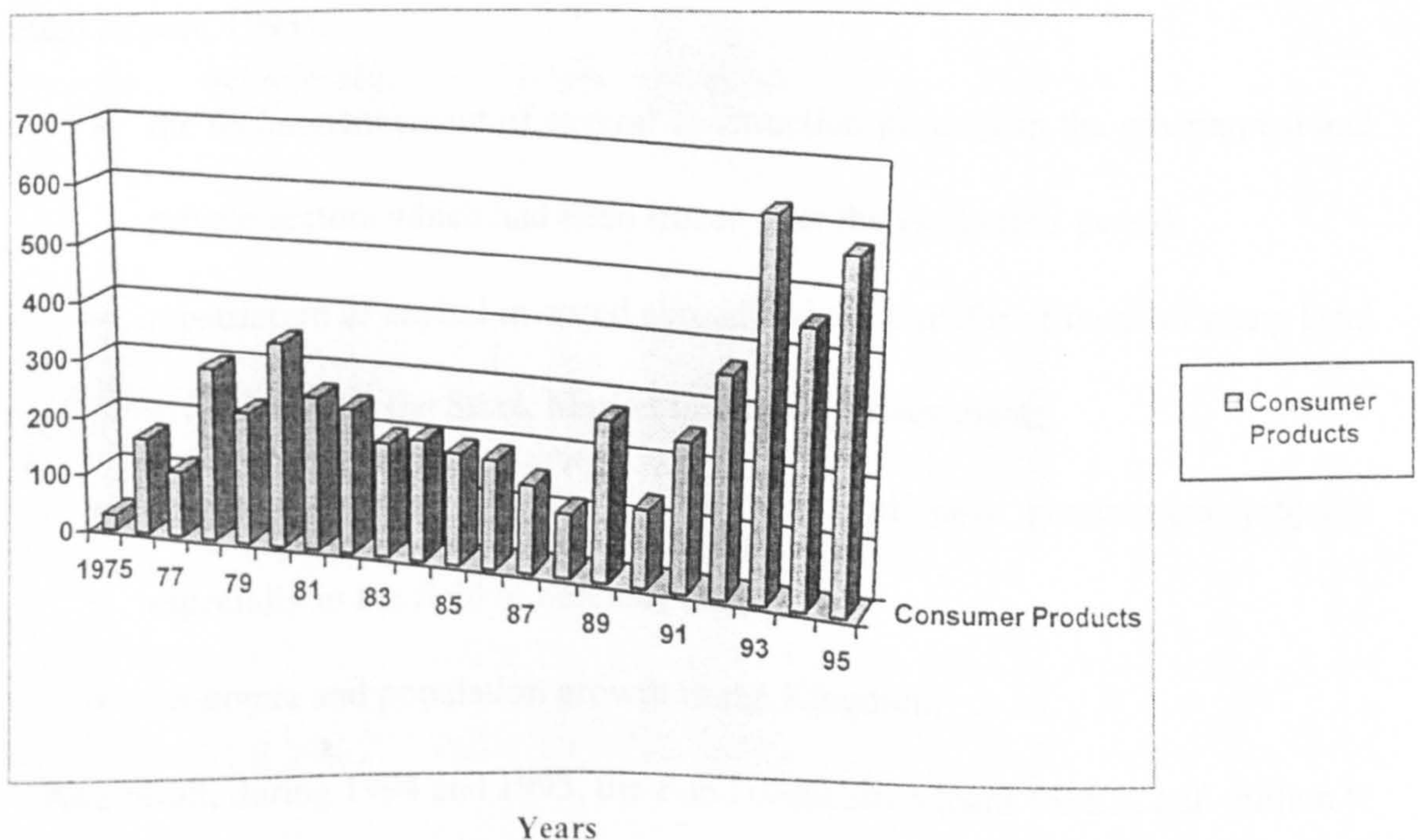
There were thus many business opportunities available for import substitution. In recent years, more and more projects have entered the market with established international brand names. Locally produced consumer products adopting this approach

include carbonated beverages, macaroni, personal care products and baby diapers. Other manufacturers have achieved success through the establishment of their own national brand names. Consumer products now available from local manufacturers are wide ranging; they include dairy products, mineral water, snack foods, tea, vegetable oil and fruit juice.

The development of the consumer products industry has stimulated a corresponding growth in the local production of packaging, leading to increased production of corrugated cartons, duplex boxes, egg trays and other paper and plastic products. During the last twenty years, the SIDF has made numerous loan commitments to factories engaged in the production of such products. Cumulative commitments to this sector at the end of the year 1995 amounted to SR. 5.4 billion or 21 % of the total loans granted by the Fund (see Figure 6.7).

Figure 6.7

Value of Approved Industrial Loans to Consumer Sector (SR Million)



Source: SIDF, Annual Reports, 1975-1995.

6.9.4 Cement

In the early years of the SIDF's operation, this sector led all other industrial sectors in terms of loan size due to the substantial financial outlays required by the industry. In the early 1970s, it was apparent that vast quantities of cement would be required in order to meet Saudi Arabian development objectives. By 1975, the total cement demand within the Kingdom had grown phenomenally, to reaching a total of 2.9 million tons.

In addition to this sudden and sharp demand, the availability of suitable raw materials and low cost energy within the Kingdom presented a good opportunity for the cement industry to develop and make a sizable contribution to SA's industrial economy. Eight cement companies have been established for the production of cement in SA, all of which have received loans from the SIDF (SIDF Annual Report, 1984).

The increase in demand for cement started again mainly by mid-1992. This sudden and sharp increase in the demand for cement can be attributed to the following (SIDF Annual Report, 1993):

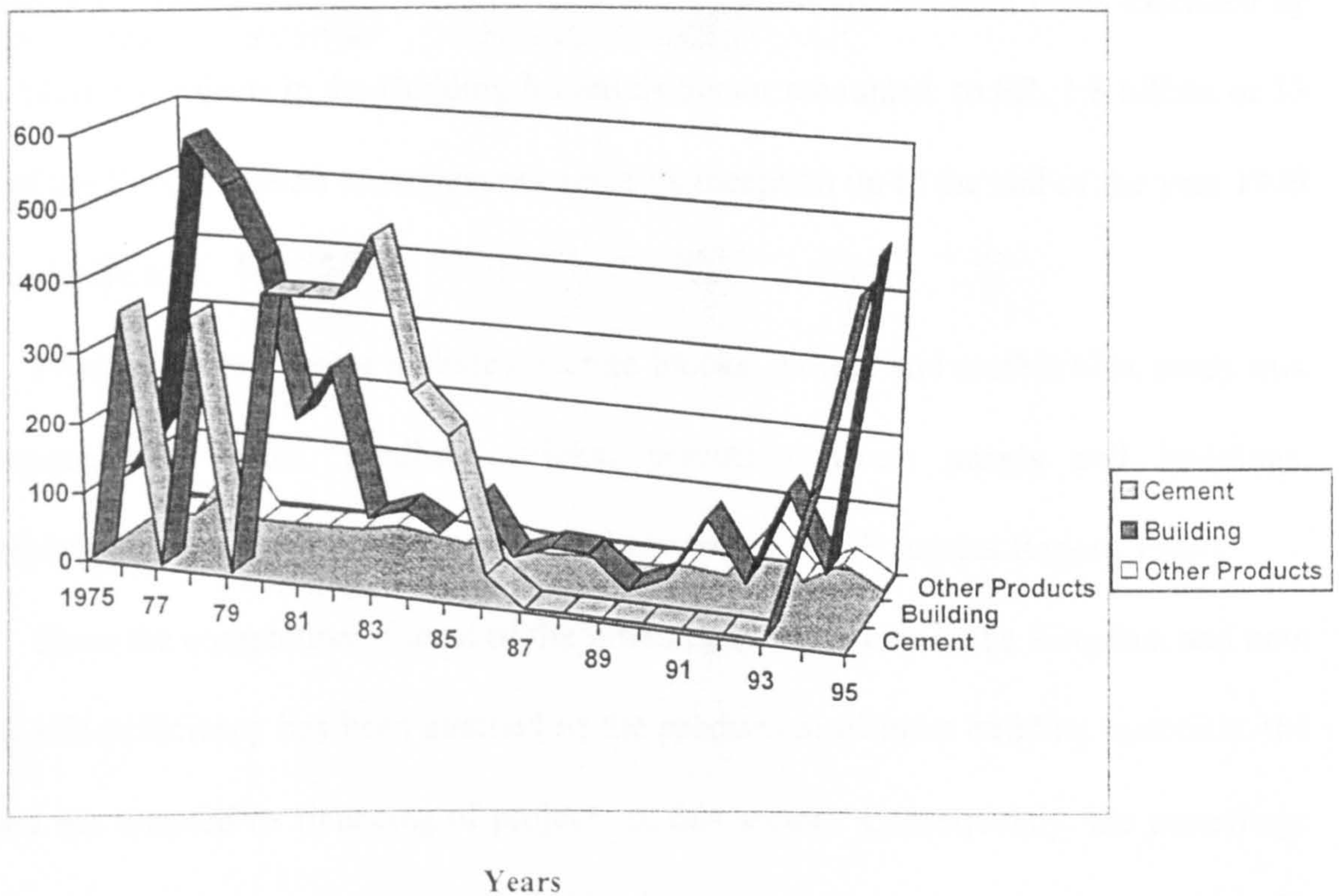
- the recommencement of several construction projects in the government and private sectors which had been frozen over the Gulf crisis period;
- repatriation of capital invested abroad and the transfer of funds of many local investors from the Stock Market to property investment;
- a substantial increase in the execution of new government projects, especially in the field of defense; and
- economic and population growth in the Kingdom.

As a result, during 1994 and 1995, the Fund committed loans for SR. 666 million to help finance the expansion of an operational cement factory in the Kingdom (see Figure

6.8). Accordingly, cumulative loans by the Fund to this sector rose to SR. 4.1 billion, or approximately 16 % of total commitments. This placed the cement sector in fourth position in terms of the size of loans approved by the SIDF.

Figure 6.8

Value of Approved Industrial Loans to Cement, Building Materials, and Other Products (SR Million)



Source: SIDF, Annual Reports, 1975-1995.

6.9.5 Building Materials

The development of the building materials sector has always been of interest to the Saudi government and has made a sizable contribution to the Kingdom's economic progress. When the SIDF started its operations in 1974, the pace of construction was

rising rapidly. At the end of 1979 the local municipalities issued as many as 100,000 building permits. This expansion of the building construction was complemented by an accelerated program of construction for infrastructure projects and these combined activities resulted in an acute shortage of basic building materials.

In order to resolve this supply problem, the Fund established the priority of assisting the private sector to achieve self-sufficiency in the production of basic building materials. During the early years of the Fund's operations, the total loans extended by the SIDF to projects in the Building Materials Sector amounted to SR. 1.8 billion or 33 % of the Fund's overall commitments since its inception up to the end of the year 1979 (see Figure 6.8).

Products of this sector include concrete blocks, mosaic and marble tiles, ready mix concrete, red bricks, sandlime bricks, precasts concrete panels and buildings, prefabricated buildings, concrete pipes and clay pipes (SIDF Annual Report, 1984).

Since the completion of most of the infrastructure projects in the Kingdom and now that self-sufficiency has been attained in the production of most building materials, the Fund has reduced its financing of projects in this sector. Consequently, the percentage share of commitments to this sector fell back in comparison with other sectors from 33 % in 1979 to about 19 % in 1985, and again to only 14 % in the year 1995.

6.10 Conclusion

The purpose of this chapter has been to provide a clearer picture of some important features of the Saudi Industrial Development Fund over a period of more than twenty years of operation. The chapter started by describing the Fund's organisational structure and went on to illustrate the lending record and achievements of the Fund during this

period. It is apparent that the SIDF has assumed an important role in the Saudi economy and its rising importance is reflected in the value of loans committed during the Fund's operations. During the period since its inception up to the end of the year 1995, the Fund has been able to approve a total of 1745 loans for the erection of 1365 industrial projects located throughout the Kingdom. Commitments to these projects have totalled SR. 25842 million, of which SR. 17491 million has been disbursed.

Chapter Seven

The SIDF and its Technological Role – A Case Study –

7.1 Introduction

This chapter presents a case study on the technological role of the SIDF. Methodologically, it is the first of the three empirical analyses using the triangulation method to address our main research question. Attention is focused on the examination of the technological role of the SIDF from the perspective of both the SIDF, as the supply side, and Saudi industrial firms, as the demand side. This chapter is divided into three main parts: the first will describe the methodology and process of data collection used in the research, the second part will describe the findings of the research and finally, some conclusions will be drawn.

7.2 Research Methodology and Data Collection

For the purpose of studying the role of the SIDF in promoting technological change in SA, this chapter uses two main research methodologies: structured interviews and postal questionnaires. This section, therefore, focuses on discussing these two methodologies and is divided into two main parts, the first which discusses the interview technique used and the second which deals with the questionnaire method.

7.2.1 The Interview Method

The interview is a highly structured technique for data collection. in which the interviewer asks a group of respondents questions which are designed to elicit answers

which are pertinent to the research hypotheses (Nachmias, 1992 and Kervin, 1992). The wording and sequence of these questions define the extent to which the interview is structured.

Using the interview method to collect data has many advantages. Firstly, the interview method is the most effective method in achieving a high response rate, due to the fact that the interviewer can increase the chances that the individual will participate in the study by arousing his or her initial interest (Warwick and Lininger, 1975). Another major advantage of the interview is that in terms of the design of the questions and both the degree of control over the process of questioning and the context in which questions are asked and answered, the interview method facilitates a great deal of flexibility. For example, when an item is not understood the interviewer can repeat it and can also clarify ambiguous answers. Moreover, the interview gives the researcher greater control over the interviewing situation. Some argue that interviews allow the interviewer to determine the wording of the questions, to clarify terms that are unclear, to control the order in which the question are presented, and to probe for additional information and detail (Nachmias, 1996). Also, carrying out a personal interview enables the researcher to deal with complicated questions that could not be stated in a postal questionnaire, either because of their complexity and the resultant difficulty of answering such questions or because of the confidentiality of the subject matter (Hoinville, 1978 and De Vaus, 1996). Finally, in an interview situation, an interviewer can collect supplementary information about respondents that can aid the researcher in interpreting the results. A related advantage of using the interview method in this particular study was that we were dealing with a specific survey group (SIDF officers) and it was likely that such a study would be of interest to them: firstly, because it was

related to their job and their daily work, and secondly, because the findings of the study which the officers participated in might have a positive effect on the Fund's achievements in the future.

The interview method also has several disadvantages; for instance, one major problem relates to its implementation. De Vaus (1996) indicates that a personal interviewer requires careful training and must be willing to face potentially unpleasant situations alone as well as to be able to approach strangers. It is also important for the interviewer to have the personal skills necessary to conduct an objective interview. Another important problem can arise from the very flexibility that is the chief advantage of interviews which leaves room for the interviewer's personal influence and bias. Although interviewers are instructed to remain objective and to avoid communicating personal views, they nevertheless often give clues that may influence respondents' answers (Nachmias, 1996). Responses to sensitive or controversial questions can also lead to bias in the information gathered. Responses to such questions can be affected by social desirability considerations: getting acceptable rather than true opinions as people sometimes say things intended to put them in a good light or try to avoid offending others (Ackroyd and Hughes, 1992). The subjective nature of the interview is another disadvantage which may result in bias and error. Interviews with persons who play a role in the investment activities might help to supply useful information. However, the problem here is that the interviewees might resort to an answer which causes the least pain and embarrassment but which is often not completely in accord with reality (Astal, 1995)

The main objectives of this chapter are to expand our view of the technological role of the SIDF and to examine some of the major internal and external factors that have an

influence on this role. The schedule-structured interview is a particularly important instrument in this investigation since it has enabled us to survey the opinions of bankers at the SIDF regarding the technological role of the Fund; in this kind of interview the number of questions and the wording of the questions are identical for all of the respondents. In order for the researcher to carry out structured interviews, the office of the SIDF Director General was first contacted by telephone in April 1996 in order to arrange a personal meeting with the Director General of the Fund. The meeting occurred two days later with the Assistant Director General. During this meeting the researcher explained the nature and aims of this study to the Assistant Director General as well as giving him some additional information relating to various aspects of the technological role of development banks. The Director General was also presented with copies of two letters, one signed by the researcher's supervisor and the other issued by King Faisal University (see Appendix 3 for the text of these letters). The meeting was very helpful in clarifying the ways in which the SIDF promotes technological change. Which SIDF officers would be interviewed was also determined in this meeting.

This selection of interviewees was to some extent influenced by the degree to which their department was involved in technology. Most of the SIDF officers interviewed were in fact from the Technical Consultants Division (TCD), the primary purpose of which is to investigate all the technological details of each and every loan application received by the SIDF. For each loan application, a report is made, and the TCD report, together with a similar document from Marketing Division, provides the basic information on which an overall appraisal is carried out to determine the viability of a project. In addition, TCD officers provide timely technical advice when, as occasionally happens, a project financed by the Fund meets technical difficulties in the

operational phase. There are thirty officers in this department, and most of them participated in the survey.

Once the respondents had been located, the researcher then attempted to increase their motivation to co-operate and to provide the desired information. Another visit to the SIDF was scheduled one week later so that the researcher could speak directly to the interviewees. During this visit a brief introduction to the nature of the research, the method of selecting respondents, and the confidential nature of the interview was given. The researcher explained why the study had been undertaken. The researcher tried to interest the respondents in the study by pointing out that the study will not only benefit the Fund but also that it deals with a significant issue and that their cooperation is very important. After this initial introduction, most of the officers agreed to participate in the survey and a time for the interviews was determined.

Two days later (at the beginning of May 1996) structured interviews began, and several questions relating to the technological mission of the SIDF and specific ways in which it could be carried out were examined. The interviews were conducted in an informal and relaxed atmosphere and all the questions asked were exactly as worded in the questionnaire. In most cases, the respondents did not have any problem interpreting or understanding a question. Interviews held with the TCD officers at the SIDF were very helpful in clarifying the technological role of the SIDF as well as the major obstacles to carrying out that role. It is worth mentioning here that the researcher did experience certain difficulties with some officials in acquiring information on the details of the technological evaluation of projects financed by the SIDF. The officers refused to co-operate, explaining that the data being requested were confidential.

7.2.2 The questionnaire

This section describes the second type of methodology, the postal questionnaire survey, used in this chapter; the section comprises four parts. Firstly, the design of the questionnaire is examined. Secondly, the selection of the pilot sample is discussed; the third section explains the selection of the final survey sample. Finally, the ways in which the collected data were prepared for computer analysis are explained.

7.2.2.1 Designing the questionnaire

In order to attain the objectives of this study, a preliminary questionnaire was designed. Because it was possible that the respondents would have difficulty answering in English, a bilingual questionnaire (English and Arabic) was used; a copy of the questionnaire is provided in Appendix 3. The questionnaire was designed with two goals in mind: relevance and accuracy. To ensure relevance, it was necessary to clarify the exact kinds of data required in the study. The wording and sequence of the questions were designed in such a way as to motivate the respondent and facilitate recall

The questionnaire used in this study (and also for the analysis of Chapter Nine) consists of twelve pages, including the cover page which was used in order to state briefly the objectives of the questionnaire and also to insure the confidentiality of all information provided by the respondents. It was necessary to emphasise the confidentiality of the questionnaire, firstly, in order to encourage Saudi industrial firms to participate and, secondly, to enable them to take the questionnaire seriously. In order to increase the response rate, the researcher emphasised, on the cover page, the importance of firms views regarding the technological role of the SIDF.

The questionnaire was divided into three parts. The first part dealt with the respondent's background by asking him some general information about his firm in order to obtain a profile of each of the respondents who participated in the research. This general information was also used in analysing the data obtained in part two of the questionnaire in order to see if these background elements had any effect on the technological behavior of Saudi industrial firms. The main function of parts one and two of the questionnaire was mainly to collect data for the analysis of Chapter Nine.

Part three of the questionnaire was designed to focus on the main research objective of this chapter. This part contained eight questions which were concerned with developing views on the technological role of the SIDF by those firms which have received financial assistance from the SIDF.

The purpose of the first question was to evaluate the understanding Saudi firms had of the SIDF's technological role. This was a "yes" or "no" type of question, which aimed to discover whether Saudi firms really appreciate the fact that the role of SIDF is not merely financial but also promotional, to stimulate technological change. To elicit more specific information with regard to the importance of the SIDF's technological role, the respondents were then asked a second question to determine whether the SIDF is more concerned about having a good and a high profitability or concentrating on the quality of its technological advice and assistance to entrepreneurs.

The third, fourth, and fifth questions dealt with the technological involvement of the SIDF at every stage of a project's life cycle in those companies which received funding from the SIDF. The aim of question three was to investigate the technological role of the SIDF during the identification stage in which new project ideas could be developed and the respondents were asked to indicate the main sources of their project

ideas. They were given five options to choose from, among which was the SIDF. Question four asked Saudi firms to give their opinions on the technical aspects considered by the SIDF during the technical evaluation of their particular projects and the firms had seven choices. The purpose of this question was to assess the degree of the SIDF's involvement in the technical evaluation stage of projects. The SIDF's technological role in assisting Saudi firms to choose their machineries and equipments was the subject of question five. The last three questions aimed at revealing the attitude of Saudi firms to possible improvements in the technological role of the SIDF.

The final issue that had to be dealt with when designing the questionnaire was the type of questions asked. To the best of the researcher's knowledge, no specific study had specifically designed a questionnaire to investigate a development bank's technological role and, therefore, the questions used in this study were based on earlier studies of the general technological roles of development banks and factors affecting this role.

7.2.2.2 Selecting the Pilot Test Sample

Once the questionnaire was designed, each individual question and the questionnaire as a whole had to be tested and evaluated. One of the main objectives of pilot testing is to refine the wording, ordering, layout and filtering and to control the questionnaire length (Oppenheim, 1992). Pilot work is also useful in making sure that translation of the questionnaire will not lead to any misunderstanding of the questions. Oppenheim (1992) argued that to translate a questionnaire from one language to another is akin to entering a series of mine fields; therefore, sufficient consideration needs to be given to the translation process in the pilot testing.

For our pilot survey, ten firms were chosen randomly from each major industry, namely; the consumer, chemical and plastic, construction, and engineering industries. These firms were a subset of the final sample, representing 10 % of it. Because the firms were scattered throughout SA, the initial contact with the managers of the selected firms in May 1996 was by telephone. The purpose of the intended research was explained and all firms contacted were willing to cooperate. Two days later, the questionnaires were sent out and after a week follow-up calls were made to firms which had not replied.

Data were collected from 32 firms out of 40, representing 80 % of the pilot survey sample. Some gaps were discovered in the preliminary questionnaire, mostly relating to the translation and these were then corrected in the main survey. Certain items on the questionnaire also needed re-phrasing for clarity and a few questions had to be changed. For example, question 22 of part two asked how much each firm spent annually on technological change activities. However, it was found that most of the firms refused to answer this question so it was necessary to change the wording, to what percentage was spent on these activities as a proportion of the firm's annual sales.

7.2.2.3 Selecting the Final Sample

The ideal way of selecting a representative sample in a research survey is to draw individuals from the target population (Hoinvill, ... [et al], 1978). The selection of such samples requires a sampling frame; that is, a list of all cases within the target population of the study, which is, in this research, Saudi industrial firms. The Directory of Saudi Industries (1996) issued by the Ministry of Industry and Electricity has been enlarged and extended to include details of over 2000 industrial firms operating in SA, including

the firm's name, location, address, products, annual production capacity, total finance. number of employees, and date of establishment.

The theoretical and empirical work on technological change supports the hypothesis that the size of the firm can be a very important factor in determining the level of technological change (David, 1969 and 1975; Kamien and Schwartz, 1975; Davies, 1979; Culbertson, 1985; Kraft, 1989; and Braga and Willmore, 1991). Consequently, we decided to use the size of industrial firms in SA as the main criterion for choosing the final sample of this study. Unfortunately, the firms included in the directory mentioned above are not listed according to the firm's size but according to the type of industry so the researcher had to enter all Saudi firms into the computer and sort them according to the size of the firm.

The largest 20 %, in terms of capital, of the total number of Saudi industrial firms operating in every main industry in 1996 was identified. This constituted 430 Saudi firms drawn from four major industries: the consumer industry (132); the chemical and plastic industry (79); the construction industry (86); and the engineering industry (133). All these firms are eligible to apply for industrial loans from the SIDF.

A few days before distributing the questionnaires, the chosen firms were contacted by telephone. The telephone was the most convenient way of communication since the firms were situated in different areas. The purpose of these calls was to encourage the firms to respond to the questionnaire by emphasising how important their participation would be in ensuring the success of the research project. When contacted, most of the firms were willing to co-operate. Only a few firms refused to co-operate in advance, explaining that the data required by the researcher might be confidential and that they would wait until they had seen the questionnaire.

The questionnaire was addressed directly to the Director or Manager concerned. A special King Faisal University envelope was used in order to add credibility to the questionnaire and thus promote the co-operation of the selected firms. A few days later follow-up calls were made to ensure that the questionnaire had been received by the right person and also to persuade directors to complete the questionnaire and to clarify questions where necessary. After two weeks, another series of follow-up calls was made to those who did not reply by that time. Some firms indicated that they did not receive the questionnaires. The researcher, therefore, had to send out follow-up questionnaires to those respondents who had not replied by that time.

The response rate for our study was 61.6 %, representing 265 firms of the actual sample. Of those firms, 146 received finance from the Fund and 119 did not receive any kind of financial assistance from the SIDF (see Table 7.1). This is a comparatively high response rate in social science research terms.

Table 7.1
Breakdown of Sample Firms which Responded to the Questionnaire

Industry	No of Firms	%*	%**	G ₁	G ₂
Consumer	132	30.7	51.5	37	31
Chemical and Plastic	79	18.4	75.9	32	28
Construction	86	20	70.9	34	27
Engineering	133	30.9	57.1	43	33
Total	430	100	61.6	146	119

* Percentage of the number of firms in every industry to the total sample firms

** Response rate

G₁ is the number of firms which received financial assistance from the SIDF and responded to the questionnaire.

G₂ is the number of firms which received no assistance and responded to the questionnaire.

Source: The questionnaire, 1996.

7.2.2.4 Data Preparation and Computer Analysis

Once the questionnaires had been collected and edited, the researcher keyed them into King Faisal University Computer using the following coding system:

- “Yes” response is represented by the figure 1
- “No” response is represented by the figure 2
- No response is represented by a 0

Where several alternatives were given to the respondent, each alternative was characterised by a figure 1. For example, in question one in part two the alternatives were:

- the firm’s R&D activity
- indigenous R&D activity in coordination with the SIDF
- licensing from international firm
- other

If only one of the above alternatives was applicable, then this alternative was represented by the figure 1 and the other alternatives were represented by the figure 0. Another example is question three where only two options were offered to the respondent: yes or no. If the answer was yes, this was represented by 1; and if the answer was no, this was represented by 2.

7.3 Research Findings and Discussion of Results

The research findings are discussed in two main stages. The first is an analysis of the results of the in-depth interviews with the SIDF’s officers. In the second part, the results of the questionnaire answered by the Saudi industrial firms which received financial assistance from the SIDF are analysed.

7.3.1 Research Findings: The Supply Side

As described in Chapter Five, the role of a development bank in promoting technological change can be analysed from different angles. The one we will focus on in this section is the ability and willingness of the SIDF to influence and promote technological change. In all our interviews with the SIDF officers we tried to explore this ability and willingness. These can be analysed, as seen in the literature review in Section 5.4.1, in a number of different ways: the bank's institutional culture, its industrial and technological knowledge and its equity participation in assisted enterprises; by ascertaining, whether there is a close relationship between the bank and science and technology institutions, and also by looking at the competition between banks, and, finally, the external environment which can be explained by government technology policies.

7.3.1.1 The Mission of the SIDF

The first important component of a development bank's ability and willingness to support technological change is the institutional culture or what is known as the mission of the bank. The institutional culture or the mission has to be considered in the light of the background and attitude of the people who occupy the bank's top positions. An understanding of a bank's mission is a very important factor in determining the technological role of any development bank. Does the bank see itself as a development institution with the role of promoting industrial and technological change? Or does it see itself merely as a financial institution with the goal of high profitability? Is the bank more concerned about the repayments of its loans, or about the success of the recipient industrial institutions as well? All these are very important questions and need to be

answered by the government, the chief executive of the bank, and the Board; their position will ultimately reflect on the thinking of the senior managers within the bank and, through them, that of the entire organization.

During our meetings with the officers of the SIDF, we attempted to obtain direct answers to these questions. Interesting responses were given by all the staff who seem to believe that the mission of promoting technological change is the responsibility of other institutions such as King Abdul Aziz City for Science and Technology (KACST). The mission of the SIDF, they believe, is financial not technological. The Fund, they argue, can help in providing technological assistance to Saudi entrepreneurs, but this is not the main mission of the Fund. It was repeatedly stated that the Fund is more concerned about its loans than the advice and technical assistance provided to the borrowing firms. In an interview with one of the SIDF staff, the researcher has been told that:

Under its Charter, the SIDF is required to provide technical assistance to its clients within the Kingdom. This provision, however, is optional and can be provided only when it is needed by the industrial institutions and when it is possible.

The SIDF has interpreted its technological mission as requiring it to furnish the finance needed by its clients in order to obtain the services of technical advice, but not necessarily to provide these services itself directly. The Fund has taken the view that borrowing firms can decide for themselves what technical assistance they need. Thus, the SIDF technical assistance is only provided when it is specifically requested to do so.

7.3.1.2 The SIDF Industrial and Technological Knowledge

The second main determinant of any development bank's ability to promote technological change is its industrial and technological knowledge. For any

development bank to succeed in promoting technological change, it has to be built on a very strong base of industrial and technological knowledge and this base should be wide enough to include all the top levels of the bank- from the bank's chief executive and its board of directors to the senior managers. The existence of such an orientation is indeed very important and will affect the ability and willingness of the bank to influence the process of technological change. An adequate level of technical knowledge and expertise in the development bank staff who deal directly with the technical evaluation of project finance is also central to a bank's ability and propensity to take an active role in promoting and influencing technological change.

In our interviews, we were told that the SIDF has always placed a very special emphasis on the training and development of the Fund's staff at all levels. From inception, the Fund has been very attentive to its responsibilities in this regard and as each year passes, the Fund develops and gains in experience which enables it to keep pace with innovations in the industrial development process. The Fund's achievements in this regard, they argue, have been quite significant. The Fund has always insisted upon selecting national professionals of the highest caliber who have then been enabled to acquire additional specialised knowledge through in house and external professional training courses.

In 1995, 90 out of a total of 400 Saudi employees, participated in in-house training courses covering a variety of areas including financial and credit analysis, auditing, accountancy, English language and computer applications. In addition, short-term and long-term training programmes were held both within the Kingdom and overseas, which covered a diversity of fields in different professional trades, such as: management, accountancy and auditing, computers, law, finance, financial analysis, marketing.

statistics, technical consultancy, English language, marketing research and secretarial skills. The total number of Saudi employees who received such training in 1995 reached 150. As well as the aforementioned in-house and overseas training courses, the SIDF's management also pays special attention to on-the-job training and a total of 34 Saudi employees were trained in 1995.

These achievements clearly reflect the SIDF's strong emphasis on the training and development of its staff. However, an increase in the number of trainees in the existing educational and training programmes cannot be an indicator of a genuine increase in the technological capability of the SIDF and its staff. Despite these achievements, we noticed that the SIDF paid more attention to the training and development of Saudi nationals in financial areas than in any other area. This could explain the belief that the SIDF is more concerned about its financial mission than its technological mission. These training programmes cannot produce the practical technical knowledge and expertise required. If such existing training programmes are not fostered along with acquisition of necessary skills and scientific capability, the SIDF will fail to produce qualified personnel capable of promoting technological change.

7.3.1.3 Equity Participation

The next important determinant of a development bank's ability and willingness to promote technological change is equity participation. The existence of equity financing in the bank's lending activities positively influences the bank's attitudes towards risk-taking which eventually leads to more projects and greater industrial and technological change. In addition, participating in the equity of the borrowing firm encourages the bank to be interested in the success of the firm instead of simply being worried about the

value of the loan itself. Such an agreement will place more responsibility on the bank which should then be more willing to provide all technical and managerial advice and assistance to the borrowing firm.

At present, equity participation can be seen in the balance sheets of many development banks. In India, the Industrial Credit and Investment Corporation of India has a widespread portfolio of common share investments. In the Republic of Korea, the Korea Development Bank holds shares directly in some 20 of its 900 borrowers, and the Korea Long Term Bank in 32 of its 700 borrowers. In Singapore, the Development Bank of Singapore has around 1500 corporate clients, and equity stakes in around 100 companies (Jequier and Hu, 1989). In the case of the SIDF, however, there are no equity investments in its balance sheets. In our interviews, most of the SIDF officers stated no reason for this lack of equity participation but a few bankers said that the reason for the Fund not participating in equity financing is the Fund's wish not to exercise any kind of direct, ownership-type control over the borrowing companies. Certain people in SA believe that the reason the SIDF does not participate in the equity of the borrowing firms is its worry that if the Fund were to invest in such a way, and if the firms subsequently turned in a bad performance, difficulties in the Fund's lending business would result, especially if we acknowledge the fact that the SIDF now depends on the repayment of its loans as the main source for any new lending. Another important reason the SIDF is not involved in equity investment, in the researcher's opinion, is the fact that the SIDF up to now has not been ordered to participate by the Saudi government.

As a development bank, a strong case can be made that the SIDF should try to develop this type of equity investment. This kind of arrangement would be very

appreciation will surely result in a better understanding of the technological role of the development bank which could, if translated into appropriate policies, contribute positively towards reinforcing a country's technological change efforts.

In our interviews with SIDF officers we completed our task of analysing the technological role of the SIDF by assessing the relationship between the SIDF and the related government science and technology institutions and whether the SIDF is aware of this relationship.

Before examining the findings of our interviews, an important question should be raised: why is the relationship between the development bank and the national government and its technology institutions important and why can this relationship affect the propensity of any development bank to promote, assist and support technological change to such an extent that the absence of this relationship can discourage a development bank from playing an active technological role?

In order for a development bank to play its proper role in promoting the process of technological change, that bank should build or have access to an institution of technological information. Considerable resources are needed to satisfy a development bank's information requirement in order to insure that a suitable form of technology is chosen and that the terms and conditions agreed between the buyer and seller are fair and reasonable. The fact that a development bank is also totally responsible for ensuring that the technology chosen is appropriate in the light of development goals has been emphasised in earlier surveys carried out by senior officials of many development banks (United Nations, 1980).

Therefore, the problem of evaluating the appropriate technology should not be left entirely to the development bank. The only solution to this problem is that the

development bank should either initiate its own research and technological institutions or have a very close and direct link with national research and technological institutions.

In SA a few institutions are involved in the promotion of technological change; for example, King Abdulaziz City for Science and Technology (KACST), the Saudi Arabian Standards Organisation (SASO), and the Saudi Offset Programme (for more details see Chapter Four). To understand the reality of the relationship between the SIDF and these institutions, we asked the SIDF officers two questions. Firstly, we asked if they thought there should be a close relationship between the SIDF and the science and technology institutions responsible for promoting technological change in SA. Most of the officers were positive about the importance of establishing this relationship. Some, however, did not believe that such a relationship should be established by the SIDF.

Secondly, we asked whether any kind of relationship existed between the Fund and the national science and technology institutions. An interesting finding deserves to be mentioned here: there is no close working relationship between the KACST, as the most important science and technology institution in SA, and the SIDF; nor was a working relationship found between the SIDF and other science and technology institutions and agencies. Without an organic functionally linked, it is not possible for the SIDF to provide any kind of technological advice. To accomplish this task, it is essential for the SIDF either to develop its technical consultancy service centre with the capacity to identify technology choice problems, to search for their solutions, and to upgrade traditional technology; or to link the Fund with the foreign as well as the domestic technological institutions. The SIDF relationship with science and technology institutions can function as a vehicle for absorbing relevant modern technology.

upgrading traditional technology, and adapting and improving modern technology consistent with development objectives. This vital link between IDBs and the foreign as well as the domestic technological institutions is even more essential when the IDBs must play a promotional role in initiating a viable and widely diffused process of industrialisation through the development of small and small to medium-size enterprises. Such small enterprise development requires technical information to identify project ideas, prepare feasibility studies, make appropriate technological choices, formulate detailed projects, and provide assistance in project implementation and operation (Diamond and Raghavan, 1982).

7.3.1.5 Competition between Development Banks in SA

Another determinant that primarily affects a development bank's ability and willingness to foster industrial and technological change is competition between development banks. The creation of a competitive environment by establishing a multiplicity of specialised institutions will help to promote industrial and technological change. In such an environment, small and medium-scale enterprises, which have a vital industrial and technological role to play in any developing economy, will be able to obtain the funds they need more easily. Any effective development program should, therefore, develop this important sector of the economy (Diamond and Raghavan, 1982).

In Saudi Arabia, small and medium-scale enterprises (SMEs) can turn either to the SIDF or to a commercial bank. The SIDF is the only industrial development bank in SA. A wide variety of specialised institutions does not exist and this lack of a competitive environment between different development banks means that small and medium-scale enterprises in SA are in a more difficult position than in many other

developing countries. This situation is likely to have a negative effect on the rate and direction of technological change in SA.

7.3.1.6 The External Environment and Government Technology Policies

The last important determinant of a development bank's ability to promote technological change is the external environment in general and government technology policies in particular. Government technology policies have a strong effect, either positive or negative, on the ability of a development bank to influence the country's technological change. This factor explains why development banks in some countries seem to play more of an active technological role than comparable banks in other countries.

Chapter Four of this thesis described the technology policies and systems in SA. In that chapter we suggested that greater emphasis needs to be given to the S&T policies and systems in SA. The improvement of S&T systems and policies is necessary if the SIDF is to fulfill its technological role because without this improvement, the Fund will be unable to participate fully in promoting technological change in SA.

7.3.2 Research Findings: The Demand Side

In this section, the results of the third part of the questionnaire answered by the Saudi industrial firms which have received financial assistance from the SIDF are examined and discussed. Several questions were asked, with the aim of gaining a better understanding of the role of the SIDF in influencing and promoting technological change in SA.

7.3.2.1 Awareness of the SIDF's Technological Role among Saudi Industrial Firms

To appreciate the fact that the role of the SIDF is not only to provide finance, but also to influence and promote technological change is a prerequisite to an understanding of the SIDF's contribution to the country's industrial and technological change. The Saudi industrial firms were asked to answer frankly whether they felt that the SIDF was truly committed to fostering technological change in SA. 85 % of the respondents thought that the SIDF was truly committed to fostering technological change in S.A. They were fully aware of the SIDF's technological role as stated in the SIDF's statute. They think that the SIDF can be viewed as a financial institution devoted to the provision of medium and long-term finance to enterprises in the industrial sector of the Saudi economy, and through its financial service - in the form of loans - the Fund can play a technological role and then can be considered as a means of promoting economic and technological development. This confirmed the researcher's belief that the business community in SA are aware of the technological role of the SIDF. Such an awareness, however, does not mean that the SIDF is necessarily contributing as much as it might to the actual process of technological change.

7.3.2.2 The Importance of the SIDF's Technological Role

In a second step, we attempted to test the importance of the SIDF's technological role by asking Saudi firms which is more important for the SIDF- having a good and high profitability, or concentrating on the quality of its technological advice and assistance to Saudi entrepreneurs?

As expected, we found that 70 % of the 146 industrial firms that responded to this question answered by saying that the SIDF was more interested in having a high

profitability than offering technical advice and other assistance to borrowing firms. They argue that when there is a confidence in the industrial project, financial assistance tends to be provided by the SIDF when it is needed on the basis of criteria which take into account financial logic. The answers obtained here are reflective of the views expressed to the researcher during the interviews with the officers at the SIDF (see Section 7.3.1). Such understanding could be attributed to a number of factors, the most important of which is probably that the SIDF is viewed, and tends to view itself, primarily as a financial institution.

7.3.2.3 The Technological Involvement of the SIDF

The involvement of a development bank in the process of technological change can be analysed by studying the stages of a project's life. Each individual stage of the project receiving financial assistance can serve as a means of bringing a development bank's technological role into play, beginning with the identification stage where new project ideas can be developed, and culminating with the economic evaluation carried out once the project has been completed. In this section, we tried to analyse the technological involvement of the SIDF by studying the life cycles of projects financed by the SIDF.

At the stage of project identification, a development bank can, through discussion with the potential local partners, identify the types of projects that can be undertaken and thus play a very important technological role.

In the survey questionnaire, Saudi industrial firms were asked to choose one or more from the five given sources of projects' ideas. Only two firms out of the 146 firms which received financial assistance from the SIDF included the SIDF as a main source of their project's ideas. Ten firms mentioned interaction between the SIDF and the owners of the firms. The remainder chose as follows: the Saudi Development Plans (48

firms), the Saudi Consulting House (69 firms), and other sources, including licensing from international firms and the owners of the firms, themselves (69 firms) (see Table 7.2). It is clear that the SIDF was not among the main sources of project ideas. It is also obvious that very little attention has been paid to coordination between the SIDF and the owners of the firms. The Saudi Consulting House seemed to be an important influence on the types of projects established in SA. The observations here indicate that the technological involvement of the SIDF at this stage of the project cycle is very weak. The SIDF plays no active technological role even in determining the broad framework for project ideas through coordination with potential local partners.

Table 7.2
Sources of Saudi Projects Ideas

Source	No of firms	%
Saudi Development Plans	48	33
SIDF	2	1
Interaction between SIDF and the owners of the firms	10	6
Saudi Consulting House	69	47
Other	69	47

Source: The questionnaire, 1996

Another important area, if not the most important where a development bank can play an active technological role, is the preparation and appraisal stages. At these stages, a number of more specific technological decisions are made. In the preparation phase, the development bank should be able to identify the best technology option among a wide range of technology alternatives and the project's main technical features will be discussed and justified as well. At the appraisal stage, the bank is responsible for providing a careful and considered judgment of the project's overall technical soundness. The banks should be able to evaluate all the technical aspects that need to be taken into consideration for future projects in order to promote national industrial and technological change.

In the questionnaires, we analysed the technological role of the SIDF during these stages by asking the Saudi firms a very direct question, "Who plays a more important role in choosing the needed technology for the project, the SIDF or the firm?" It is interesting to note that all the firms, without exception, stated that the SIDF played no role in this regard, and only the firm chooses the needed technology. The firms were also asked to give their opinions on the technical aspects considered by the SIDF during the stage of technical evaluation of their projects. Six options were given to the respondents, who were asked to tick more than one choice if applicable.

It was found that not enough attention is apparently given (in the survey respondents' views) by the SIDF to a project's potential contribution to the development of the Saudi's technological change in this stage. Only two factors were considered by the SIDF: the kind and the price of technology used. Other factors such as the source of technology used, the matching of the technology used with the project, and the possibility that the technology used should promote Saudi technical skills apparently received little attention (see Table 7.3).

Table 7.3
Factors Technically Evaluated by the SIDF

Factors	No of firms	%
Source of technology used	33	22.6
Kind of technology used	113	77.4
Price of technology used	76	52
Fitness of technology used with the project	18	12.3
Possibility that the technology used should promote the Saudi technical skill	6	4
Others	4	3

Source: The questionnaire, 1996

It is thus obvious that the SIDF involvement at these stages is very limited. The SIDF apparently does not make any contribution toward specifying the best technology

choice among various possible technological options. Nor does it pay explicit attention to the mission of promoting the technical skill of the Saudi workforce. As we saw earlier in Chapter Five, the promotion of national technical skills is one of the basic missions of development banks, along with the objective of promoting industrial and technological change. This commitment can frequently be found in a bank's policy statement, and notably in its lending guidelines: projects selected by the bank for financing must contribute to developing local human resources and, all other things being equal, the preference should be given to projects which generate the largest quantum of skilled manpower (Jequier and Hu, 1989). Therefore, it should not be forgotten that one of the important dimensions of the SIDF mission as an instrument of national development is its ability to help and contribute in providing people with the skills and scientific capability needed by industrial projects.

Needless to say, the quality and the standard of manpower largely determine the levels of present and future economic and technological development in SA. The most serious problem facing the development of Saudi industrial sector is the shortage of properly qualified manpower who can perform the tasks and responsibilities of development process at all levels. The SIDF' role in this respect is still traditional, haphazard, and weak for planning and implementing any changes. It is necessarily for the SIDF to face the manpower dilemma in SA with more intensive and serious efforts.

7.3.2.4 The Satisfaction with the SIDF's Technological Role

The experience of Saudi industrial firms with the SIDF shows a number of elements which should be highlighted in our analysis. All the firms believe that over the past

twenty years or so, the SIDF has been the most important single factor in financing private industry in SA; its contribution has been quantitatively very large.

Aside from the financial assistance provided by the SIDF, however, its contribution toward technological change is questionable. In the questionnaire, respondents were asked to give their opinions on whether they are satisfied with the technological role played by the SIDF. Only 45 firms (31 %) answered "yes". The remainder were dissatisfied with the SIDF's technological role.

The dissatisfaction of Saudi firms with the SIDF role in promoting and influencing technological change can be illustrated by another question. The study revealed that out of the total sample, 98 firms (67 %) reported having experienced technical problems during the past few years. Out of these firms, only 4 received technical assistance from the SIDF.

The firms were also asked to think of mitigating factors for the present situation. The main ones stated were the lack of commitment of the Fund, the technological capability of the Fund, and the technology policy followed by the government.

It has been stated many times by the respondents that the main mission of the SIDF is to provide finance to private industrial firms and not to promote technological change: respondents believe that the SIDF is more concerned about their financial functions than their technological function. They also believe that the direct responsibility of promoting and fostering technological change in SA is taken by other government agencies, such as KACST.

In our judgment, the future of the SIDF's technological role is determined by the government and the country's political leadership as well as the Fund's general attitude towards industry and its willingness to support national technological change. Both the

government and the Fund should recognise and acknowledge this role, and should give it the appropriate weight in national policies. Any investigation of SIDF past experience and predicted future changes betrays that unpleasant consequences cannot be avoided unless policies are carefully reconsidered so that the SIDF views itself as responsible for furthering national technological change. The SIDF has accomplished various objectives on the way to industrial development but technological objectives must be clearly defined and proper planning for the best possible technological role is necessary.

7.4 Conclusion

The purpose of this chapter has been to examine the role of the SIDF in promoting and influencing technological change in SA. Our analysis of the ways in which the SIDF contributes to the Saudi technological change has been undertaken from two different angles. First, we looked at the ability and propensity of the SIDF to promote, influence, and support technological change using structured interviews and examined some of the major internal and external factors that might affect this ability. We then moved to the second part in which we tried, through a survey questionnaire, to collect more information about the technological role of the SIDF, and also identify the main obstacles standing in the way of achieving this goal.

The overall analysis of this chapter revealed that the role of the SIDF in promoting technological change in SA is weak and we have pinpointed a number of elements which should be highlighted in this respect. For instance, despite the fact that a bank's ability and willingness to act as a technological institution depends to a large extent on the importance of its technological mission, our analysis showed that the SIDF is more concerned about its financial mission than its technological mission; in fact, the SIDF apparently pays only lip service to its technological mission.

Furthermore, it was found that little attention has been paid to the technological capability of the SIDF. The existence of such capability is essential if a development bank is to take an active technological role. The SIDF was also found to be very weak in its participation in the equity of the borrowing firms although equity participation in assisted enterprises is among the main factors determining a development bank's ability and willingness to support industrial and technological change.

In recognition of the importance of technological change in the economic development process, the Saudi government has established a wide range of scientific and technological institutions. However, it was found that there is no mechanism of coordination between the SIDF and these institutions. It is evident that the SIDF ought to be linked to those institutions if the Fund is to play a more effective technological role and that the existence of a mechanism of coordination would permit the efficient and creative exchange of information between all sides.

Finally, it should be re-emphasised that the work reported in this chapter is just one part of our empirical analysis of the role of the SIDF in promoting technological change in SA. The following two chapters will examine the relationship between SIDF funding and technological change (Chapter 8) and present the results of the field survey analysis (Chapter 9).

Chapter Eight

The Effect of the SIDF Funding on the Rate of Technological Change in SA (An Econometric Analysis)

8.1 Introduction

This chapter presents the second part of our empirical analysis of the role of the SIDF in financing and promoting technological change in SA. In this chapter we carry out an econometric investigation of the relationship between the amount of money distributed by the SIDF and the level of technological change in SA. First we present an overview of the empirical models of technological change, which is essential in order to discover the modelling/econometric role of finance in general, and development banking in particular, in influencing and promoting technological change.

This analysis is the first of its kind (to the researcher's knowledge) which investigates the relationship between the finance provided by a development bank and the level of technological change. It will contribute to the body of literature on technological change and will hopefully have a significant impact on further research into the Saudi case and the cases of developing countries in general.

8.2 Empirical Models of Technological Change

Technological change has been the subject of considerable attention by economic theorists; most of this attention has concerned the related philosophical considerations (Stewart, 1978; Fransman and King, 1984; Fransman, 1985; and Katz, 1987). Several

studies, however, have attempted to formulate models for technological change which can be tested and supported by empirical data. Thus, we survey the empirical models of technological change in order to locate relevant work that can be used to test the role of development banks in financing and promoting technological change.

8.2.1 The Mansfield-Type Model

Much of what is known about the adoption of new technologies comes from the seminal contribution by Mansfield (1968, 1977). Mansfield's work has forcefully called attention both to the general overall slowness as well as to the wide differentials in adoption rates among different technological innovations (Rosenberg, 1976). Much of the theoretical and empirical work that has been undertaken was carried out in order to develop his ideas further and to test for those factors which can affect the rate of technological change.

We start our analysis of the Mansfield model by looking at Griliches's (1957) classic work on the spread of hybrid corn in the US. Griliches fitted the following basic logistic equation to the spread of the use of hybrid corn in different US states:

$$P_t = K/(1+e^{-(a+bt)}), \quad (8.1)$$

where P_t is the proportion of total corn acreage of a state that is planted with hybrid seed at time t , K is the equilibrium value of land planted with seed, b is a growth coefficient, and a is the integration constant. Griliches then proceeded to investigate the role of profit-related variables in influencing the level and speed of hybrid seed spread. He asserted that the fraction of acreage ultimately planted by hybrid seed depends upon expectations of profits to be realised from the change. His model was estimated for thirty-one states using OLS procedures and generating R^2 in all cases above 0.89.

This early work of Griliches was very important, for it suggested a number of questions that have to be answered, the most basic being why the diffusion curve follows an S shape. Moreover, it raises other questions. One might ask which characteristics of the sector other than profitability are important in the diffusion process, for example, the degree of concentration of the product market might be relevant. Griliches's work tells us little about these points (Stoneman, 1983).

Mansfield (1968, 1977) utilised the logistic growth curve in order to analyse the time-path of use of a new technology from the time it has been adopted until the diffusion is completed. The new technology concerned can be a new type of capital good, a new form of work organisation, or a new management style.

Mansfield started his analysis by defining S^*i as the post-diffusion stock of the new capital good for firm i and S_{it} as the stock of the new capital good in time t used by firm i . He then defined W_{it} (the addition to the stock of new technology in time t as a proportion of the gross additions still to be made) as:

$$W_{it} = (S_{it+1} - S_{it}) / (S^*i - S_{it}) \quad (8.2)$$

Mansfield assumes that W_{it} is related functionally to a number of variables. He supposes that W_{it} is a positive function of the expected profitability of a change in technology (Π_i), and a negative function of the risk involved in making the change (U_{it}). He also supposes that W_{it} is a positive function of a firm's liquidity (C_i) and a function (with ambiguous sign) of the firm size (I_i). We thus have

$$W_{it} = f(\Pi_i, U_{it}, I_i, C_i, \dots) \quad (8.3)$$

The risk involved in changing technology, Mansfield argues, should depend upon two main factors:

- (1) the date when the new technology is first used by the firm (L_i).

(2) how close the firm is to complete diffusion (S_{it}/S^*_i).

The argument is that L_i will yield a value for U_{it} at the date of first use, U_i . We may then proceed as follows:

$$U_{it} = U_i (U_{it}/U_i) \quad (8.4)$$

Mansfield next assumes that U_{it}/U_i is inversely related to S_{it}/S^*_i . We thus have:

$$U_{it} = N(L_i, S_{it}/S^*_i, \dots) \quad N_1 < 0, N_2 < 0. \quad (8.5)$$

Substituting into (8.2), we obtain the following difference equation:

$$W_{it} = (S_{it+1} - S_{it}) / (S^*_i - S_{it}) = H(\Pi_i, L_i, I_i, C_i, S_{it}/S^*_i, \dots) \quad (8.6)$$

• Writing (8.6) as a differential equation, we have:

$$dS_{it}/dt = H(\) (S^*_i - S_{it}) \quad (8.7)$$

Mansfield assumes that one can write $H(\)$ as solely a linear multiple of S_{it}/S^*_i , so (8.7) can correspond to the logistic curve and the solution, therefore, for this equation is:

$$H(\) = \phi_i (S_{it}/S^*_i) \quad (8.8)$$

where

$$\phi_i = c_1 + c_2 \Pi_i + c_3 L_i + c_4 I_i + c_5 C_i + \epsilon_i \quad (8.9)$$

The analysis of Mansfield shows that the diffusion of technological change follows a logistic or learning curve. The rationale for the S-shape diffusion pattern through time is that adoption of a technological innovation (new technology) spreads slowly at the early stage because the risk of adoption is high. When technology proves to be profitable and less costly relative to firms assets, diffusion accelerates and this usually happens at the intermediate stage. Eventually, the pace of adoption declines as most potential adopters acquire the technology in question (Kamien and Schwartz, 1975 and 1982).

Mansfield tested his model on a sample of the spread of diesel locomotives in US railroads. He suggested that the logistic function was a fair representation of his data. He then applied regression analysis to Equation (8.9) above. He found that his model explained the actual diffusion patterns well. His results showed that the coefficients on Π_i , L_i , C_i were statistically significant and of expected signs. The sign of the coefficient on I_i was always considered ambiguous. Mansfield additionally suggested that ϕ_i might also be related to:

- the age distribution of the firm's steam locomotives when the firm first began to dieselize: the variable was a statistically insignificant determinant of ϕ_i ;
- the absolute size of investment required by firm i to fully dieselize, with an expected negative coefficient;
- the overall profitability of the firm.

All these variables were added individually to Equation (8.9) above for estimation purposes (Stoneman, 1983).

In a subsequent study, Mansfield (1977) tried to introduce the effect of R&D into the diffusion argument. He found that R&D expenditure by a firm encourages the adoption of new technology. He argued that an increase in R&D expenditure made the firm more informed about new technological developments in their field. The model introduced a number of variables affecting the rate and the direction of technological change. Profitability had a positive effect, the investment size required by the firm had a negative effect and R&D had a positive effect. The intra-firm version of the model added two factors for risk and liquidity: the former had a negative and the latter, a positive effect.

Romeo (1977) tested the Mansfield model on data from ten industries over different periods of time. He found that the diffusion of technological innovations followed an S-shaped pattern in all industries, which was consistent with Mansfield's model.

The Mansfield model has received a great deal of attention. Many studies have used and tested this model. In most cases a multiple linear regression was run on the testable equation (8.9) above. Examples of such studies in this vein are those by Blackman (1971); Swan (1973); Hsia (1973); Nabseth and Ray (1974); Gold, Rosegger, and Boylan, (1980); Frame (1983); Al Ghamdi (1987); Jagtiani, Saunders, and Udell (1995); and others.

In spite of the popularity of the Mansfield model, it has some shortcomings. For example the model provides no theoretical justification for its selected independent variables (Stoneman, 1983). Most of the aforementioned studies tested the model at a country level: it has not been widely tested using cross-country data, which could introduce new variables to affect the speed and direction of technological change.

8.2.2 The Bayesian Learning Model

In both the Lindner, Fischer, and Pardy (1979) and the Stoneman (1981) studies, a model of diffusion was developed independently, in which firms learned in a Bayesian way from their experience. The Bayesian model is based on three assumptions:

- a model of the choice of technique can be constructed so that the desired level of usage of new technology can be determined indigenously;
- over time the firm is assumed to learn about the characteristics of the new technology and this affects the desired level of use;

- there are costs of adjustment involved in changing the level of use of the new technology;

The interaction among these three factors generates a time-path for the usage of new technology; namely, the diffusion path (Stoneman, 1983). As a starting point, we consider that the firm in question faces a choice between using an old type of technology or new technology. Then returns to both types of technologies are assumed to be normally distributed as follows:

$$\text{New: } N(\mu_{nt}, \sigma_{nt}^2) \quad (8.10)$$

$$\text{Old: } N(\mu_{ot}, \sigma_{ot}^2) \quad (8.11)$$

Where μ_n and μ_o are the means of return to both new and old technology at time t ; and σ_n and σ_o are the respective variances.

It is assumed that P_t = the output proportion produced by new technology, and $1-P_t$ is the proportion produced by old technology. In order for a firm to specify the value of P_t and $1-P_t$, an additive distribution of total return is necessary, which can be written as follows:

$$\mu_t = P_t \mu_{nt} + (1-P_t) \mu_{ot} \quad (8.12)$$

$$\sigma_t^2 = P_t^2 \sigma_{nt}^2 + (1-P_t)^2 \sigma_{ot}^2 + 2P_t(1-P_t)\sigma_{not} \quad (8.13)$$

where μ_t is the mean of total return, σ_t^2 is the variance of total return, and σ_{not} is the covariance of the total returns to the new and old technologies. The entrepreneur chooses value for P_t by maximising the following utility function (8.14) in which C is defined as the disutility of the adjustment costs that arise from changing technology.

$$U = H(\mu, \sigma^2) - C \quad (8.14)$$

A firm is assumed to obtain a positive utility from an increased return, but to dislike risk. For simplicity, Equation (8.14) can be written in linear form as follows:

$$H(\mu, \sigma^2) = a\mu - (1/2) b\sigma^2 \quad b > 0, a > 0 \quad (8.15)$$

If we omit $a = 1$, then the utility function can be maximised as follows:

1. When $C = 0$, the desired level of P_t is given by P^*_t

$$P^*_t = (\mu_{nt} - \mu_{ot} + b(\sigma^2_{ot} - \sigma_{not})) / (b(\sigma^2_{nt} + \sigma^2_{ot} - 2\sigma_{not})) \quad (8.16)$$

2. When there are non-zero adjustment costs, the maximisation of Equation (8.14) with respect to P_t yields

$$\partial C / \partial P_t = [\mu_{nt} - \mu_{ot} + b(\sigma^2_{ot} - \sigma_{not})] ((P^*_t - P_t) / P^*_t) \quad (8.17)$$

In investment theory literature, a growing volume of studies have considered the existence of adjustment costs and their effect on the level of investment (Nickell, 1978). This adjustment cost is directly related to the change in P_t according to:

$$C_t = (\theta/2) ((P_t - P_{t-1})^2 / (P_{t-1})) \quad (8.18)$$

As P_t increases for a given level of P_{t-1} , adjustment costs will increase. The greater the existing level of technology use (P_{t-1}), the lower the adjustment cost. This is similar to Mansfield's argument that the closer the firm is to the equilibrium level of diffusion, the lower the risk.

Assuming that the firm acts in a myopic manner, such that given P_{t-1} it chooses P_t to maximise (8.14), one can derive finally the general form of the model by utilising both Equations (8.17) and (8.18):

$$(dP_t/dt)(1/P_t) = (1/\theta) [\mu_{nt} - \mu_{ot} + b(\sigma^2_{ot} - \sigma_{not})(P^*_t - P_t)/P^*_t] \quad (8.19)$$

Thus, the growth rate of adopting technology is proportionately related to the difference between the means of returns of new and old technology, and to some proportional terms of returns variances.

The learning process of the model is based on the distribution of the return to old technology. This distribution is assumed to be known, fixed, held with certainty and to be normally distributed, so that

$$\sigma_{not} = \rho \sigma_{nt} \sigma_o \quad (8.20)$$

where ρ is the correlation between the returns to new and old technologies. It is further assumed that ρ remains constant over time. This implies that

$$d\sigma_{not}/dt = \rho \sigma_o d\sigma_{nt}/dt \quad (8.21)$$

Entrepreneurs start with a technology mix of P^*_t . As time moves on, they learn and adjust their mix in a Bayesian manner. The outcome of the learning process is that σ^2_{nt} , the anticipated variance of the returns to the new technology, decreases over time. The mean of anticipated return μ_{nt} might rise or fall depending on whether the initial estimate was greater or smaller than the true mean return. And the model's general form can be written as follows:

$$\bar{P}_t = (\bar{\mu}_n - \mu_o + b(\sigma_o^2 - \rho \bar{\sigma}_o \sigma_o)) / (b(\bar{\sigma}_n^2 + \sigma_o^2 - 2\rho \bar{\sigma}_o \sigma_o)) \quad (8.22)$$

Where $\bar{\mu}_n$ and $\bar{\sigma}_n^2$ are the true mean profitability of the new technology and the variance of its returns, respectively.

From the above discussion, it can be seen that the choice of techniques depends on:

- 1) the true mean and variance of return to new technology;
- 2) the mean and variance of returns to the old technology;
- 3) the correlation between the returns to the new and old technology;

- 4) the firm's risk coefficient b ;
- 5) the initial estimate of μ_{nt} and σ_{nt} ;
and indirectly,
- 6) the adjustment cost factor C .

The model has strong links to economic theory, i.e. choice, cost, and investment as well as to learning theory. The model, however, faces some shortcomings. For the model to be tested, data need to be collected about the model variables: collecting this kind of data may be very difficult since it is very specific and related to a firm's performance. Also, the model is somewhat narrow. In spite of the fact that the model is capable of explaining how profitability is an important force behind diffusion, there are equally important sources of technological change that this model totally ignores: such as, the effect of skilled labour on the choice of technology.

8.2.3 David's Model

David's model (1969 and 1975) concentrates on the characteristics of individual firms in a sector in order to understand the circumstances in which firms will be either early or late adopters. The model takes firm size as the critical variable to the diffusion of new technology. David studies how firm size is distributed within an industry and how that size can be determined. Defining S as the firm size, we can see that diffusion takes place when the firm passes S critical size. The segment of the population which adopts new technology can be expressed as:

$$\int_{\bar{S}_t}^{\infty} f(S_i) dS_i \quad (8.23)$$

Both $f(S)$ and \bar{S} have to be specified in order for the model to have operational significance. David argues that a firm will adopt new technology when it exceeds a certain critical size. That size is reached when the labour saved by the adoption of new technology is at least enough to compensate for the increased capital cost necessary to acquire new technology.

8.2.4 Davies' Model

Davies' model (1979) argues that the diffusion of new technology depends on the inverse measure of profitability: that is, the expected pay-off period of adopting a type of technology. A firm will adopt new technology if the expected pay-off period from its use is less than or equal to some critical pay-off period. The expected pay-off period, Davies argues, is a function of firm size and other firm characteristics and time. Davies further argues that actual firm sizes are lognormally distributed. We then have the distribution of firm sizes and a definition of the critical level of firm size. And once we specify how the critical firm size varies over time, we have a diffusion path.

The model predicts that the probability of a firm adopting a type of new technology in time t is a linear function of the log of the firm size. Davies tests his hypothesis on twenty-two innovations using the following regression model:

$$Z^* = a_1 + b_2 \log t \quad (8.24)$$

where Z^* is the normal equivalent deviate of the proportion of the population using the innovation in time t read off from the standard normal tables and b is the diffusion speed parameter to test the determinants of diffusion. He found that the diffusion speed is significantly negatively affected by:

- the number of firms in the industry;

- the typical pay-off period associated with adoption;
- the variance of the log of a firm size;

and is significantly positively affected by:

- the labour intensity of the industry; and
- the rate of growth of the industry.

8.2.5 Findly's Model

The objective of Findly's work is to develop a simple dynamic model that captures some relevant factors that might affect the rate of technological change in a relatively backward region. Findly (1978) argues that the rate of technological change in a relatively backward region is an increasing function, improving at a constant rate, of the gap between its own level of technology and that of advanced regions, and the degree to which it is open to direct foreign investment.

Making the assumption that the world is divided into two distinct regions, one "advanced" and the other "backward", Findly argues that the greater the gap between advanced and backward regions, the faster the rate of technological change at which the backward region catches up. He defines $A(t)$ as an index of technological efficiency in the advanced region. He postulates that:

$$A(t) = A_0 e^{nt} \quad (8.25)$$

Technology grows at a constant rate of n . If $B(t)$ is the corresponding level in the backward region which is equivalent to P_t (diffusion level), then the Veblen-Gerschenkron hypothesis, Findley states, can be applied as follows:

$$dP_t/dt = dB/dt = \lambda [A_0 e^{nt} - P(t)] \quad (8.26)$$

where λ is a positive constant. Thus technological advancement in the backward region is proportionately related to the difference between the two indexes $A(t)$ and $P(t)$.

Findly (1978) therefore hypothesises that, all things being equal, the rate of change of technical efficiency in a backward region is an increasing function of the relative extent to which the activities of foreign firms with their superior technology pervade the local economy. To measure the effect of direct foreign investment on the local economy, he adopted the ratio of the capital stock of foreign-owned firms in the backward economy to the capital stock of domestically owned firms. He expressed foreign capital by $K_f(t)$, and domestic capital by $K_d(t)$. $A(t)$ and $P(t)$ stand for the levels of technical efficiency in the advanced and backward regions. Thus,

$$x \equiv P(t) / A(t) \quad (8.27)$$

and

$$y \equiv K_f(t) / K_d(t) \quad (8.28)$$

x can be called backwardness effect and y the contagion effect. Combining the "relative backwardness" and "contagion", leads to the following equation:

$$\bar{P}/P = f(x,y) \quad (8.29)$$

with

$$\partial f / \partial x < 0, \quad \partial f / \partial y > 0,$$

\bar{P}/P represents the technological change in the backward region and the motion of x is described by equations (8.27) and (8.29) above. This model regards foreign and domestic capital as essentially distinctive factors of production. It must, however, be remembered that the rate at which new technology is diffused is a function of many

other factors as well. The model has not been tested empirically by the author, nor by anyone else. Significant factors relating to technology transfer, such as the role of funds availability in financing the transfer, and the technological capacity to initiate and support the transfer of new technology are ignored by the author.

8.2.6 Ireland and Stoneman's Model

Despite the growing interest in the subject of technological change and in the understanding of the factors affecting the process of that change, there remain many unanswered questions. Ireland and Stoneman's model (1986) investigates one of these questions: how expectation affects the rate at which new and improved technologies are adopted.

Rosenberg (1976) has discussed at some length the role of expectations in technological diffusion. His discussion, however, is based on philosophical considerations. He argues that, for a given current price and technology, the lower the expected future price, or the more improvements expected in the future, the greater is the likelihood that a potential adopter of that new technology will delay adoption. Thus expectations will affect the path of diffusion. Ireland and Stoneman's task was to model this argument of Rosenberg.

Ireland and Stoneman's model (1986) is one of the important models focusing on technology diffusion. In this model, they argue that the way in which buyers form their expectations can be a crucial factor in determining the profile and extent of technological diffusion. Rosenberg's hypotheses regarding the impact of expectations on the diffusion path are to some extent confirmed in this model but despite its importance and the support of formal analysis, no empirical support for the model was

provided by the authors. However, Weiss (1994) contributed to the literature by empirically investigating the relationship between technological expectations and a firm's tendency to suspend the adoption decision process. To the best of the researcher's knowledge Weiss' study is the first to demonstrate an expectation effect on the technological change process. Weiss's study supported the analyses of both Rosenberg (1976) and Ireland and Stoneman (1986).

8.2.7 Other Studies

Other studies have not, on the whole, devoted much attention to the formulation of explicit empirical models of technological change; instead, they have addressed the subject through theoretical analysis. Some variables affecting the rate and the direction of technological change have been suggested (Barason, 1970; Peck and Tamura, 1976; Kamien and Schwartz, 1982; Cortes and Becock, 1984; Mytelka, 1985; Kraft, 1989; Geroski, 1990; Braga and Willmore, 1991; Patel, and Pavitt, 1992; Kokko, 1994 ; Kokko and Blomstrom, 1995; and Romp and Burger, 1995).

The study by Kraft (1989), for example, investigated the relationship between the number of competitors, the barriers to entry, the skill level of the workforce, and the rate of technological change. This study supported the hypothesis that these factors can determine the rate and direction of technological change. In addition, Braga and Willmore (1991) attempted to determine the effect of selected variables on technological activity in Brazilian industry. They found that three variables -- firm size, exports and foreign ownership -- have a positive and highly significant effect on technological change. Studies carried out by the United Nation (1980, 1992) and the World Bank (1985) focusing on the role of development banks in promoting

technological change can be included in this category as well. These studies demonstrated that a development bank can play a clearly identifiable role in the process of technological change and in the development of a country's technological capabilities.

8.2.1 Summary and Conclusion

This section has provided a selective survey of the most important empirical models on technological change for present purposes. It has demonstrated that policy makers and researchers are increasingly recognising the importance of technological change in the successful industrialisation of both the developed and developing countries and that this recognition has paved the way for studies of factors inducing technological change in these countries.

The theoretical and empirical work in this area has indicated that firm-specific variables, market structure, macroeconomics environment, and factors such as the skills of the workforce, the prevailing trade regime and barriers to entry are the most important factors influencing the rate and direction of technological change (see the summary in Table 8.1).

The possible influence of industrial development banks on the rate and direction of technological change activities, however, has not received any significant empirical attention. Although some theoretical works have suggested that industrial development banks can play a very active role in promoting and supporting technological change activities, there is, as yet, no serious empirical work on this subject. The following section, therefore, will be concerned specifically with this latter role of development banks.

Table 8.1
Summary of selected Empirical Models
of Technological Change

Authors	Type of Study	Results
Griliches (1957)	Investigated the role of profit in influencing the spread of hybrid corn in the USA.	He found that the spread of hybrid corn followed an S shape and the role of profit-related variables in influencing the level and speed of hybrid spread were statistically significant.
Mansfield Type Model (1968, 1977)	Introduced a number of variables that affect the rate and the direction of technological change	Profitability has a positive effect, investment size required by the firm has a negative effect, and R&D expenditure by a firm has a positive effect. The intra-firm version of the model adds two factors for risk and liquidity. The former has negative and the latter has a positive effect.
Lindner, Fischer, and Pardy (1979) and Stoneman (1981)	Arguing that firms learn in a Bayesian way from their experience	The model explained how profitability is an important force behind technological diffusion
David's Model (1969, 1975)	Defined the firm size as the critical variable determining the technological change	A firm will adopt new technology when it passes a certain critical size. This size is reached when the savings in labour from adopting the new technology at least balanced out the increased capital cost needed in acquiring new technology.
Davies' Model (1979)	Argued that the diffusion of new technology depends on the inverse measure of profitability; that is, the expected pay-off period of adopting a technology	After testing his hypothesis on twenty-two innovations using a regression model, he found that the diffusion speed is significantly negatively affected by: (i) The number of firms in the industry; (ii) The typical pay-off period associated with adoption; (iii) The variance of the log of firm size: and significantly positively affected by (i) The labour intensity of the industry; and (ii) The rate of growth of the industry.
Findly's Model (1978)	Developed a simple dynamic model to capture some relevant factors affecting the rate of technological change in a relatively backward region.	He concluded that the greater the gap between advanced and backward regions, the faster the rate of technological change at which the backward region catches up. He also regarded foreign firms with their superior technology as the best promoter of technological change.
Ireland and Stoneman (1986)	Investigated the role of expectation in affecting the rate at which new and improved technologies are adopted	The model confirmed Rosenberg's hypotheses that, for a given current price and technology, the lower the expected future price, or the more improvements expected in the future, the greater is the likelihood that a potential adopter of that new technology will delay adoption

8.3 Research Methodology

Having discussed the most important empirical models commonly used in determining the rate and the direction of technological change, we must decide now which model can be used to measure the role of SIDF in promoting Saudi technological change. Empirical models of technological change, however, have on the whole not devoted much attention to the role of finance or development banks as important factors influencing the rate and direction of technological change. One notable exception is Mansfield, upon whose work we shall be drawing in this chapter.

Since Mansfield's seminal contribution (1968,1977) a great deal of theoretical and empirical work has been undertaken to develop his ideas further and to study more determinants affecting the rate and direction of technological change. The main idea of Mansfield's theory (as we have seen in the previous section) is that the diffusion of technological change throughout an industry follows a logistic curve. He then assumes that the rate of technological change (ϕ) is related functionally to a number of variables (see Table 8.1). Among these variables is the investment size required by the firm. He argues that the rate of technological change is affected negatively by the size of investment required by the firm. The theoretical justification for this argument is presented in Section 8.4.

The present study carries out an empirical investigation, using Mansfield's model (Equation 8.9), of the relation between the amount of money provided by a development bank, namely the SIDF, and the rate of technological change in a developing country like Saudi Arabia. In addition to this factor, the effect of other variables will also be tested. We focus on two industrial sectors of SA; namely the chemical and engineering sectors, because these two sectors expanded at a faster rate than the average for

manufacturing activities in SA. The dynamism of these two sectors, however, is derived not only from their capacity for rapid growth but also from the rapid technological change that characterises them: More than any other sectors of Saudi industry, the chemical and engineering sectors illustrate the degree of industrialisation and technological change which has taken place in Saudi Arabia over the past twenty years.

In this study, the phenomenon of technological change is measured as the growth in the number of newly established Saudi chemical (NOCF) and engineering (NOEF) firms, because for every newly established firm in these sectors, new technology must be adopted. Moreover, the establishment of new firms advances the national technological capability by creating a well trained scientific and technical labour force. This measure has been used by other researchers, such as Al-Ghamdi (1987) in his study on transferring petrochemical technology to Saudi Arabia.

The independent variables used to explain the variation in the rate of technological change in SA are closely related to, and, in some instances, derived from the models of technological change discussed earlier in this chapter. These variables are shown in Table 8.2. Seven basic variables are identified. The first, termed CFA in the chemical industry and EFA in the engineering industry, attempts to measure the technological role of the SIDF. Our hypothesis suggests that the rate of technological change in SA is higher when the quantum of finance provided by the SIDF is higher. Since the Fund provides interest-free medium and long-term loans, this will lead to reductions in the cost of finance needed by business founders which should positively influence the choice of technology to be adopted and eventually the rate of technological change.

Table 8.2
List of Explanatory (Independent) Variables

Number	Variable	Definition
1	CFA	The SIDF's financial assistance to the chemical industry
	EFA	The SIDF's financial assistance to the engineering industry
2	IR	The Saudi interest rate
3	CJVF	The percentage of joint-venture firms established in the chemical industry to the total number of industrial chemical firms
	EJVF	The percentage of joint-venture firms established in the engineering industry to the total number of industrial engineering firms
4	SSL	Growth in the Saudi skilled-labour force
5	VCPI	The value of chemical products imported to SA
	VEPE	The value of engineering products imported to SA
6	OGDP	Saudi oil-gross domestic product
7	M ₂	Saudi currency in circulation, demand deposits, and time and saving deposits

8.4 The Theoretical Justification for Included Variables

Seven independent variables are included in our econometric model. These variables are SIDF financial assistance; the interest rate; the percentage of industrial joint-venture firms to total number of Saudi industrial firms; the rate of growth in the Saudi skilled labour force; the value of imported products of both the chemical, engineering & allied industries; the gross domestic product; and the money supply.

The impact of the capital investment required by a firm on the level of technological change was demonstrated by Griliches (1957) and Mansfield (1968 and 1977) to be statistically significant. They showed that the probability that a business will adopt a new technology is a decreasing function of the capital investment required. The theoretical justification for this relationship is simple. Hicks, (1969); Robson and Shah, (1989); Keeble -- [et al], (1993); and Bencivenga -- [et al], (1995) stated that an important aspect of industrial development is the adoption of new technologies and this

becomes economically viable in the presence of low-cost financial markets that provide liquidity to investors. A reduction in the cost of finance can lead to the increased use of technology, and such a reduction necessarily increases the level of technological change. Because, as we saw earlier, the SIDF aims to provide financial support for national technological change by offering interest-free medium and long-term loans to private industrial firms, we can therefore hypothesise that the more finance provided by the SIDF, the higher the level of potential technological change in SA.

By the same token, but in a different way, one can argue that the interest rate should negatively influence the choice of technology to be adopted and eventually the level of technological change. In this study, we hypothesise that the interest rate is negatively related to the rate of technological change in Saudi Arabia.

The impact of international firms on the technological change of developing countries has been a controversial issue in recent years (Quinn, 1969; Mason, 1973; and Kokko, 1992). Some researchers argue that international firms can promote the technological change, generate employment generation, provide access to export markets, develop local resources, and stimulate economic growth in general (e.g. Vernon 1971, 1975, 1977; Caves, 1974; Behraman, 1977; Lall and Paul, 1977; Findly, 1978; Globerman, 1979; Streeten 1979; Mansfield and Romeo, 1980; Blomstrom and Persson, 1983; Kokko, 1992, 1993 and 1994; and Kokko and Blomstrom, 1995). Braga and Willmore (1991) argue that the presence of transnational firms in an industry will make domestic firms more aware of technological options available to them. All domestic firms may benefit from the increased availability of trained labour and management and react positively to increased competition. Emphasising this point further, Kokko (1994, p.279) asserts that:

The technology and productivity of local firms may improve as foreign firms enter the market and demonstrate new technologies, provide technical assistance to their local suppliers and customers, and train workers and managers who may later be employed by local firms. The competitive pressure exerted by the foreign affiliates may also force local firms to operate more efficiently and introduce new technologies earlier than what would otherwise have been the case.

In contrast, there are those who argue that international firms introduce inappropriate patterns of consumption as well as inappropriate capital-intensive technologies which cause unemployment. They also argue that these firms usually foster dependency in retarding the indigenous development of productive forces (e.g. Barnett and Muller, 1974; Bierstaker, 1978; Hymer, 1979; Sagafi, Moxon, and Perlmutter, 1981; Cantwell, 1989; Haddad and Harrison, 1991; and Aitken and Harrison, 1991).

Some analysts (UNIDO, 1971) have implied that many conflicts of interest between international firms and developing countries can be resolved by establishing joint-venture firms (JVs). Findly (1978) and Frame (1983) suggested that JVs had at least a moderate impact on the rate of technological change of developing economies (see Section 8.2.3). Thus, it is worth investigating the effect of JVs. In this study we anticipate a positive relationship between the number of JVs and the level of technological change in SA.

In spite of the fact that industrialisation, particularly the chemical and engineering production of SA, is capital intensive, labour is an important factor in any production function. In SA the skilled labour force is limited and expensive. Saudi industry depends heavily on foreign manpower and this situation is unlikely to change due to an insufficient supply of skilled national manpower and the low wages of non-Saudi workers. Therefore, Saudi development plans assign the highest priority to the

employment and training of Saudi nationals in private industry, where they represent only a small percentage of total employment, particularly in production and technical jobs.

The importance of skilled labour in technological change has been discussed by many researchers (Kamenta, 1967; Derakhshani, 1980; Robson, 1989; Kraft, 1989; and Keeble, 1993). All of whom support the idea that the growth of a skilled labour force is a significant and consistent positive inducement to the level of technological change. Kamenta (1967) argued that the educational level of labour force is an important factor in determining the rate and direction of technological change. Detailed study of Iranian development by Derakhshani (1980) showed that the level of education and the training of the labour force were a significant factor in successful technology transfer to some Iranian industries. The same point was made by Cortes and Bocock (1984) on their study of South American countries (Al-Qamdi, 1987). All these studies support the argument of the positive impact of skilled labour on the level of technological change.

To increase the industrial sector's contribution towards meeting the local demand through developing economically feasible import substitution industries has always been a key feature of Saudi industrial development strategy. Establishing new Saudi industrial firms according to this strategy is affected strongly by the amount of products imported to the country. In this study, we therefore hypothesise that the value of products of the chemical, engineering & allied industries imported into SA will be positively related to the number of newly established Saudi chemical and engineering firms and eventually to the rate of technological change.

A theoretical justification for the inclusion of the gross domestic product and the money supply comes from the theory of comparative advantage developed by Ricardo

(1929). His theory is that the exchange of goods and services between countries occurs because of relative cost advantages that can be gained due to differences in the natural resources of those countries, different pools of skilled labour and different stocks of capital. The concept of comparative advantage was subsequently refined by Heckscher and Ohlin (1933) who argued that a country would export commodities which made intensive use of inputs which were relatively plentiful in that country (Al-Gamdi, 1987).

Saudi Development Plans have stressed the importance of instituting industrial programs in order to support industrial growth in the Kingdom. Therefore industrial production has to be based on relatively plentiful input. In the present case, that of the chemical and engineering industries, the major inputs entering the production process are capital and materials. At present, Saudi Arabia does not produce any of the technology needed by these industries but has to import from the international markets. Because the transfer of production technology involves large payments in foreign currency to technology suppliers, Saudi Arabia must have a strong capital advantage. Such a capital advantage exists and is strong in Saudi Arabia; thus, the country faces no financial difficulty in this respect.

We would expect that both the oil GDP and the money supply would have a positive effect on the rate of technological change in Saudi Arabia; namely, that a higher oil GDP and money supply will enable Saudi investors to raise capital more easily and thus enable them to start new businesses and to obtain all the necessary technology.

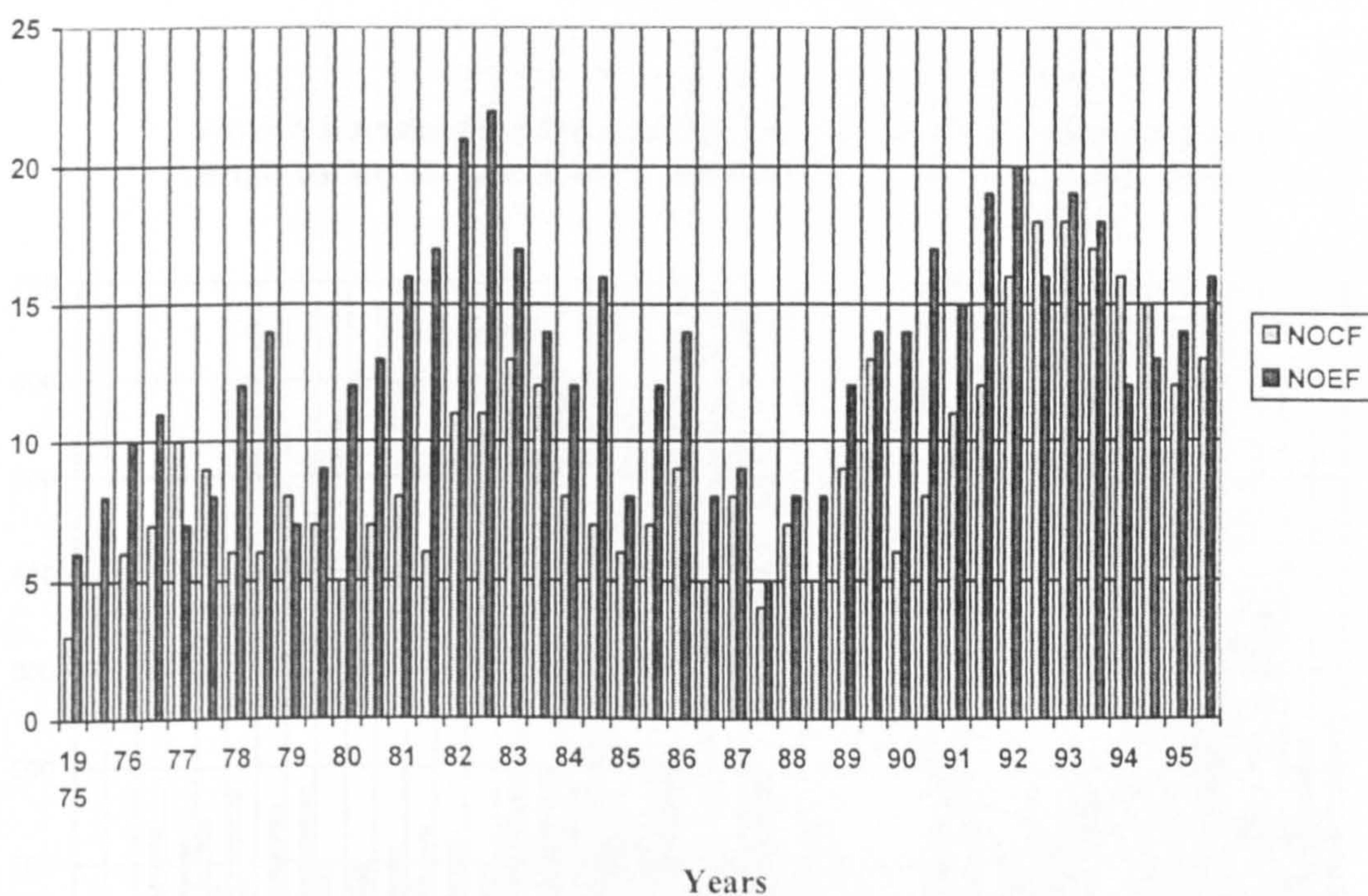
8.5 Data Sources

This study utilises six monthly data from various issues of the annual reports of the SIDF and other government agencies during the period from January 1975 to December 1995. Data used in this study are real data measured at 1970 and 1984 constant prices.

Data not available in the reports have been collected from other sources; for example, data on the number of chemical firms (NOCF) and engineering firms (NOEF) established every six months have been collected from the Directory of Saudi Industries published reports by the Ministry of Industry and Electricity (see Figure 8.1). This directory has a full information about all Saudi industrial firms, their dates of establishment, location, production capacity, product quality etc.

Figure 8.1

The Number of Chemical and Engineering Firms from 1975-1995



Source: Ministry of Industry and Electricity, 1996

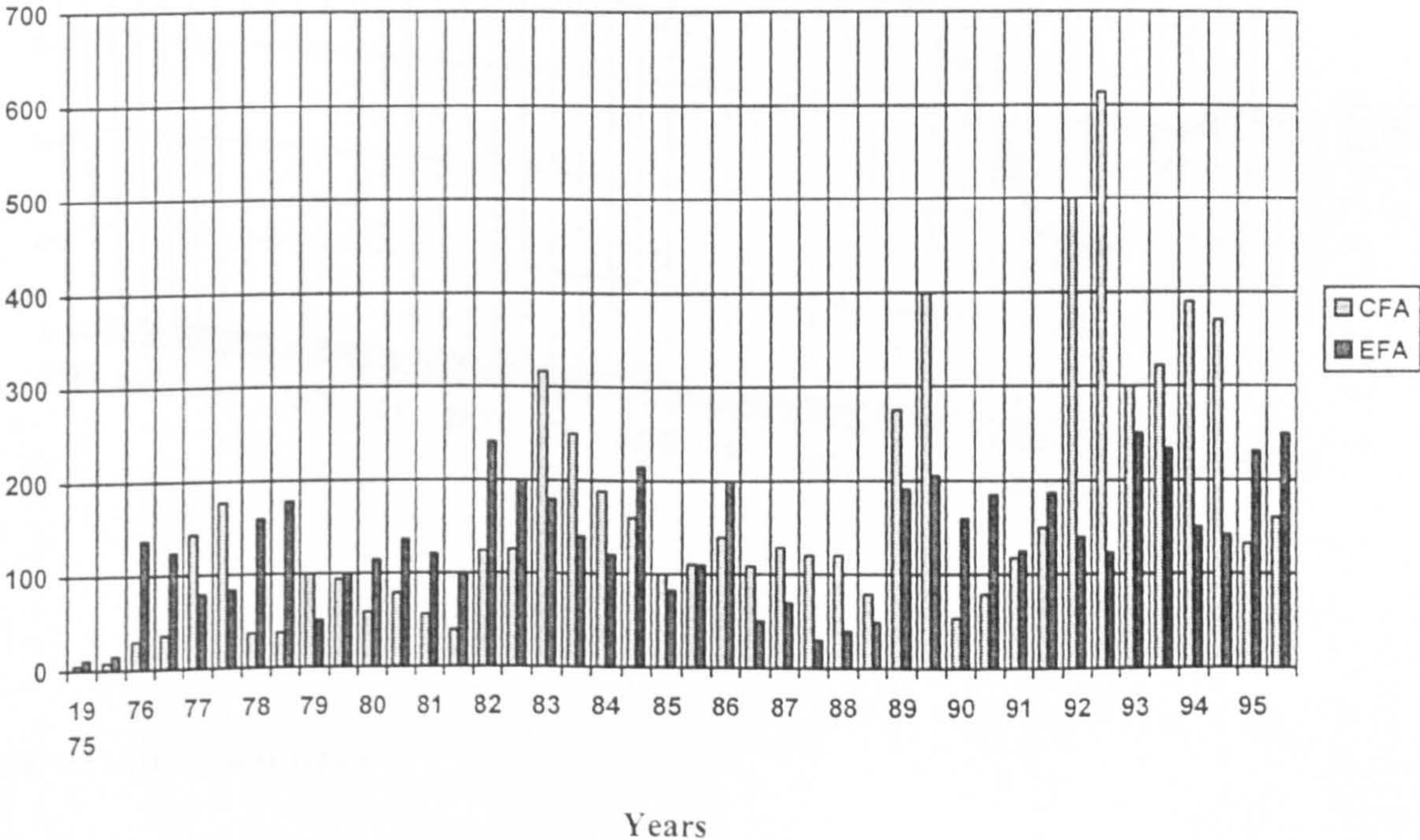
8.5.1 Financial Assistance from the SIDF to the Chemical and the Engineering Industries

Over the period since its inception up to the end of the year 1995, the SIDF has approved a total of 677 loans for the implementation of both chemical and engineering

industrial projects located throughout the Kingdom. The commitments to these projects totalled SR. 12,464 million. Up to the end of 1995, the value of these commitments represented approximately 48 % of the total loans approved by the Fund (The SIDF, Annual report, 1995). In this study, observations for the financial assistance to chemical and engineering industries (CFA,EFA) are measured by the amount of money provided by the SIDF to these industries, respectively, during each six month period of the study period (see Figure 8.2). Value of SIDF approved industrial loans to both chemical and engineering sectors is obtained from SIDF's Annual Reports.

Figure 8.2

Financial Assistance Provided By the SIDF to Both the Cemical and Engineering sectors Every Six Months from 1975-1995 (SR. Million)



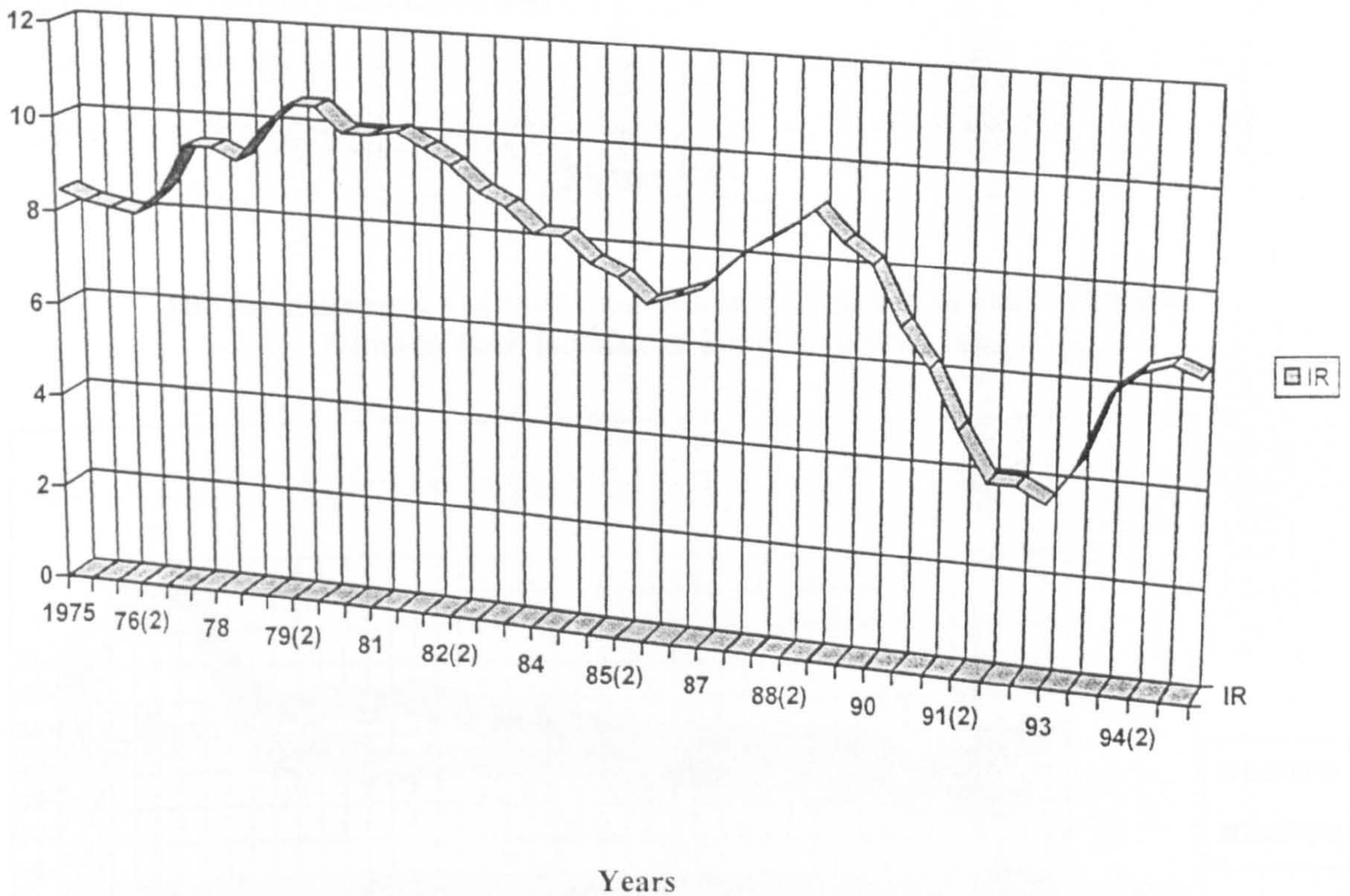
Source: The SIDF's annual reports.

8.5.2 The Interest Rate

The second major variable that will be tested in our model is the Saudi interest rate. Observations on the interest rate (IR) are defined here as the average interest rate available in Saudi Arabia every six months of the study period (see Figure 8.3). Data on Saudi interest rate are obtained from Money and Banking Statistics published by SAMA.

Figure 8.3

Saudi Interest Rate Every Six Months from 1975-1995



Source: The SAMA's annual reports

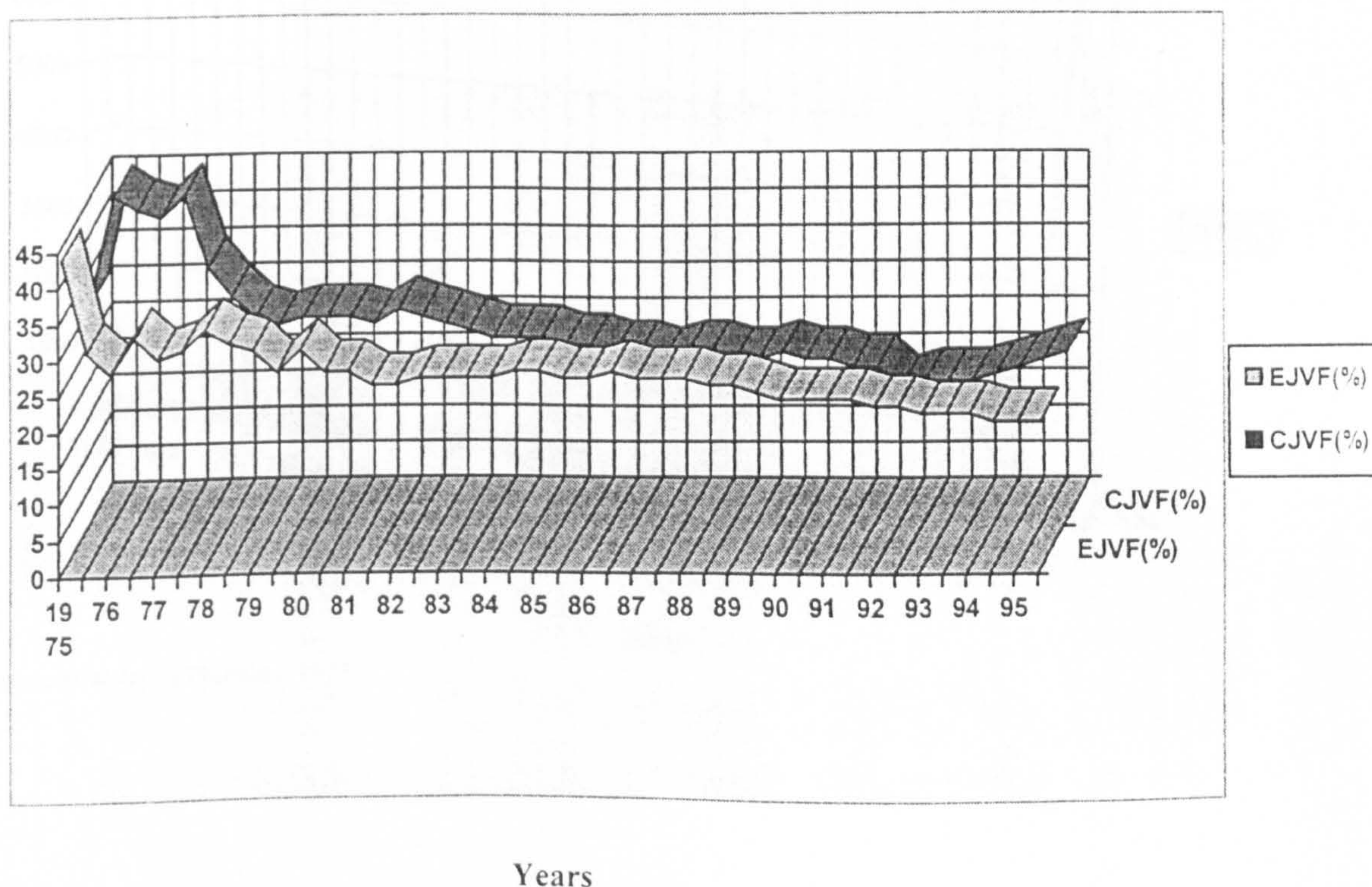
8.5.3 Industrial Joint-Venture Firms

The Saudi development plans strongly encourage the establishment of joint-venture firms, particularly with well-established international companies in order for the

efficient transfer of modern technology to the country and to open new industrial markets for Saudi exports (The SIDF, Annual Report, 1994). The engineering products sector has continued to lead other manufacturing sectors in terms of the number of joint-venture firms, followed by the chemical products sector which occupies second position. Observations on chemical and engineering industrial joint-venture firms (CJVF,EJVF) are measured by the percentage of joint-venture firms to the total number of firms in the chemical and engineering sectors respectively every six months of the study period (see Figure 8.4). The number of both chemical and engineering industrial joint-venture firms is again obtained from the Directory of Saudi Industries published by the Ministry of Industry and Electricity.

Figure 8.4

The Percentage of Both the Chemical and Engineering Joint- Venture Firms to Total Number of Saudi Industrial Firms



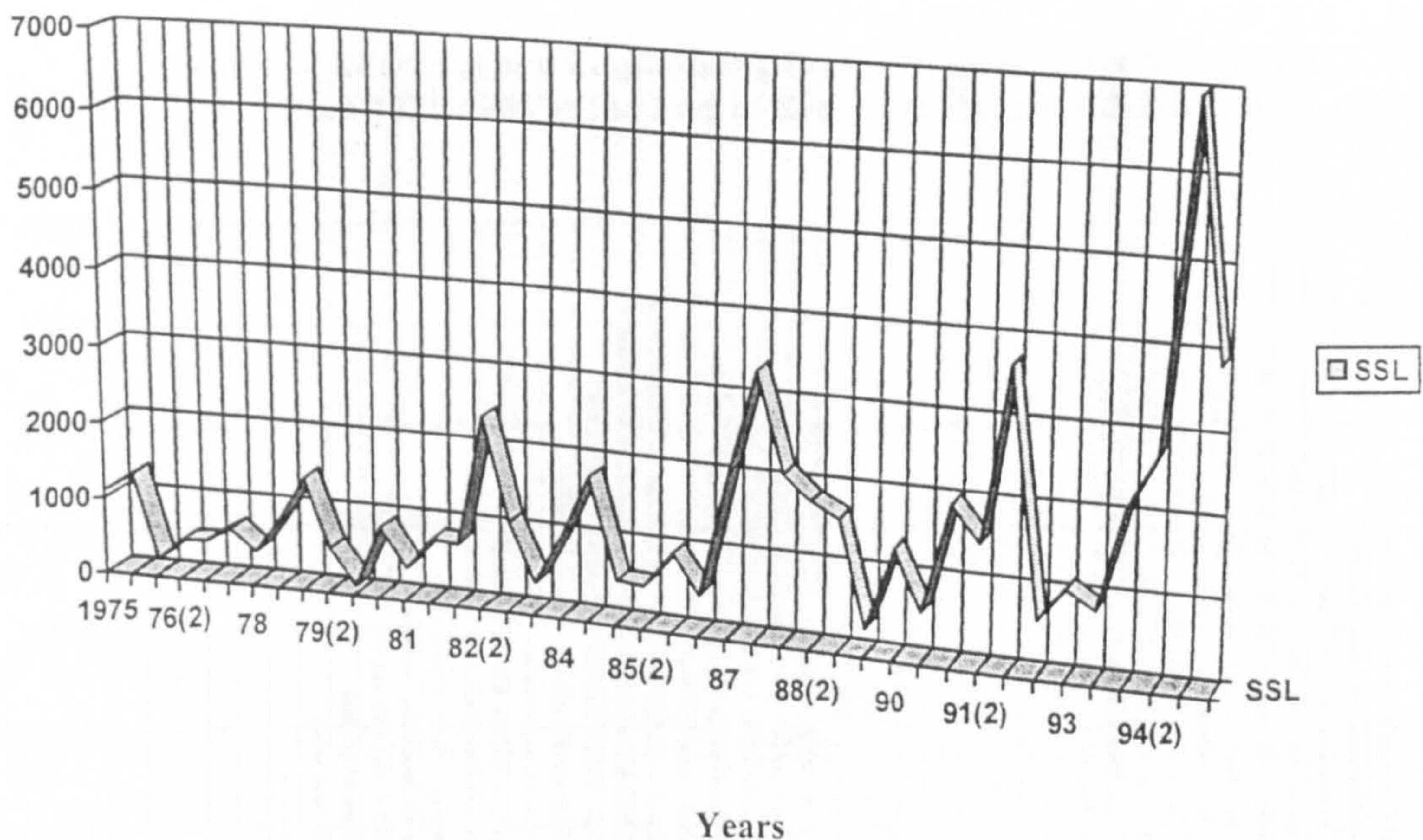
Source: Ministry of Electricity and Industry, 1996.

8.5.4 The Skilled Labour Force in Saudi Arabia

Skilled labour is considered to be one of the scarcest resources of Saudi Arabia. The growth rate of skilled labour is much less than Saudi industry demands (MOP, Sixth Development Plan, 1995). Most of the skilled labours in Saudi industry are foreigners from various countries and dependence on foreign manpower is likely to remain a feature of industrial development for some time to come (AL-Rumaihi, 1994). The observations on Saudi skilled labour (SSL) are defined by the prior growth in the number of Saudi graduates of secondary and higher education levels every six months (see Figure 8.5). Data on the growth of the Saudi skilled labour are obtained from Achievements of the Development Plans published by the Saudi Ministry of Planning.

Figure 8.5

The Growth of the Saudi Skilled Labour Every Six Months (000)



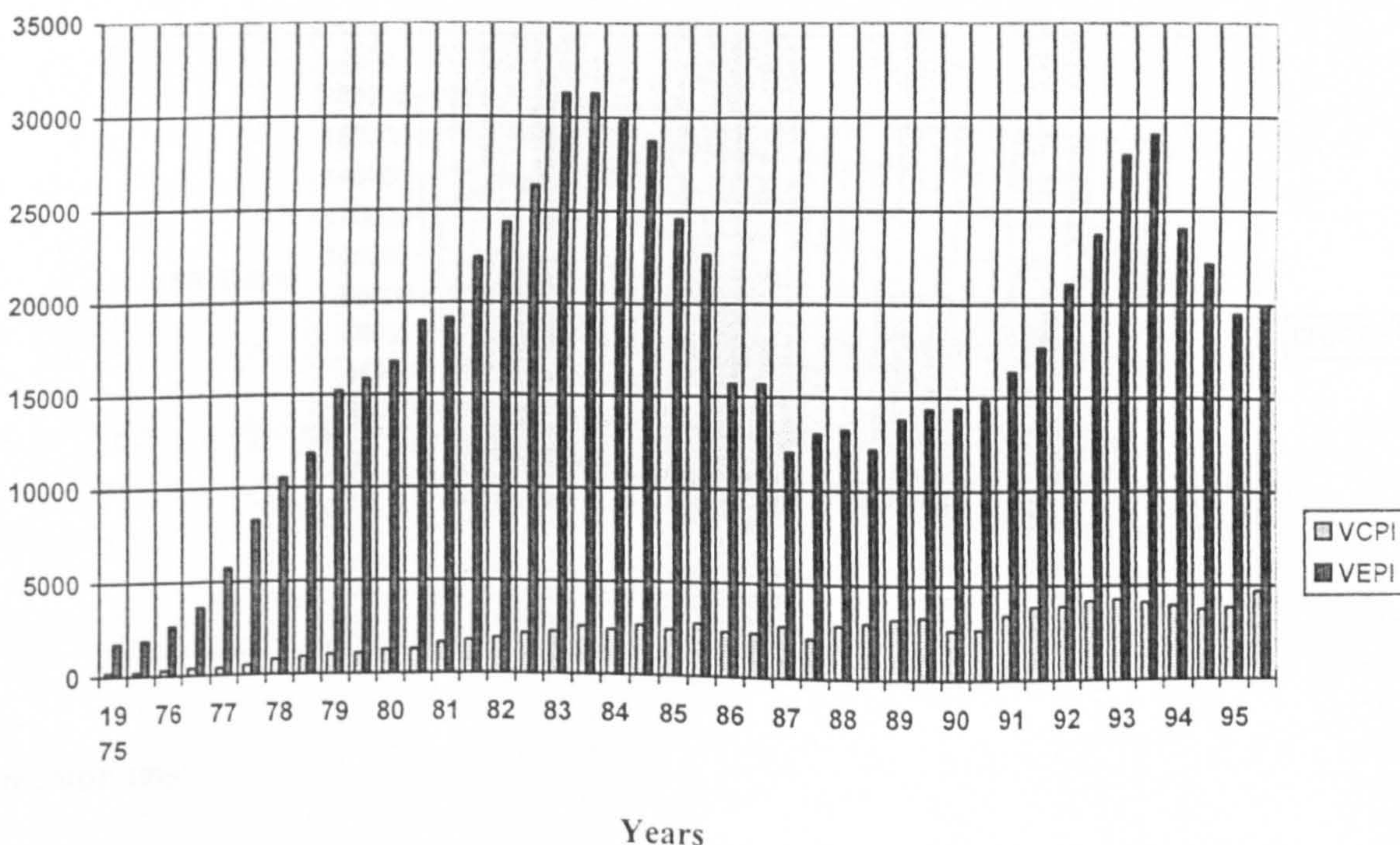
Source: Ministry of Planning, 1995

8.5.5 The Value of the Chemical and the Engineering Products Imported to Saudi Arabia

The chemical and engineering sectors have received special attention from the Saudi government because they are considered to be the most dynamic sectors of the Saudi economy: on average, their growth rate is about two-thirds higher than that of the national economy as a whole. The Saudi government has implemented many projects in order to enable the Kingdom to attain self-sufficiency in the products of these two sectors. Observations for the values of chemical and engineering products (VCPI, VEPI) are measured in this study by the amount of money spent to import such chemical and engineering products in the previous year (see Figure 8.6). Data on the amount of money spent on chemical and engineering products imported to SA are obtained from Annual Reports published by SAMA.

Figure 8.6

Value of Chemical and Engineering Products Imported to Saudi Arabia from 1975-1995 at the End of Every Six Months (SR.Million)



Source: The SAMA's annual reports

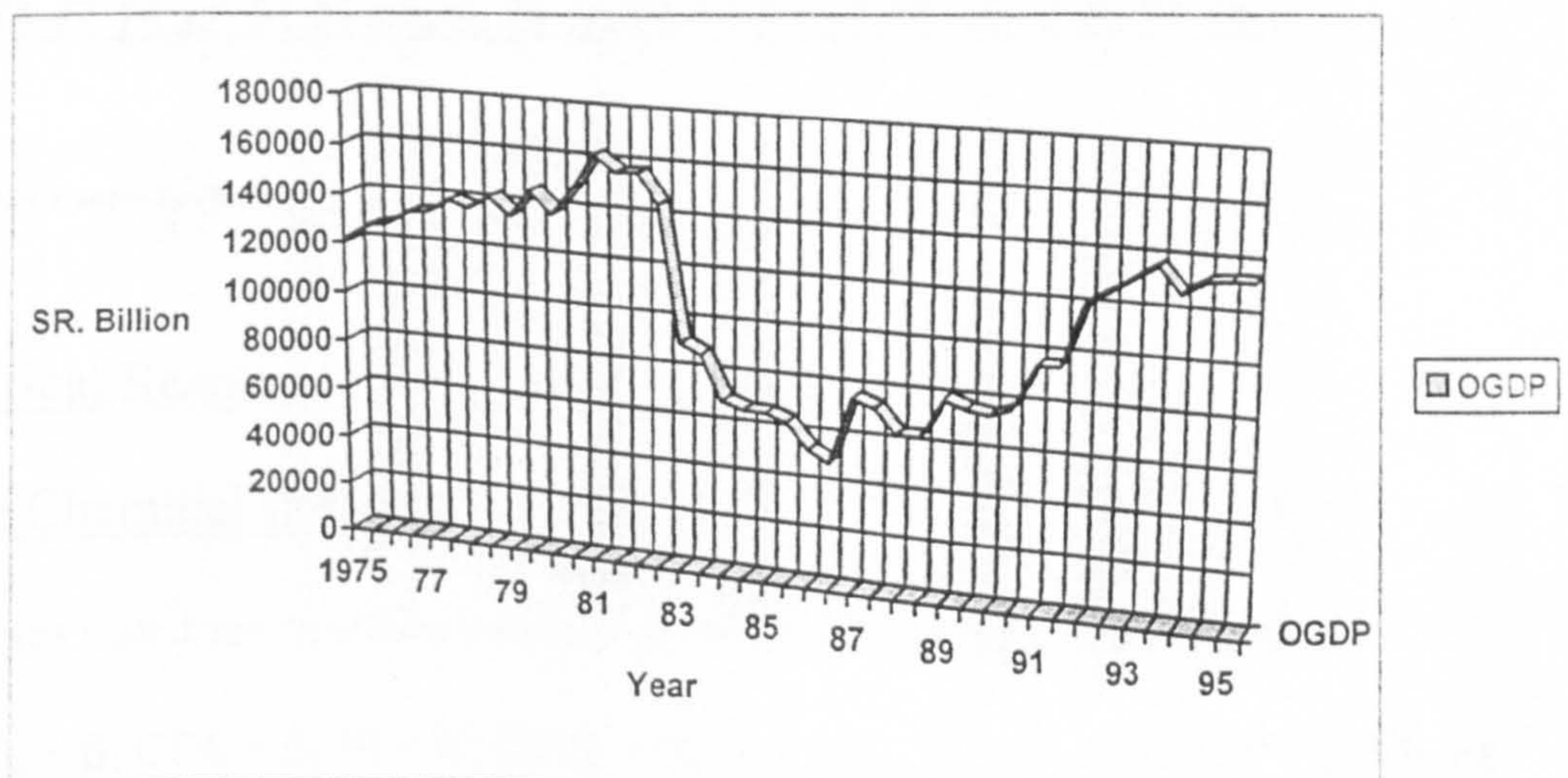
8.5.6 The Gross Domestic Product

The GDP is a major factor affecting the Kingdom's economic prospects. Any change in the value of the GDP will have significant implications. The structure of the Saudi economy is unlike that of many other countries. Oil still accounts for more than one-third of the GDP. Although in 1994 the private sector's contribution to GDP was for the first time greater than that of oil, in general, oil remains dominant. Around 90 % of the Saudi exports come directly from oil (see Chapter Two).

The data of oil real GDP observations in this study cover the period beginning with the commencement of SIDF operations in 1975 up to the end of 1995. As may be seen from Figure 8.7, the value of non-oil real GDP fluctuated from SR. 249 billion in 1975 to SR. 105 billion in 1986 and then increased to SR. 268 billion in 1995, mainly due to oil price movements. All data of oil real GDP were obtained from Achievements of the Development Plans published by Ministry of Planing.

Figure 8.7

Saudi OGDG at the End of Every Six Monthes from 1975-1995



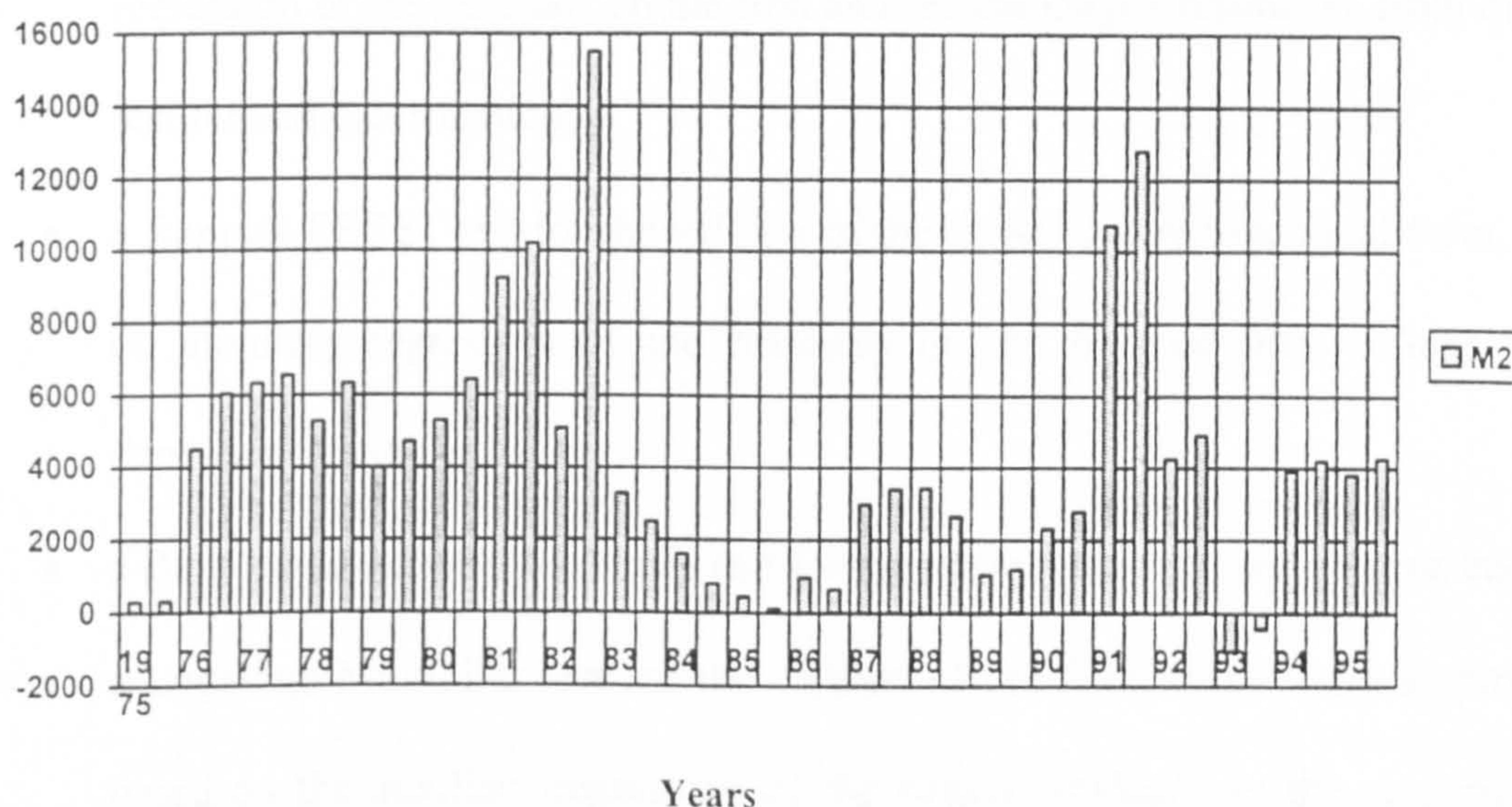
Source: MOP, 1995

8.5.7 Personal Savings

Another variable to be included in our model is personal savings (M2) which consist of currency in circulation, demand deposits, and time and saving deposits. Saudi personal savings can be an important source of financing for new technology. Our observations on M2 represent the changes in the value of M2 at the end of every six months of the study period (see Figure 8.8). Data on the value of M2 of the study period are obtained from SAMA's Annual Reports.

Figure 8.8

The difference in M2 at the End of Every Six Month (SR. Million)



Source: The SAMA's annual reports

8.6 Empirical Results

8.6.1 The Chemical Industry

The hypotheses stated are tested by estimation the following regression equation:

$$\text{NOCF} = \beta_0 + \beta_1 \text{CFA} + \beta_2 \text{IR} + \beta_3 \text{CJVF} + \beta_4 \text{SSL} + \beta_5 \text{VCPI} + \beta_6 \text{OGDP} + \beta_7 \text{M}_2 + \varepsilon \quad (8.30)$$

The results of the ordinary least squares (OLS) estimation of the above equation are reported in Table 8.3. Estimations were carried out using the MINITAB¹ and MICROFIT² statistical packages. The overall fit of the model measured by an R^2 value of 0.89 is satisfactory. The correlation coefficients between all possible explanatory variables, reported in Table A-9 in Appendix 4, suggest that there are no major problems of multi-collinearity with the largest coefficients in the range 0.65 to -0.85.

The following diagnostic tests were carried out to check for the statistical adequacy of the model:

- a Durbin Watson test, and a Lagrange Multiplier test based on an auxiliary regression of the residuals on the first and second lagged residuals. Both of these test for serial correlation;
- a Ramsey RESET test for the validity of the chosen linear functional form, based on auxiliary regression of the residuals on the squared fitted values of the dependent variable;
- a Bera-Jaque skewness-kurtosis test for the normality of the error terms; and
- a Lagrange Multiplier test for the validity of the homoscedasticity assumption, based on the auxiliary regression of the square residuals on the squared fitted values of the dependent variable.

With the exception of the Durbin Watson test, reported in Table A-10, the other test statistics described above are reported in Table A-11. All of the diagnostics are satisfactory, with the exception of the RESET test for the functional form of the model. In the serial correlation (autocorrelation) tests, both the Durbin-Watson and the

¹ Release 10 for Windows.

² MICROFIT is a well-known statistical and econometric software package that can handle all of the regression diagnostic tests discussed in this chapter.

Lagrange Multiplier tests indicate that there is no positive serial correlation in the model. The skewness-kurtosis test convincingly accepts the null hypothesis that the error terms are normal. The errors are also found to be homoscedastic, although in this case, acceptance of the null is only just possible with the test statistic of 3.73 only slightly less than the critical value of 3.84. With regard to the functional form of the model, the value calculated using Ramsey's RESET test suggests that there is a problem with the use of a linear functional form. However, experimentation with simple alternatives, such as a logarithmic and semi-logarithmic functional form, did not produce any apparent improvement in the diagnostic test results. At this stage, we therefore simply report the failure to find a fully acceptable functional form as a limitation of the analysis.

Table 8.3

Results of OLS estimations When the Dependent Variable is the Number of New Chemical and Engineering Firms Established

Industry	CFA/ EFA	IR	CJVF/ EJVF	SSL	VCPI/ VEPI	OGDP	M2	R ²	F [7.42]
Chemical	0.0151 (6.76)*	-0.3119 (1.72)***	13.618 (2.18)**	-0.0003 (1.35)	0.0018 (4.11)*	0.000039 (5.02)*	0.00005 (0.65)	0.89	47.82
Engineering	0.0379 (6.43)*	-0.4700 (2.00)**	-3.06 (0.19)	-0.0004 (1.53)	0.0002 (3.15)*	0.000007 (0.69)	0.0004 (4.15)*	0.80	24.12

Estimated coefficients are shown together with the absolute value of the t-statistic in parentheses.

A full description of standard deviations, correlation coefficients, and regression diagnostics tests are given in Appendix 4.

* Significant at the 1% level

** Significant at the 5% level

*** Significant at the 10% level

In general, most of the regression coefficients in the model have the expected signs and tend to be statistically significant, often at less than five percent level. More specifically, CFA, VCPI, and OGDP are all highly significant at the 1 % level. The coefficient of CJVF is statistically significant at the 5 % level and IR is significant at the 10 % level. The other two variables, SSL and M2 are statistically insignificant despite the fact that the latter has a positive coefficient as expected.

Our results show that the size of finance (CFA) provided by the SIDF is highly positively related to the rate of technological change, as expected. The model suggests that each one SR. billion change in the amount of money provided by the Fund to the chemical industry is associated with 15 units of technological change as measured by the number of new firms established. The interest rate also has a significant negative coefficient, as also expected. Each 1 % decrease in the interest rate increases the technological change by .31 unit. The highly significant positive coefficient of the CFA and the significant negative coefficient of the IR provide strong support for the Mansfield hypothesis.

The coefficient of chemical joint-venture firms (CJVF) is positive and statistically significant. The model shows that each 1 % increase in the ratio of the total number of joint-venture firms to the total number of all chemical firms increases the technological change in SA by 13.6 units. The sizes of the value of chemical products imported to SA (VCPI) and the oil gross domestic product (OGDP) are both positively related to the rate of technological change. A change in the VCPI by one SR. billion is associated with 1.8 units of technological change. The ultimate effect of the value of OGDP, however, is less than the effect of the VCPI. A change of SR. 100 billion in the OGDP is associated with about 4 units of technological change in SA in the same direction. Concerning the last two variables, M2 and SSL, there is no evidence of a positive effect on the rate of technological change in SA.

8.6.2 The Engineering Industry

The model of the engineering industry tests the following regression equation:

$$\text{NOEF} = \beta_0 + \beta_1 \text{EFA} + \beta_2 \text{IR} + \beta_3 \text{EJVF} + \beta_4 \text{SSL} + \beta_5 \text{VEPI} + \beta_6 \text{OGDP} + \beta_7 \text{M}_2 + \varepsilon$$

(8.31)

The overall fit of the model measured by an R^2 value of .80 is satisfactory and the results are found in Table 8.3. To ensure that the chosen model is adequate, we looked at some broad features of the results, such as the R^2 value, the estimated t ratios, the signs of the estimated coefficients as well as some regression diagnostic tests which have been used in the previous model. These diagnostics are reasonably good and look very encouraging, with the exception of the RESET test for the functional form of the model. The correlation coefficients between all possible explanatory variables, reported in Table A-13 in Appendix 4, suggest that there are no major problems of multicollinearity with the largest coefficients in the range 0.66 to -0.54.

As reported in Tables A-14 and A-15 in Appendix 4, the serial correlation (autocorrelation) tests, both the Durbin-Watson and the Lagrange Multiplier tests indicate that there is no positive serial correlation in the model. The skewness-kurtosis test convincingly accepts the null hypothesis that the error terms are normal. The errors are also found to be homoscedastic and with regard to the functional form of the model, the value calculated using Ramsey's RESET test also, as in the previous model, suggests that there is a problem with the use of a linear functional form. However, experimentation with simple alternatives, such as a logarithmic and semi-logarithmic functional form, did not produce any apparent improvement in the diagnostic test results. At this stage, we therefore simply report the failure to find a fully acceptable functional form as a limitation of the analysis.

Different to what we expected, the coefficients of both the engineering joint-venture firms (EJVF) and the Saudi skilled-labour (SSL) are inversely related to the rate of technological change in SA. However, both variables are statistically insignificant. The

remaining regression coefficients have the expected signs and four variables are statistically significant, three of them at the 1 % level.

The SIDF funding (EFA) (significant at the 1% level) has the strongest effect. An increase in the amount of finance provided by the SIDF by one SR. billion will promote technological change by 38 units as measured by number of new firms established. Another important factor affecting the rate of Saudi technological change is the interest rate (IR). The coefficient of interest rate is negative and statistically significant at 5 % level. Each 1 % decrease in the interest rate increases the technological change rate by .47 unit. The highly significant coefficients of EFA and IR in our model confirm our expectations as well as providing support for the Mansfield (1977) hypothesis.

The model shows that the rate of technological change is higher when the value of engineered products imported into SA (VEPI) is higher: a change in the VEPI by one SR. billion is associated with about .2 of a unit of technological change. The fourth influence is personal savings (M2), which represent the changes in currency in circulation, demand deposits, and time and saving deposits, and which have been shown to have an important effect on technological change in the Saudi engineering industry. The coefficient of M2 is positive and statistically significant in this model. SR. 10 billion of change in M2 is associated with 4.1 units of technological change in the same direction. The last two variables, EJVF and SSL have insignificant negative coefficients.

8.7 The Analysis and Comparison of the Results

Table 8.3 showed that over time there appear to be several variables that can affect the rate of technological change in SA. Our studies of both the chemical and

engineering industries are primarily concerned with the role of SIDF funding in financing and promoting technological change in SA. Our hypothesis examines that finance provided by the SIDF is very likely to promote technological change in SA. This is because the SIDF aims to promote technological change by offering interest-free medium and long-term loans to private industrial firms and this reduction in the cost of finance should positively influence the choice of technology adopted by these firms and eventually the rate of technological change. To test this hypothesis, it is necessary to hold a number of other influences constant. These influences, a total of seven variables, are shown in Table 8.2. Both studies use the multiple regression model proposed by Mansfield (1968 and 1977).

As far as SIDF funding is concerned, the results of both studies showed that increases in the amount of money provided by the SIDF were associated with increases in the rate of technological change in SA. This appears to be quite a consistent pattern in the two studies. The findings on interest rates are also similar in both studies. The two models suggest that the rate of technological change in SA will be high when the interest rates are relatively low. This also parallels the findings referred to earlier which suggest that the interest rate is a major factor in determining the rate of technological change.

The third important variable included in our models is the value of the chemical and engineering products imported to SA (VCPI/VEPI). The results were again constant in both studies. The two models found that both these variables play an important role in promoting technological change and hence we can suggest that the rate of technological change will be higher when the value of products imported by these two industries is

higher, on the grounds that this will motivate investors to establish more industrial firms, and that those firms will in turn adopt more new technology.

The other variables which were included in our two models but were not shown to be significant in both studies were the number of joint-venture firms (CJVF/EJVF), Saudi skilled labor (SSL), the oil gross domestic product (OGDP), and personal savings (M2). Only the first model shows that CJVF and OGDP are positively related to the rate of technological change. In contrast, the second model suggests that M2 is a significant and consistent positive inducement to the rate of technological change in the engineering industry although this is not the case in the first model.

There is an explanation for these relationships. The fact that CJVF and OGDP are significant variables in the first model and not in the second can be attributed to the fact that the percentage of joint-venture firms in the chemical industry to the total number of the chemical firms is higher than in any other industry which explains the importance of CJVP in our first model. In addition, the chemical industry is more capital intensive than the engineering industry in SA. The average capital investment in a Saudi chemical firm is about SR. 56.7 million compared with only SR. 25.3 million in an engineering firm. This high cost of establishing a chemical firm will give the JVs an advantage over the individual in establishing a business and adopting the necessary technology.

8.8 Conclusion

This chapter and the previous chapter have addressed similar issues. Both chapters have examined the technological role of the SIDF but this chapter has focused more narrowly on quantifying the role of the SIDF and other factors in promoting technological change

in SA. Perhaps the single most important point to emerge from this chapter is the apparently great importance of the SIDF in financing industrial and technological change in SA..

Two models were utilised to test the effect of the SIDF funding and other economic variables on the rate of technological change in SA. The first model concentrated on the chemical industry and the second on the engineering industry. Our regression analyses confirms that three variables have a highly significant effect on the rate of technological change: these are SIDF funding, the value of both chemical and engineering products imported into SA, and the interest rate. The first two variables have a positive effect and the third has a negative effect. The number of joint-venture firms and the oil gross domestic product have a moderate positive effect on the rate of technological change in the chemical industry. Personal savings, however, are an important variable in promoting technological change in the engineering industry.

The main conclusion we can draw from the analysis of this chapter is that, as industrial economists have stressed, any reduction in the cost of finance, as explained by the amount of finance provided by the SIDF, is a key factor in influencing the rate of technological change. However, we should emphasise here that the purpose of this chapter has been primarily to explain the role the SIDF played in promoting the phenomenon of technological change, as illustrated by the establishment of new chemical and engineering firms. A more analyses of technological change activities will be undertaken in the following chapter.

Chapter Nine

The SIDF and Technological Change Activities in Saudi Industrial Firms - A Field Survey Analysis-

9.1 Introduction

In the previous chapter we examined the role of the SIDF in financing and promoting technological change in Saudi Arabia. The findings suggest that the SIDF has played an important role in influencing Saudi technological change through financing the establishment of new chemical and engineering industrial firms.

This chapter will attempt to express in more detail the possible influence the SIDF might have on the rate and direction of technological change activities in SA. The following research question will be addressed: "Does the SIDF influence the rate and the direction of the in-house technological change activities of Saudi industrial firms?" A field survey is again used to capture both qualitative and quantitative aspects of this influence.

We will begin by outlining the modern development of Saudi industrial firms and go on to set out the research methodology and data sources. The empirical findings of the study will then be presented. Finally, we will recapitulate the main results, thus concluding the study.

9.2 Saudi Industrial Firms

Within a relatively short period of time, industrial public and private firms emerged as an important component of the Saudi economy. The number of operating industrial firms increased from 199 firms in 1970, employing 14 thousand workers, to 2380 firms in 1995 employing more than 196 thousand workers. Capital investment in these firms rose by a factor exceeding 54 fold during the same period, rising from SR. 2.8 billion to about SR. 151.2 billion (see Figure 9.1).

The products of these firms enjoy a very big share of the Saudi domestic market. This is evident by the fact that the local sales of these products reached more than SR. 60 billion in 1995. In addition, many industrial products are geared to export markets, as can be seen from the increase of industrial exports during the last ten years, from SR. 369 million in 1986 to SR. 13 billion in 1996, and from the fact that SA now export to 66 countries (Ministry of Industry and Electricity, 1996).

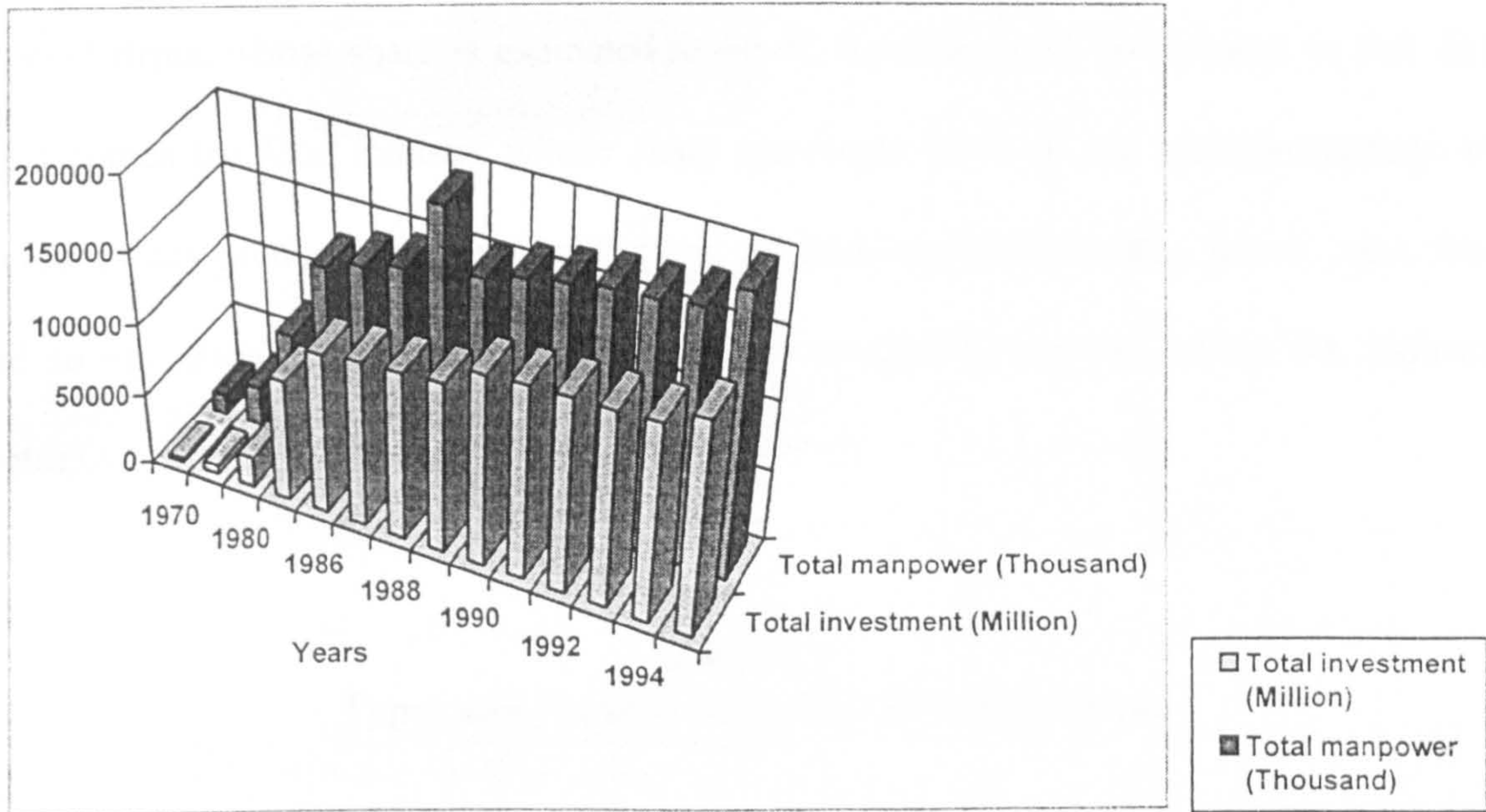
9.2.1 Types of Saudi Industrial Firms

Table 9.1 shows the types and numbers of productive firms up to 1995 as compared to the types and numbers for 1975 and 1985. It is apparent that the steel and metal industry, the chemical industry, and the building materials industry top all the other industries in terms of numbers of firms. In terms of the distribution of the total number of the industrial firms among the various regions of the Kingdom, the Central region stands at the top of all other regions, followed by the Western, Eastern, and other provinces (MIE, The Directory of

Saudi Industries, 1996). This is because there is a greater demand to meet the requirements and needs of the citizens in regions that are very heavily populated (eg. Riyadh).

Figure 9.1

Growth of Both Manpower and Capital of Operating factories in SA



Source: Ministry of Planning Achievement of the Development Plans, 1995.

The chemical industry lies at the top of all other industries in respect of capital invested. This is due to the fact that projects in the chemical industries are considered to be areas of great investment: they have a greater dependence on advanced technology. The total amount invested in these industries represents approximately 36 % of the total investment in industry up to the present time. Next is the building materials industry which

represent about 30 % of the total investments in Saudi industry. This industry include the cement and associated products: gypsum, bricks, marble, stones, concrete, and others. Such industries are favoured by Saudi investors as they supply the requirements of various development projects.

Next comes the metal industry whose value represents 18 % of the total value of all industrial firms. These firms include the basic metal construction and engineering as well as steel firms, whose share is estimated to be 40 % of the total investments in this field. Next comes the food industry whose share represents 10 % of the total investment: this includes dairy products, preparation of meat, mineral water, cold drinks, juices, jams, foods and so on. Finally, the other industries which comprising the rest of the SA industrial sector.

Table 9.1
Types and Number of Saudi Industrial Firms

Industrial Activity	Firms up to 1975	Firms up to 1985	Firms in 1995
Food and Beverage Industries and Drinkable	73	287	351
Textiles and Ready-made Clothes	10	33	63
Leather Industries & their Products	2	11	33
Wood Industries & Products	25	60	125
Paper, Printing & Publication	46	106	200
Chemical Industries	53	259	470
Chinaware, Ceramics Clay, Glazed Ceramics & Glass	1	5	55
Building Materials	90	486	428
Steel and Metal Industries	159	500	604
Other Industries	4	38	51

Source: MIE, The Directory of Saudi Industries, 1996.

9.2.2 Joint Industrial Firms

Up to the end of 1995, approximately 720 industrial joint venture firms were established under the rules and regulations for the foreign capital investment. This represents 30 % of total industrial firms. The majority of these firms are in industries that require a great amount of advanced technology, such as, the engineering and chemical industries. In 1995, the share of foreign partners reached 40 % of the total investment in joint venture firms and 20 % of the total capital investment of industrial firms functioning in the Kingdom. The majority of those joint industrial firms are situated in the Central, Western, and Eastern provinces (MIE, The Directory of Saudi Industries, 1996).

9.3 Research Hypothesis

The role of a development bank in influencing and promoting technological change may be analysed through investigating the technological success or failure of firms already financed by that bank. One way of doing this is to analyse the difference between two groups of firms (one which received finance and other which did not) in terms of their technological achievements. If no difference exists between these two groups, then it might be possible to conclude tentatively that the existence of the development bank is not consistent with, or associated with, more technological change.

We would expect *a priori* a discernible superiority in the technological achievements of firms which received finance from SIDF compared to those which received no kind of financial assistance from the Fund. This will help to improve our understanding of the technological role of the SIDF. The various technological change activities used in the empirical research of this chapter as indicators of technological change are all retrieved

from our definition of technological change (Further discussion of the activities and elements of technological change is provided in Chapter Five). The following activities and other technological change activities will be used in order to investigate a possible link between the SIDF industrial funding and the rate and direction of technological change:

1. The existence of a special department for designing and developing new products;
2. Involvement in new product development or upgrading existing products;
3. The development or upgrading of the firm's production methods;
4. Involvement in developing or upgrading of the firm's machinery and equipment;
5. Adaptation of the existing products and processes to local conditions;
6. Reduction of the firm's production cost;
7. Looking for new ways to maximise the yield from existing plant capacity;
8. Seeking new methods in order to maximise the technical skills of the firm's labour:
and
9. Spending on research and development as a proportion of the firm's annual sales.

The foregoing case study and related survey (Chapter 6 and 7) and econometric analysis (Chapter 8) drew out some interesting empirical findings. However, we have stressed that the role of any development bank in influencing technological change is multifaceted, covering many different channels of influence, and reflected in a wide variety of technological change "indicators". The research in this chapter complements the preceding empirical studies (Chapter 7 and 8) by exploring some other possible indicators of technological influence by the SIDF. It was explained earlier that no single empirical

exercise can answer these questions. That is why the empirical method of this study deploys a triangulation approach.

9.4 Research Methodology and Data Collection

In order to test the hypothesis of this chapter, a cross-tabulation analysis of the technological behaviour of Saudi industrial firms is undertaken. Using data gathered through company surveys on the basis of a set questionnaire, a Chi-square test will be used to measure the difference between two groups of firms in terms of their technological change. The first group are those which received finance from the SIDF and the second group are those which did not receive any financial assistance from the Fund. In order to perform the statistical analysis, the MINITAB Package was used to describe the data and to prepare various tabulation results.

In addition to this investigation of the possible influence the SIDF has on the technological behaviour of manufacturing firms in SA, the chapter will also attempt to test empirically the effect of some selected variables on technological change activities undertaken by those firms. This analysis will complete our understanding of the factors that can affect the rate and direction of technological change activities undertaken by Saudi firms. To the researcher's knowledge, this is the first study of its type to be done in SA.

In order to carry out the research, a bilingual questionnaire (English and Arabic) was designed (see Appendix 3 for a copy of the questionnaire): this same questionnaire was used earlier and described in Chapter 7 (7.2.2). The questionnaire, which was divided into three parts, was designed with two basic goals in mind; relevance and accuracy. The first part dealt with the respondent's background by asking him some general information about

his firm. The aim of this part was to obtain a profile of the respondents who participated in this research and also to gather general information to be used in analysing the data obtained from part two of the questionnaire in order to see if background elements have any effect on the technological behaviour of Saudi industrial firms.

Part two of the questionnaire was designed to focus on the main research objectives of this chapter. This part consisted of twenty-two questions, the purpose of which was to investigate the technological change activities of Saudi industrial firms. The third part was concerned with developing views about the technological role of the SIDF held by those firms which received financial assistance from SIDF. Part three was used only for the analysis of Chapter Seven (for full details concerning the design of the questionnaire, the selection of the pilot test sample, the selection of the final sample, data preparation, and the response rate, please see Chapter Seven, Section, 7.2.2).

With regard to the type of questions asked, to the best of the researcher's knowledge, no specific study has designed a questionnaire to investigate a development bank's technological role. Therefore, the questions used in this study were based on earlier studies of technological change and factors affecting this change such as those by Fransman and King (1984), Fransman (1985), Katz (1987), and Kirim (1990).

9.5 Research Findings

9.5.1 Sources of Production Technology

As a starting point, it should be recalled that a development bank can influence a firm's source of production technology in many different ways. The technical experience of a

development bank embodied in the bank's staff, for example, can contribute to making better technological decisions. During the early stages of the project cycle, the bank can offer technical advice to its client which is not limited to purely technical matters, but may also touch upon the possible local and international markets for the project's machinery and equipment.

In order to understand the ways in which the SIDF may influence the decisions of Saudi industrial firms regarding their sources of production technologies, we asked the two types of firms (firms which received finance from SIDF (FRF) and firms that did not receive any sort of financial assistance (FRNF)) to indicate how they determined the initial sources of their respective production technologies. The firms were asked to give their opinions by ticking more than one choice, if applicable, of the four options given.

Table 9.2 outlines the options firms had in determining the sources of their firms production technologies. Two main points can be inferred from the table. Firstly, it appears that, according to these figures, both the FRF and FRNF depend heavily on both their own R&D activities, and licensing from international firms in order to acquire production technologies. Nearly 82 % of FRF said they depend on their own R&D activity in determining the sources of their firms' production technologies and. for the FRNF, the figure was closer to 86%. In the case of licensing from an international firm, nearly 30% of the FRF reported undertaking this factor, whereas for the FRNF the figure was about 28%.

Secondly, Table 9.2 also shows that there is no discernible difference (measured by Chi-square) between the two types of firms in their methods of determining the sources of

their technologies. This is consistent with the SIDF not playing an active role in influencing the decisions of Saudi firms regarding the sources of their production technologies. The sample data confirm this observation. Of the 265 Saudi firms surveyed, only two reported that they had received technological advice from the SIDF which was useful in determining the sources of their production technologies.

Table 9.2

Factors Affecting Saudi Firms in Determining the Sources of their production technologies

Source	FRF Number %*	FRNF Number %	Chi- square	Level of Significance
Firm's own R&D activity	120 82.2	102 85.7	0.598	.380***
Firm's own R&D activity in co-ordination with the SIDF	2 1.4	0** 0	-	-
Licensing from international firm	44 30.1	33 27.7	0.184	.700***
Other	5 3.4	4 3.4	0.001	.950***

* Percentages do not sum to 100 because of multiple responses.

**Because all firms which did not receive financial assistance from the SIDF have no co-ordination with the Fund

*** indicates that the level of significance is approximate

Source: The questionnaire, 1996

In order to obtain an indication of the significance of the technological advice provided by the SIDF, we asked all the firms to give a direct answer if they thought that co-ordination with SIDF was important in determining the initial sources of their firms' production technologies. Of the 265 Saudi firms, 181 (nearly 68 %) reported that technological aid by the SIDF was important.

Similarly, we asked these firms, if they thought co-ordination with the SIDF in this respect was important, and to specify why. Table 9.3 gives the numbers and percentage distributions of the various possible reasons. These results indicate that the SIDF can play an active technological role in defining the sources of Saudi firms' production technologies through early discussions with those firms. This role is also very much welcomed by Saudi firms and can be helpful in many ways. The question asked in this connection suggested four possible ways in which the SIDF can provide technological advice: within each of these particular ways, the technological advice of the SIDF was apparently appreciated. But perhaps the two most important ways in which the SIDF can provide technological advice appear to be in assisting a firm to determine: first, the most suitable type of technology and, second, that technology which is most price competitive.

Table 9.3
Reasons for the Importance of the
co-ordination With the SIDF

Reason	Number	%*
Helping the firms know the best producers of the technology	122	46.04
Helping the firms know what technology is produced in SA	94	35.47
Helping the firms know the best kind of technology to use	160	60.38
Helping the firms know the best priced technology to use	154	58.11
Other reasons	10	3.77

* Percentages do not sum to 100 because of multiple responses.

Source: The questionnaire, 1996

9.5.2 The SIDF's Funding and the Direction of Technological Change Activities

As mentioned previously (Chapter 5), a development bank has the ability to influence and promote the rate and direction of technological change. Thus, dissimilarities in the

technological behaviour of the two groups of our sample of Saudi firms should be expected. In other words, we would expect that the technological behaviour of firms which received financial assistance from the SIDF would be influenced to a greater extent by the technological role of the SIDF and, as a result, might exhibit better technological performance.

In order to investigate the possible link between the SIDF's funding and the level of technological change of Saudi firms, we considered the existence of various technological change activities undertaken by both types of firms. We examined four important activities and Table 9.4 provides information on the existence of each in the sample firms. This table indicates that the differences between the two types of firms with regard to these particular technological change activities were statistically insignificant.

Table 9.4
Cross Tabulation of Technological Change Activities by Type of Firms
(Number and % of Firms Reported the Existence of Such Activity)

Technological Change Activity	FRF		FRNF		Chi-Square	Level of Significance
	Number	%	Number	%		
The existence of a special department for designing and developing new products	85	58	62	52	0.994	.300*
Involvement in new product development or upgrading existing products	125	86	100	84	0.128	.650*
Development or upgrading of the firm's production methods	86	59	60	50	0.700	.350*
Involvement in developing or upgrading the firm's machinery and equipment	138	95	108	91	1.431	.200*

* indicates that the level of significance is approximate

Source: The questionnaire, 1996

As a second step, we asked several questions in order to gain a better understanding of the technological role of the SIDF. We started by investigating the extent to which the activities of new product development or the upgrading of existing products within the firms were regularly and systematically carried out, or effected on an ad-hoc basis as and when the need arose. Nearly 40.8 % of the 125 FRF reported these activities to have been regularly and systematically carried out as compared to 31 % of the 100 FRNF. In spite of the fact that the FRF showed greater involvement in new product development or the upgrading of existing products than the FRNF, the difference between these two types of firms was insignificant (Chi-square = 2.420 and level of significance = .130).

The FRF which responded that they had been involved in developing or upgrading their firms' machinery and equipment were also asked (in Question 16) to answer directly whether they had ever received any sort of respective technical assistance from the SIDF during the process of this development. Only 4.8 % of the 138 FRF reported they received some sort of technical assistance in this area from the SIDF.

The study also investigated the importance of other technological change activities undertaken by both types of firms: Table 9.5 shows how firms ranked the importance of such activities. Two important points are contained in this table. First, the table indicated that there is no discernible difference in the importance of various technological change activities between the two types of firms. The only difference that is noticeably significant exists in the last technological change activity: looking for new ways to maximise the yield from existing plant capacity. Moreover, the order of importance is shown to be very similar

whether the firms received finance from the SIDF or not. The technological change activities by the FRF, in order of their importance were:

- (1) adapting the existing products and processes to local conditions;
- (2) reducing production costs;
- (3) maximising the yield from existing plant capacity; and
- (4) maximising a firm's labour technical skills.

For the FRNF, on the other hand, the order of importance was:

- (1) adapting the existing products and processes to local conditions;
- (2) reducing production costs;
- (3) maximising a firm's labour technical skills; and
- (4) maximising the yield from existing plant capacity.

Table 9.5

Cross Tabulation of the Importance of Technological Change Activities by Type of Firms (Number and % of Firms Reported Each Activity as Important)

Technological Change Activity	FRF		FRNF		Chi-Square	Level of Significance
	Number	%	Number	%		
Searching for ways in order to adapt the existing products and processes to local conditions	91	62.3	66	55.5	1.280	.280*
Attempting to reduce the production cost	79	54.1	56	47.1	1.304	.255*
Seeking new methods in order to maximise the technical skills of the firm's labour	69	47.3	47	39.5	1.606	.150*
Looking for new ways to maximise the yield from existing plant capacity	70	47.9	42	35.3	4.300	.030*

* indicates that the level of significance is approximate

Source: The questionnaire, 1996

9.5.2.1 Adapting Existing Products and Processes to Local Conditions

The literature has emphasised that adapting products and processes to local conditions is perhaps the most important type of technological change activity (Kirim, 1990). Furthermore, development banks, through medium and long-term credit, have been seen to provide and encourage the adaptation and improvement of imported machinery, equipment and materials to local conditions (Fransman, 1985). The data we have collected reveal that both types of firms ranked this activity as the most important technological change activity. These data also showed that there is no statistically discernible difference between the two types of firms in terms of the relative importance of this type of technological change activity (see Table 9.5).

Considering the belief that the SIDF has a technological role to play in influencing technological change activities undertaken by firms which received financial assistance, we would expect that the FRF would adapt local products and processes to local conditions to a greater extent than the FRNF. These findings, however, do not confirm our *a priori* expectations.

9.5.2.2 Reducing Production Cost

The second most important technological change activity reported by both types of firms was reducing the firm's production cost. Nearly 54 % of the firms receiving finance from the SIDF reported undertaking this activity, whereas for the other group the figure was about 47 %. In spite of the fact that the FRF seem to carry out this technological change

activity more frequently than FRNF, the difference between the two was statistically insignificant (see Table 9.5).

This finding supports that of the previous section: namely that the SIDF has no apparent influence on the level of technological change activities undertaken by firms even though they are financed by the SIDF.

9.5.2.3 Maximising Firm's Labour Technical Skills

The third most important technological change activity reported by the FRF and the FRNF was maximising a firm's technical skills. In the literature, the maximising of the technical skills of labour has been singled out as being particularly important in the process of technological change. It is also argued that one of the important dimensions of a development bank's mission as an instrument of national, industrial and technological development is its influence in promoting the skills of the nation's labour force (Jequier and Hu, 1989).

Nearly 47 % of the firms which received financial assistance from SIDF reported this activity to be one of their most important technological change activities. This type of activity was also important for the other group of firms. Approximately 40 % of the FRNF reported maximising the technical skills of the firm's work force to be an important activity. The difference, however, between the FRF and the FRNF was statistically insignificant (see Table 9.5). This finding supports the findings reported earlier for the two previous technological change indicators.

9.5.2.4 Maximising the Yield from Existing Plant Capacity

The only important technological change activity that seems to have been carried out more intensively by firms receiving finance from the SIDF is maximising the yield from existing plant capacity. Nearly 48 % of the FRF reported that they considered that searching in order to maximise the yield from existing plant capacity was an important technological change activity; but only 35.3 % of the FRNF reported they considered that this activity should be undertaken by their firms. This time the difference was statistically significant at the 5 percent level (see Table 9.5).

This finding supports the view that the SIDF has an apparent positive effect on the level of such technological change activity undertaken by firms who received financial assistance from the SIDF.

9.5.2.5 The SIDF's Funding and Firms' expenditure on Technological Change Activities

In the literature it is repeatedly argued that research and development spending is an important factor in the building of domestic technological capability. R&D spending contributes to both invention and technological innovation. It influences all types of technological change activities and determines the level of that change (Kirim, 1990).

As instruments of national policy, development banks can have a direct and indirect influence by supporting national R&D activities. The SIDF's funding is expected to influence the R&D spending of firms which received financial assistance from the Fund. In this regard, we investigated a possible link between the SIDF's funding and the R&D spend undertaken by Saudi firms. Table 9.6 provides information on the spending of both types of

firms in the sample. The table, however, indicates that there is no statistically discernible difference between the two types of firms in terms of the amount spent on the R&D activities as a proportion of the firm's annual sales. Thus there seems to be no relationship between SIDF' funding and the expenditures of firms on R&D activities.

Table 9.6

Cross Tabulation of R&D Spending by Type of Firms

Spending*	FRF		FRNF		Chi-Square	Level of Significance
	Number	%	Number	%		
Less than 2%	50	34.2	46	39	0.552	.400
2% - less than 5%	45	30.8	41	34.7	0.395	.600
5%-7%	37	25.3	26	22	0.442	.520
More than 7%	14	9.6	5	4.2	-	-
Total	146	100	118	100		

*Spending is measured as a proportion of the firm's annual sales

- indicates that the number of firms is too small to calculate the Chi-Square between the two groups

Source: The questionnaire, 1996

9.5.3 Technological Change Activities: An Analysis of the Determinants in Saudi Industrial Firms

Earlier in the previous section we saw that the SIDF has no apparent, measurable (statistical) effect on the rate and direction of technological change activities of Saudi firms which received financial assistance from the Fund. A great deal of theoretical and empirical work has, however, been undertaken in order to determine the factors that can affect the rate and direction of technological change activities. Most of the research

findings indicated that firm-specific variables, the market structure, and macro-economic variables were the most important factors affecting and influencing the firm's technological change activities (see Section 8.2 of Chapter Eight). This section will investigate empirically the effect of selected variables on the decisions of Saudi firms to engage in nine different technological change activities. In addition to providing an understanding of the determinants of technological change which can be useful in the formation of industrial policies in SA, this study will assess whether the SIDF funding makes a difference to the technological behaviour of Saudi firms.

9.5.3.1 Research Methodology

Nine dependent variables are used in this study and are listed in Table 9.7. These variables are binary, taking the values of unity or zero (except variable Y_9). Each dependent variable was used to explain the existence or non-existence of a particular technological change activity. Every firm of the sample was asked whether or not it undertook the technological change activity in question and the firm's responses provide the data for the eight dependent variables (Y_1 - Y_8). Data regarding the firm's spending on research and development (Y_9) are based on each firm's response when asked specifically how much they spend on R&D activities as a proportion of the firm's annual sales. Each firm was given four options from which it had to select one.

A probit regression model was employed to explain the variation in the rate and direction of technological behaviour of Saudi industrial firms. Probit is used because OLS is not applicable to a model with a binary dependent variable because the error terms are heteroscedastic and this will yield inefficient estimates. The probit model makes it possible

to estimate the heteroscedasticity and apply weighted least squares (Ramanathan, 1992). The statistical package used in this analysis was LIMDEP¹.

Table 9.7

**List of Technological Change Activities
(Dependent Variables)**

1	The existence of a special department for designing and developing new products	Y ₁
2	Involvement in new product development or upgrading existing products	Y ₂
3	Developing or upgrading the firm's production methods	Y ₃
4	Involvement in developing or upgrading the firm's machinery and equipment	Y ₄
5	Attempting for ways in order to adapt the existing products and processes to local conditions	Y ₅
6	Searching in order to reduce the production cost	Y ₆
7	Looking for new ways to maximise the yield from existing plant capacity	Y ₇
8	Seeking new methods in order to maximise the technical skills of the firm's labour	Y ₈
9	Spending on research and development as a proportion of the firm's annual sales	Y ₉

9.5.3.2 The Theoretical Justification for Included Variables

Five explanatory variables are included in our model and these are listed and described briefly in Table 9.8. Most of these variables have been used frequently in empirical work on this subject. The first variable (FIN) relates to the role of SIDF funding in promoting technological change activities. This variable is particularly important because the availability of finance, as we have discussed earlier, is expected to have a positive effect on technological change activities undertaken by Saudi firms. Each technological change

¹ LIMDEP is a widely-used statistical and econometric software package that can be used *inter alia* to run a multiple regression in which the dependent variable is a dummy variable.

activity almost always requires some initial financial outlay. The finance provided by the SIDF is therefore likely to have an important bearing on the rate of technological change activities.

Aside from (FIN), other variables are relevant and therefore worth testing; for instance, the size of the firm can be an important determinant of technological change activities. A vast amount of literature has emerged concerning the effect of firm size on technological change and this theoretical and empirical work supports the hypothesis that there is a positive relationship between firm size and the rate and direction of technological change activities (Kamien and Schwartz, 1975; Culbertson, 1985; Kraft, 1989; and Braga and Willmore, 1991). Kraft (1989) argues that nowadays large firms are the better innovators because in modern societies, technological innovations are so expensive that only large firms can support them. In addition, some argue that large firms can undertake more innovation projects of the same magnitude than small firms (Braga and Willmore, 1991).

Table 9.8
List of the Explanatory Variables

Variable Name	Definition
FIN	SIDF's finance, a dummy variable equal to unity if the firm has received finance from SIDF and zero if it has not
SIZE	The capital investment of the firm
MKT	The firm's products, a dummy variable equal to unity if the products of the firm are destined for both export and local markets and zero if they are destined for local market only
TYPE	A dummy variable equal to unity if the firm is joint-venture and zero if it is a Saudi firm
AGE	The age of the firm since the date of its establishment

Another important independent variable included is the export orientation of the firms (MKT). Many researchers argue that increasing the size of the market through exporting a firm's products will promote technological change activities (Pugel, 1978; Zimmerman, 1987; Chen, 1987; Kirim, 1990; and Braga and Willmore, 1991). Analysing the case of American industry, Pugel (1978) argued that exports, by increasing the size of the market, increase the return to innovation activity. He further stated that there exists a well-known argument that firms operating in industries protected from foreign competition are apt to enjoy a quiet life, paying little attention to technological innovation or product quality. We can thus infer that the greater the degree of competition which is introduced, particularly by expanding the borders of the domestic market via exports, the higher the level of technological change activities. Some also argue that export orientation can have a bearing on the channels through which technologies are acquired. Dahlman and Westphal (1983) and Fransman and King (1984), for example, argue that export activities open up new possibilities for the transfer of knowledge into Third World countries.

The type of firm for example, if it is a joint-venture, is also expected to have a positive impact on the rate of technological change activities. Many researchers argue that the presence of international firms in an industry can have spillover or external effects on the efficiency and technological change activities of the other firms in that industry (Blomstrom and Persson, 1983; Braga and Willmore, 1991; Kokko, 1994; and Kokko and Blomstrom, 1995). More details about the role of foreign firms in promoting technological change are provided in Chapter Eight.

The age of the firm is another variable that can be expected to have a positive impact on technological efforts but as yet there is no empirical work in this subject. It stands to reason that older firms may be more aware of the technological options available to them. Therefore, we shall test the alternative hypothesis that the older the firm, the greater the probability of technological activities.

9.5.3.3 Empirical Findings

The hypotheses stated are tested by estimation the following regression equation:

$$Y = \beta_0 + \beta_1 \text{FIN} + \beta_2 \text{SIZE} + \beta_3 \text{MKT} + \beta_4 \text{TYPE} + \beta_5 \text{AGE} + \varepsilon \quad (9.1)$$

The results of both the probit regressions ($Y_1 - Y_8$) and the ordinary least square (Y_9) estimations are reported in Table 9.9. Estimations were carried out using the LIMDEP and MINITAB statistical packages. The overall fits of all nine models measured by Chi-Square (in the first eight models) and an R^2 (in the ninth model) are very acceptable. In determining the adequacy of the nine regression models, we looked firstly at some specific features of the results, such as the Chi-square, significance level, the R^2 value, the estimated t ratios, the signs of the estimated coefficients in relation to their prior expectations. All these early diagnostics are good for all nine models.

In order to find out whether multicollinearity or heteroscedasticity are present or likely to be present in these models, the correlation matrix for all explanatory variables was calculated (see Table A-18 in Appendix 5). No evidence was found of a systematic relationship between these variables and the absolute values of the residuals (the largest coefficients in the range 0.31 to - 0.04), which suggests that there are no problems of multicollinearity or heteroscedasticity exist in these nine models.

In general, most of the regression coefficients have the expected sign and only two variables tend to be statistically significant. As far as the role of SIDF (FIN) is concerned, there is no evidence of any positive effect; nor is the coefficient of FIN significant in all equations. This finding supports the findings in the previous study of this chapter. On the basis of this evidence, the SIDF's financial and technological assistance can be regarded as an insignificant determinant of technological change activities undertaken by Saudi industrial firms.

Table 9.9

Results of Probit Regressions ($Y_1 - Y_8$) and
OLS for the Dependent Variable Y_9

Dependent Variable	FIN	SIZE	MKT	TYPE	AGE	Chi-Squ (5)-257	Significance Level
Y_1	0.0240 (0.140)	1.4112 (6.244)*	0.9966 (3.923)*	0.2413 (1.069)	-0.0115 (-0.880)	70.368	0.1000000E-06
Y_2	0.0297 (0.151)	0.6123 (2.527)**	0.4092 (1.684)***	0.0022 (0.008)	0.0145 (0.868)	14.088	0.1505765E-01
Y_3	0.0085 (0.051)	0.9468 (4.448)*	0.9533 (3.942)*	0.1766 (0.8.3)	-0.0052 (-0.412)	45.868	0.8929464E-08
Y_4	-0.2423 (-0.863)	1.0383 (2.484)**	0.9480 (3.230)*	0.0558 (0.138)	0.0110 (0.458)	28.424	0.3006458E-04
Y_5	-0.0583 (-0.345)	1.3381 (5.670)*	0.5141 (2.209)**	-0.0888 (-0.400)	0.0190 (1.322)	54.676	0.1000000E-06
Y_6	-0.0650 (-0.383)	1.6654 (6.543)*	0.3670 (1.518)	0.1395 (0.616)	0.0068 (0.486)	65.938	0.1000000E-06
Y_7	-0.2290 (-1.304)	1.7231 (6.984)*	0.9569 (3.062)*	0.1241 (0.555)	0.0060 (0.442)	82.571	0.1000000E-06
Y_8	-0.1132 (-0.639)	2.1185 (7.428)*	0.4412 (1.610)***	0.3658 (1.599)***	-0.0017 (-0.126)	88.982	0.0000000
" Y_9 "	-0.0597 (-0.606)	1.0793 (4.027)*	0.5452 (4.027)*	-0.0241 (-0.188)	0.0042 (0.557)	(R^2)=32.3	F value = 26

Estimated coefficients are shown together with the absolute value of the t-statistic in parentheses.

A full description of standard deviations, correlation coefficients, and a sample of the data used are given in Appendix 5.

" Y_9 " has been calculated using ordinary least squares regression because the values of this variable were not binary but numbers ranking from 1-4.

*** Significant at the 10% level

** Significant at the 5% level

* Significant at the 1% level

The coefficient of firm size (SIZE) is positive in all nine equations, and highly significant in all cases. In eight of the nine regressions, MKT's coefficient is also significantly positive as expected, but the estimated coefficients are rather low compared with those of firm size. The findings on these two variables firm size and the firm's participation in international trade are broadly compatible with *a priori* theorising. They suggest (as we saw in Section 9.5.3.2) that firms which have a large capital investment budget can undertake more technological change activities than small firms. They also argue that exports, by increasing the size of the market, increase the return to innovation activity.

TYPE performed quite poorly as an explanatory variable. In one equation (Y_8), the coefficient was significant only at the 10 percent level, and in all the other equations the coefficients were not significant. An increase in the firm's age has also appeared to have no effect on technological change activities.

9.6 Conclusion

This chapter has considered the relationship between SIDF funding and technological change efforts undertaken by Saudi industrial firms. Firstly, the effect of SIDF finance on the decisions of Saudi firms to engage in technological change activities was analysed using appropriate data. This analysis was achieved through measuring the difference between two groups of Saudi firms in terms of their technological performance; one group received finance from the SIDF and other group received no sort of financial assistance from the Fund. The results show that there was no observable difference in the level of technological change activities between the two groups. Therefore, the SIDF does not

appear, in this particular (and limited) research exercise, to be an important determinant of the direction of technological change activities in Saudi firms.

We went on to measure empirically the influence of the SIDF and other selected variables on the decision of Saudi firms to engage in nine technological change activities. Using an appropriate regression model (probit), the SIDF appeared not to be a significant factor in promoting these specific technological change activities. Two variables: namely, the size of the firm and the export orientation (whether the firms' products were destined for export or for local market) had a positive and highly significant effect on virtually all nine technological change activities.

The findings of this chapter provided empirical evidence on the role of SIDF and other important determinants of technological change in SA.

Part Five: Conclusions

Chapter Ten

Conclusions, Recommendations, and Limitations of the Study

10.1 Introduction

This chapter presents a synthesis of the findings of this study and advances some related recommendations for both the Saudi Arabian development planners and the Saudi Industrial Development Fund. Any study has its limitations, and those of this thesis are also set out in this chapter. Finally, suggestions are made for possible areas of further research.

10.2 Conclusions

This thesis began with the idea of locating and developing a precise quantitative method for measuring the influence and the role of a development bank in promoting technological change in the respective economy. It was soon discovered that such an objective is very difficult if not practically impossible to achieve. The technological role of a development bank can only be measured and analysed from several different perspectives. Because of this intrinsic lack of universally accepted methods to measure a development bank's technological role, three different approaches have been applied to triangulate our investigation of the SIDF's technological role. Case study work, econometric analysis and a field survey with related statistical analysis have all been employed in order to approach our research questions from different angles.

Due to the fact that the performance of a development bank as a technology-influencing player in the domestic industrial sector depends essentially on the nature and

ability of the bank itself, the first part of our empirical research was case study work which examined the ability and propensity of the SIDF to promote and stimulate technological change in SA. It started by looking at all incentives and penalties that might promote such change. The case study work covered the SIDF, as the supply side, and a wide range of Saudi industrial firms on the demand side.

The overall analysis of this part of the empirical work revealed that the technological role of the SIDF is not clear at the operational level and perspective. Operationally, the Fund itself does not admit specifically to a direct technological role. It was found, for instance, that very little attention has been paid by the SIDF to the technological capability of the Fund, nor is there any real co-ordination between the SIDF and other scientific and technological institutions established in SA. The SIDF itself was generally found to be more concerned about its financial role rather than its technological role. It was stated many times by SIDF officers, and by many Saudi industrial firms that the mission of promoting technological change in SA resides primarily with other government agencies and not to the SIDF.

In his classic empirical work on the factors which influence the level of technological change, Mansfield (1968 and 1977) attempted to test the hypothesis of negative correlation between investment size and the rate and direction of technological change. He found that the impact of the investment requirement on the rate of technological change is empirically significant. In our particular case we know that the SIDF provides interest-free medium and long-term loans to Saudi industrial firms in order to enable them to expand their activities, replace their equipment and introduce new and modern technology. The second part of our empirical study, therefore, concentrated on investigating the relationship between the financial assistance provided

by the SIDF and the rate of technological change. In addition, other variables were tested. The study focused on two main sectors; namely, the chemical and engineering industries. These two sectors were selected because they have expanded faster than the average of all manufacturing industries in SA. More than any other sectors, they also illustrate the degree of Saudi industrialisation and technological change.

Perhaps the most important point which emerged from the empirical analysis in Chapter Eight was the enormous importance of the SIDF in financing technological change in SA. However, we should emphasise that the focus in this part of our empirical research was primarily to explain the role of the SIDF in financing technological change, which was measured by the increasing number of newly established chemical and engineering Saudi firms.

The last part of the empirical research of this thesis examined the possible influence of the SIDF on the rate and direction of specific technological change activities in Saudi industrial firms. Our argument was that we expect a positive relation between the SIDF's funding and the extent and nature of in-house technological change activities of Saudi industrial firms. Nine technological change activities were used in order to investigate the research hypothesis. The empirical results in Chapter Nine showed that there was no observable statistical difference in the level of technological change activities between firms which received financial assistance from the SIDF and firms that received no such kind of financial assistance. This alone suggests that the SIDF may not be an important direct and perceived determinant of the direction of technological change activities in Saudi firms.

Our general conclusions are that the SIDF has vigorously participated financially in the development of the private industrial sector in the Kingdom. This has been achieved

by extending free-interest medium and long-term loans. Over the period since its inception up to the end of 1995, the Fund had been able to approve a total of 1745 loans for the erection of 1365 industrial projects located throughout the Kingdom. Commitments to these projects totalled SR. 25,842 million, of which SR. 17,491 million has been disbursed. In this study, however, we tried to focus more narrowly on the technological role of the SIDF and on the different ways in which the SIDF could contribute positively to technological change. Our investigation showed that the technological role as a strategic and operational target of the SIDF is very weak and has been largely ignored by the Saudi development planners as well as by the SIDF itself, despite the technological mission specified within the SIDF's Articles and the large volume of finance provided by the Fund. Given the technological importance of finance, one can argue that the SIDF and the Government should recognise more clearly the need for increased operational links and more comprehensive planning strategies to facilitate the simultaneous deployment of finance and technological change. These are not mutually exclusive activities, either in a positive (empirical) or normative (to achieve the best developmental policy outcome) sense.

10.3 Recommendations

The SIDF was created in 1974 and since then it has become the major promoter and supporter of Saudi industry. The mission of the Fund is to serve as a key instrument of national technological change. This involvement, however, varies in different circumstances: for example, SIDF involvement is influenced by the national technology and science policies and systems, by the relationship between government and its science and technology institutions and the SIDF, and by the technological capability of the SIDF itself.

The extent and the nature of the technology policies and systems of the country in which a development bank is operating affect the ways in which banks in general, and a development bank in particular, influence the processes of technological change. For a development bank to play an active technological role, the national government needs to have a clear technology policy which specifies the technological role of this bank. The more effective and the more coherent this policy, the more active and effective the development bank can be in playing its technological role.

On the other hand, a close relationship between a development bank and the government and its science and technology institutions can also encourage the development bank to be more effective in performing its technological role. A development bank without such relations cannot implement effective suitable technological choices, nor satisfy itself that the technologies or processes chosen by its clients are appropriate or that the terms and conditions agreed between the buyer and seller of these technologies are reasonable and equitable. The only way the bank can do this is to have very close and direct links with capable technological institutions.

The central planners in Saudi Arabia might benefit from considering the following recommendations:

1. Technological change activities should be co-ordinated.

Saudi Arabia should establish a centre to co-ordinate technological change activities in order to eliminate the duplication of research projects among different technological institutions which is a waste of money, time, and manpower.

2. Some kind of technology information system should be established.

Information plays a crucial role in promoting the process of technological change.

Saudi Arabia should establish a system for collecting statistics on S&T in order to

enable decision-makers to evaluate successfully the national S&T capabilities and to assess the national S&T needs.

3. Links between technological institutions should be promoted.

To accomplish the various objectives on the way to technological change, the Saudi planner should encourage all technological institutions as well as the SIDF to link their research activities with industrial projects. This will promote and facilitate the local technological capabilities development.

4. Awareness of the technological mission of the SIDF should be increased.

To be possible for the SIDF to function as a catalyst for both financial and technological development, the government of Saudi Arabia and the country's leadership should appreciate and acknowledge the technological role of the SIDF; and give it the appropriate weight when setting down national technology policies. This recognition will eventually be reflected in the thinking of the SIDF's officials and through them of the entire staff of the Fund. In the absence of such recognition, it is logical that the SIDF should focus essentially on profitability rather than on its own contribution to national technological change.

Another important element, if not the most important, that can affect the technological involvement of a development bank is the technological capability of the bank itself. The existence of such a capability is central to a bank's ability to take an active role in providing technical assistance to clients and their projects. It should be emphasised, however that this capability requires some inputs and management. The main ones are, firstly, the employment of a well-trained professional team which has practical technical knowledge, and secondly, building or having access to a data base of critical technological information in order to enable the bank to implement the right

technological decisions. In the case of the SIDF, a very strong emphasis has been placed on promoting the training and the development of the Fund's staff. But despite this emphasis, our study confirms that the SIDF has paid much more attention to the training of Saudi nationals in financial areas rather than in technology-related areas. Regarding the need for technological information, the analysis of Chapter Seven revealed that the SIDF has not set up any technical consultancy organisation, nor has it any sort of continuous co-ordination mechanism with another technological institution. As a result, it is proposed that the SIDF might benefit from considering the following recommendations:

1. The establishment of a centre for training and developing the Fund's staff.

A centre should be established to train Saudi nationals for the SIDF in the specialised areas of technology transfer and evaluation that might become an internal department of the SIDF. This department and its staff would accumulate, analyse and deploy technological information, which is essential for decision making both within the SIDF and for SIDF projects. The SIDF must have the ability to judge not only the financial worthwhileness of the project but also the technological influence of projects the SIDF seeks to finance.

2. The need for links between the SIDF and other technological institutions in Saudi Arabia.

One important aspect needs to be mentioned here: the establishment of links between the SIDF and science and technology policy institutions. None of the Saudi technological institutions was found to have links with the SIDF for the joint promotion of technological change. The SIDF, as far as we have been able to discover, has never been associated with the formulation of the country's science and technology policy, nor

does it have any representative from the government agencies dealing directly with science and technology on its board of directors. The SIDF should be linked formally to those technological institutions since this should have a positive effect on both the SIDF and the science and technology community.

3. Adding equity financing to the SIDF's lending activities.

The SIDF was found to be very weak in its participation in the equity of the borrowing firms despite the fact that equity participation in assisted enterprises has been shown to be among the main factors that can affect a development bank's ability to promote and stimulate national technological change. The SIDF, therefore, should explore more thoroughly this type of equity investment. However, there are associated risks which the SIDF must evaluate and consider whether they are outweighed by the associated developmental attractions of taking equity stakes.

In addition to the belief that the existence of equity participation is one of the main components of a development bank's ability to take an active technological role (as discussed in Chapter Five), this kind of arrangement would be very popular with the people of Saudi Arabia because the equity stake is similar to one of the main principles of Islamic banking. As we have seen, there are two kinds of lending in Islamic banking: firstly, a one party joint partnership, known as Mudarabah and, secondly, a multi-party joint partnership known as Musharaka. The principle is the same under both ventures. According to this Islamic principle, the SIDF can take an equity position through the credit that it provides. Thus, the SIDF can supply the funds for a productive investment in the form of a joint venture between itself and single or multiple investors.

Without equity financing added to the SIDF's portfolio of available lending activities, there is no way in which the Fund can share in the project's good fortunes, its

upside potential. Also, equity financing may assist the Saudi borrowing firm to grow faster than it could on the basis of debt finance alone. Added to this is the fact that in SA interest rate variations which might be necessary for more risky loans are simply not permitted by the Fund. The only way to compensate the SIDF for more risky loans, to encourage the Fund to be more risk-taking rather than risk-avoiding, and to make the Fund more interested in the firm instead of simply being concerned about the security of its loans is to become a partner with the firm it seeks to finance.

10.4 Limitations of the Study

This study, like any other, has some theoretical and conceptual limitations. Firstly, our investigation has sought to provide a number of answers concerning the role of a development bank; namely, the SIDF, in promoting and influencing technological change. The role of banks in influencing and promoting technological change has, however, been largely disregarded by the contemporary literature which has little to offer in this respect. Although, Jequier and Hu (1989) stated that some 300 books, articles, mimeographed papers and internal bank documents were potentially important sources of information on the technological role of banks, a closer look shows that over three-quarters of this literature does not discuss the subject directly. The researcher had to spend a great deal of time and effort collecting all the possible material related to the subject of this thesis from journal articles, numerous books and data sources. Given this relative paucity of information and data, it was difficult to replicate an established technique on data.

Secondly, there was a related problem associated with the measurement of the technological role of development banks. As stated in Chapter Five, to set forth a precise method for measuring the influence of a development bank in promoting and

stimulating technological change is very difficult, if not practically impossible. There is no single quantitative model that can be used for this task because the quantitative channels themselves are potentially many and heterogeneous. Also, important elements of the technological influence of development banks may be nonmeasurable and qualitative. Because of this lack of a universally accepted model by which a development bank's technological role can be measured, three different approaches were used in this study in order to triangulate our investigation of the SIDF's technological role. Triangulation of this kind is used in research where it is difficult to collect the kind of data or to use a single technique or model to address the main research question being explained. But in using this kind of approach, the researcher has to be very careful. Far from being an easy or safe play of attack, it is in reality a difficult approach to apply successfully. It requires a deep knowledge of the cognate literature, very good synthesising skills, and a competent knowledge of how to apply the different research methodologies used.

The third source of limitation comes from data availability. In general, this type of research calls for an extensive effort from the researcher. In order to gather much of the required data, the researcher had to travel to the SIDF's headquarters. Some of the data required in the questionnaire were classified by both the officials at the SIDF and the Saudi firms as confidential. Although this lack of information must affect the robustness of the research's findings, it felt by the researcher to be unlikely to alter the general conclusions which have been drawn.

This study was also affected by some other limitations, such as the Gulf War which had a negative effect not only on the Saudi economy, but also because of restrictions imposed on government agencies and officials regarding the disclosure of economic and

financial information. The researcher experienced some difficulty when gathering information and when encouraging individuals to answer some questions.

10.5 Suggestions for Further Research

In addition to the forgoing recommendations which are addressed to Saudi planners and to officials at the SIDF, many of the concepts and conclusions developed in this thesis seem to indicate areas for further research.

1. Although this thesis has tried to shed some light on the technological role of a development bank, the present lack of universally accepted and tested empirical methods by which a development bank's technological role can be measured should indicate that measurement standards is an area for further research.
2. The lack of adequate data was also a factor in this researcher's decision not to cover all the possible angles of the SIDF's technological role. A study of the technological role of the SIDF could be made through an analysis of the technical evaluations of borrowing projects undertaken by the Fund. This suggests that a detailed series of project - by - project case studies of how SIDF carries out its project applications analyses would provide farther useful data on SIDF polices and the impact of the SIDF on the level of Saudi technological change.
3. It can be seen from the literature review on development banking that quite a few comparative studies have been undertaken to evaluate the operational and financial performance of development banks. It would be worth undertaking more comparative cross country studies on the performance of development banks in general and their technological performance in particular. Such studies would be very useful and have a positive effect on future assessment of development banks.

APPENDIX 1

Statute of the Saudi Industrial Development Fund

KINGDOM OF SAUDI ARABIA

STATUTE OF THE SAUDI INDUSTRIAL

DEVELOPMENT FUND (SIDF)

GOVERNMENT PRESS RIYADH

Mecca, 1394 H,

IN THE NAME OF GOD, THE MOST
GRACIOUS, THE MOST MERCIFUL

NO. : M/3.

DATED : 26 — 2 — 1394 AH

We, Faisal bin Abdulaziz Aal Saoud, Monarch of the Kingdom of Saudi Arabia.

After Perusing Article (19) of the Council of Ministers' Regulations issued by the Royal Decree No. (38) dated 22 — 10 — 1377AH.

And after reviewing the Council of Ministers' decision No. (172) dated 23 — 2 — 1394 AH.

We ordain the following :

- 1) The approval of the attached statute of the Saudi Industrial Development Fund (SIDF).
- 2) Both Deputy Premier and minister of Finance and National Economy shall put this decree of ours into effect.

(SIGNATURE)

FAISAL

**STATUTE OF THE SAUDI INDUSTRIAL
DEVELOPMENT FUND (SIDF)**

ARTICLE ONE : Fund, Establishment, Name and Centre :

According to this statute, there shall be established a fund known as (the Saudi Industrial Development Fund) with a juridical abstract identity, represented by its Chairman and have its headquarters in Riyadh city. In order to maintain its activities, the Fund can establish branches and or nominate agents in other towns. Administratively, the Fund shall be attached to the Ministry of Finance and National Economy.

ARTICLE TWO : Objectives of the Fund :

The Fund aims to support the national industrial development sector of the Kingdom's economy by :

1. Offering interest free medium or long term loans to the newly established industrial institutions within the Kingdom.
2. Offering interest free medium and long term loans to the existing Private industrial institutions to enable them to expand their activities, replace their equipment and introduce new modern technology.
3. Offering, if needed and when possible, economic, technical or administrative advice to the industrial institutions within the Kingdom.

ARTICLE THREE : Powers of Authority :

The Fund shall have all powers of authority necessary to attain its objectives contained in this statute, i. e. the Fund can

within the scope of authorised activities, conclude loan agreements and other agreements, accept mortgages and other securities for its loans, own, mortgage or sell properties of all kinds whether movable or immovable, borrow or undertake any other liabilities.

ARTICLE FOUR : Investment and Loan Policy :

1. The Government industrial policy shall constitute the broad guidelines for the Fund activities regarding the support and encouragement of industry in the Kingdom. To achieve this goal, the Fund shall cooperate and coordinate with specialized Government Agencies and Institutions.
2. The Fund shall conduct a full fledged evaluation to determine the economic feasibility of each project requested to be financed taking into consideration its sound management, so as to ascertain its feasibility with respect to the economic, financial and technical aspects.
3. When examining projects to be financed, the Fund shall investigate whether the required total financing of the project has been reasonably conducted and, whether the size of the Fund's help represents a reasonable percentage of such requirements.
4. The Fund shall obtain sufficient securities from the owners of industrial projects to be financed proportional to the size of the financial aid rendered by the Fund.
5. To ensure that everything is regularly progressing according to the specified plan, the Fund shall supervise the execution of the financed industrial projects, and offer its advice regarding the problems and difficulties besetting each project. This supervision can be carried on through reports and inspection visits carried out by the specialized Fund official.

6. The Fund should not finance more than 25% of the financing capital required for the execution or the development of the project.
7. The Fund should not give loans to cover the requirements of the working capital.
8. The loan repayment period shall, under any circumstances, not working capital.
9. As decided by the Board of Directors, the Fund shall charge reasonable fees to meet the expenses incurred during the carrying on of its activities.
10. The Fund shall fix a maximum amount of the loan advanced in any project.
11. The Fund can invest its surplus funds, if any, in short term investments inside or outside the Kingdom until such funds are used in the Funds activities. The Fund should investigate the availability of both the liquidity and security factors of such investments. The income resulting from these investment shall be added to the Fund resources.

ARTICLE FIVE : The Capital of the Fund :

The capital of the fund shall be (500) million Saudi Riyals. This can gradually be paid by the Ministry of Finance and National Economy as agreed upon with the fund. The capital can be increased by a Council of Ministers' Decree according to the Minister of Finance and National Economy recommendation.

ARTICLE SIX :

The loans given by the Fund enjoy the same advantages and guarantees bestowed to the public treasury rights and will be collected as any other state funds, in accordance with the regulations govern the collection of state funds.

ARTICLE SEVEN : The Fund,s Board of Directors :

The Fund shall have a five — member Board of Directors including the Chairman. The members shall be appointed by the Council of Ministers according to the Minister of Finance and National Economy recommendation for a period not exceeding four years. The members can be re - appointed for another period or periods. The Council of Ministers shall fix the remunerations paid to the Chairman and the members of the board. The board will be responsible for execution of the Fund's activities and its general policies.

ARTICLE EIGHT : Board of Directors Meetings :

The Board of Directors shall assemble upon its Chairman's request whenever needed. It shall elect a Vice Chairman to assist the Chairman during his presence and act on his behalf during his absence. The meetings will not be legal unless attended by the majority of its members. Decisions shall be made by the majority of the attending members. In case the votes are equal, the chairman's side will prevail.

ARTICLE NINE : The Director General and the Assistant Director General of the Fund :

The Fund shall have a Director General and an Assistant Director General. The Director General shall be responsible to the Board of Directors regarding the execution, implementation and support of the Fund policy together with its regulation and the Board's decisions. The Director General shall attend the Board meetings, participate in its debates, sign minutes but shall not have a vote during its deliberations.

ARTICLE TEN : The Funds Regulations :

The Board of Directors of the Fund shall issue the necessary regulations for its administration.

ARTICLE ELEVEN :

The Fund may enter into an agreement with a well reputed international institution or institution to provide the Fund with technical and professional services under agreed terms and for a limited number of years. These agreements can be renewed upon the option of the Board of Directors. These contracted institutions or institution shall perform services including the provision of a Director General for the Fund as from the date the fund commences its activity for a mutually agreed period of time.

ARTICLE TWELVE : Fund Auditor :

The Board of Directors shall appoint a highly qualified auditor or auditors to perform the usual auditing duties together with any internal auditing decided by the fund's regulations or by its Board of Directors. The Board of Directors shall determine the auditor's fees and his employment's period. The auditor can be reappointed.

ARTICLE THIRTEEN : The Fiscal Year :

The fiscal year of the Fund is corresponding with the State Fiscal Year.

ARTICLE FOURTEEN : The Board of Directors' Report :

The Board of Directors shall submit to the Minister of Finance and National Economy within four months following each fiscal year, a report regarding the activities and accountancies. Such report has to be certified by the Chartered Accountants. The Minister, after attaching his comments on this report, will submit it to the Council of Ministers for consideration, approval or for issuing necessary instructions. Whenever ratified, the report shall be published in the official newspaper (GAZETE).

APPENDIX 2

Supplementary Data on the Saudi Arabian Economy

Table A-1

Gross Domestic Product by Oil and Non-oil Sectors in Producers' Values

Million Saudi Rivals (in current prices)

	1969	1974	1979	1984	1986	1988	1989	1990	1991	1992	1993
a. Oil Sector											
Mining of crude oil & natural gas	7,741	92,800	187,745	120,305	61,262	61,711	83,847	130,801	149,575	174,942	147,703
Petroleum refining	1,093	5,129	10,568	13,824	5,894	9,675	9,405	12,415	10,655	18,673	15,765
Construction associated thereof	191	701	213	(1,573)	305	(2,270)	(2,503)	3,244	(2,494)	(7,091)	(5,104)
Sub-Total:	9,025	98,630	198,526	132,556	67,461	69,116	90,749	146,460	157,736	186,524	158,364
b. Non-oil Sectors											
Private Sector	5,279	14,192	71,360	129,998	123,66	126,812	130,045	139,008	148,127	156,365	162,760
Government Sector	2,307	7,572	54,185	84,871	76,699	80,981	83,289	99,525	119,056	109,409	113,441
Sub-Total:	7,586	21,764	125,545	214,869	200,385	207,793	213,334	238,533	267,183	265,774	276,201
c. Summation											
Gross domestic product in producers' values	16,611	120,394	324,071	347,425	267,846	276,909	304,083	384,993	424,919	452,298	434,565
Import Duties	271	442	2,160	3,973	3,245	8,236	6,740	7,000	7,000	9,100	9,277
Gross domestic product in purchasers' values	16,882	120,836	326,231	351,398	271,091	285,145	310,823	391,993	431,919	461,398	443,842

Source: Ministry of Planning (MOP), 1990 and 1995.

Table A-2

Gross Domestic Product by Oil and Non-oil Sectors in Producers' Values

Million Saudi Rivals (at 1984 constant prices)

	1969	1974	1979	1984	1986	1988	1989	1990	1991	1992	1993
a Oil Sector											
Mining of crude oil & natural gas	96,946	233,048	276,081	120,305	141,327	147,811	146,658	183,016	232,543	240,357	231,226
Petroleum refining	8,157	10,260	12,995	13,824	17,579	26,025	23,871	25,062	29,171	39,077	37,589
Construction associated thereof	4,044	5,679	(1,467)	(1,573)	(7,603)	(15,992)	(15,732)	(15,010)	(13,243)	(9,595)	(7,777)
Sub Total:	109,147	248,987	287,609	132,556	151,303	157,844	154,797	193,068	248,471	269,839	261,038
b Non-oil Sectors											
Private Sector	27,592	43,576	86,785	129,998	126,794	131,011	132,842	137,842	140,033	143,581	141,840
Government Sector	21,100	34,661	74,431	84,871	82,410	88,729	90,389	103,369	109,990	103,046	108,623
Sub-Total:	48,692	78,237	161,216	214,869	209,204	219,740	223,231	241,211	250,023	246,727	250,463
c Summation											
Gross domestic product in producers' values	157,839	327,224	448,825	347,425	360,507	377,584	378,028	434,279	498,494	516,566	511,501
Import Duties	2,956	3,318	3,506	3,973	3,314	8,605	6,990	7,202	7,202	7,925	7,999
Gross domestic product in purchasers' values	160,795	330,542	452,331	351,398	363,821	386,189	385,018	441,481	505,696	524,491	519,500

Source: MOP, 1990 and 1995.

Table A-3

Average Annual Growth Rates of Gross Domestic Product by Oil and Non-oil Sectors and Kind of Economic Activity in Producers' Values

-% (at 1984 constant prices)

	1969- 74	1974- 79	1979- 84	1984- 87	1988	1989	1990	1991	1992	1993	1969- 93
a Non-oil Sectors											
Agriculture, forestry & fishing	3.5	6.9	10.4	16.5	10.8	7.0	7.0	1.3	1.8	1.2	8.7
Mining & quarrying	12.7	7.2	7.8	-2.9	1.2	3.4	3.3	2.2	1.1	1.0	5.6
Manufacturing	11.6	15.2	15.2	0.3	3.0	4.0	6.1	1.2	1.9	1.5	10.2
Electricity, gas & water				-6.0	-6.0	-5.1	-5.0	-6.5	-6.5	-6.5	
Construction	20.9	28.8	-0.1	0.2	0.1	-0.9	-1.6	-2.7	4.6	-1.7	10.4
Trade etc	12.5	22.9	9.6	-1.8	-1.0	-1.0	2.0	0.8	1.2	0.7	10.0
Transports, storage & communication	9.0	10.5	7.8	-1.8	1.0	0.5	3.5	-12.8	1.4	0.7	6.0
Finance, insurance, real estate & business services	11.9	16.8	4.6	-8.0	3.9	2.1	3.1	1.6	0.8	0.7	6.1
Community, social & personal services	7.2	11.8	5.6	2.8	3.2	1.5	3.0	0.6	0.8	1.0	6.2
Government services	6.7	7.3	7.6	1.8	0.3	2.7	24.6	16.9	-5.0	5.4	6.6
Sub-Total:	9.9	15.6	5.9	0.2	1.7	1.6	8.1	3.7	0.3	1.5	7.5
b Oil Sector											
Mining of crude oil & natural gas	19.2	3.4	-15.3	4.8	21.9	-0.8	24.8	27.1	7.1	-3.8	0.2
Petroleum refining	4.7	4.8	1.2	18.3	15.1	-8.3	5.0	16.4	7.0	-3.8	6.2
Construction associated thereof	7.0			-124.6	-11.2	1.6	4.6	11.8	11.8	11.8	
Sub-Total:	17.9	2.9	-14.4	2.9	21.9	-1.9	24.7	28.7	5.2	-3.3	0.3
c Summation											
Gross domestic product in producers' values	15.7	6.5	-5.0	0.17	9.2	0.1	14.9	14.8	2.8	-1.0	3.1
Import duties	2.3	1.1	2.5	-2.9	140.4	-18.8	3.0	0.0	10.0	0.9	3.9
Gross domestic product in purchasers' values	15.5	6.5	-4.9	0.13	10.6	-0.3	14.7	14.5	2.9	-1.0	3.1

Source: MOP, 1990 and 1995.

Table A-4

Percentage Distribution of Gross Domestic Product by Oil and Non-oil Sectors and Kind of Economic Activity in Producers' Values

(at 1984 constant prices)

	1969	1974	1979	1984	1986	1988	1989	1990	1991	1992	1993
a Non-oil Sectors											
Agriculture, forestry & fishing	2.6	1.5	1.6	3.3	4.3	5.3	5.7	5.3	4.7	4.4	4.5
Mining & Quarrying	0.3	0.3	0.3	0.5	0.5	0.4	0.5	0.4	0.4	0.3	0.4
Manufacturing	1.2	1.0	1.5	3.9	3.8	3.7	3.9	3.6	3.2	3.0	3.1
Electricity, gas & water	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Construction	3.2	4.0	10.4	13.2	11.1	12.0	11.9	10.2	8.7	10.5	10.4
Trade etc	2.4	2.1	4.2	8.6	8.0	7.4	7.3	6.5	5.7	5.6	5.7
Transports, storage & communication	4.0	3.0	3.6	6.8	6.4	5.9	6.0	5.4	4.1	4.6	4.7
Finance, insurance, real estate & business services	3.4	2.9	4.6	7.4	5.5	5.4	5.5	4.9	4.4	4.1	4.2
Community, social & personal services	1.9	1.3	1.6	2.8	2.9	2.8	2.8	2.6	2.2	2.1	2.2
Government services	11.4	7.7	8.0	14.8	15.2	14.3	14.7	16.0	16.3	12.4	13.2
Sub-Total:	30.3	23.7	35.6	61.1	57.5	56.9	58.0	54.6	49.4	47.0	48.2
b Oil Sector											
Mining of crude oil & natural gas	60.3	70.5	61.0	34.2	38.8	38.3	38.1	41.5	46.0	45.8	44.5
Petroleum refining	5.1	3.1	2.9	3.9	4.8	6.7	6.2	5.7	5.8	7.5	7.2
Construction associated thereof	2.5	1.7	-0.3	-0.4	-2.1	-4.1	-4.1	-3.4	-2.6	-1.8	-1.5
Sub-Total:	67.9	75.3	63.6	37.7	41.6	40.9	40.2	43.7	49.1	51.4	50.2
c Summation											
Gross domestic product in producers' values	98.2	99.0	99.2	98.9	99.1	97.8	98.2	98.4	98.6	98.5	98.5
Import duties	1.8	1.0	0.8	1.1	0.9	2.2	1.8	1.6	1.4	1.5	1.5
Gross domestic product in purchasers' values	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: MOP, 1990 and 1995.

Table A-5

Percentage Distribution of Gross Domestic Product by Oil and Non-oil Sectors and Kind of Economic Activity Within Sectors

(at 1984 constant prices)

	1969	1974	1979	1984	1986	1988	1989	1990	1991	1992	1993
a Non-oil Sectors											
Agriculture, forestry & fishing	8.7	6.5	4.4	5.4	7.5	9.3	9.7	9.6	9.4	9.4	9.4
Mining & quarrying	1.0	1.2	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7
Manufacturing	3.9	4.2	4.2	6.3	6.7	6.5	6.7	6.5	6.4	6.4	6.4
Electricity, gas & water	-0.3	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4
Construction	10.5	16.9	29.1	21.7	19.3	21.0	20.5	18.7	17.6	22.3	21.6
Trade etc	7.8	8.7	11.9	14.1	14.0	13.0	12.6	11.9	11.6	11.9	11.8
Transport, storage & communication	13.3	12.7	10.1	11.1	11.1	10.4	10.3	9.8	8.3	9.8	9.7
Finance, insurance, real estate & business services	11.1	12.1	12.8	12.0	9.5	9.4	9.5	9.1	8.9	8.8	8.7
Community, social & personal services	6.2	5.4	4.6	4.5	5.1	4.9	4.9	4.7	4.5	4.5	4.5
Government services	37.7	32.5	22.4	24.2	26.4	25.1	25.3	29.2	32.9	26.4	27.4
Sub-Total:	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
b Oil Sector											
Mining of crude oil & natural gas	88.8	93.6	96.0	90.8	93.4	93.6	93.6	94.8	93.6	89.1	88.6
Petroleum refining	7.5	4.1	4.5	10.4	11.6	16.5	15.4	13.0	11.7	14.5	14.4
Construction associated thereof	3.7	2.3	-0.5	-1.2	-5.0	-10.1	-10.2	-7.8	-5.3	-3.6	-3.0
Sub-Total:	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: MOP, 1990 and 1995.

Table A-6

**Receipts & Disbursements of Current Account
of Balance of Payments**

-Million Saudi Riyals-

	1970	1974	1979	1984	1986	1988	1989	1990	1991	1992	1993
Receipts											
Merchandise exports fob	9 401	106 969	194 957	131 871	74 529	91 060	106028	165 889	180 580	176199	168218
Other goods, services & income Credit	1 274	9 241	32 788	62 019	51 639	47 970	48 741	45 682	44 513	40652	36151
Total (Receipts)	10 675	116 210	227 745	193 890	126 168	139 030	154 721	211 571	225 093	216851	204369
Disbursements											
Merchandise imports fob	3 731	12 670	70 278	100 629	63 201	74 170	72 020	80 480	97 831	113278	96984
Other goods, services & income Debit	5 436	16 358	98 750	129 797	77 751	58 613	77 859	87 139	147 871	126303	98351
Private unrequited transfers	824	1 839	12 650	18 620	17 791	24 380	30 949	43 449	51 479	50171	58860
Official unrequited transfers	355	3 600	11 770	12 679	11 110	9 359	48 239	16 482	24 301	5621	3520
Total (Disbursements)	10 356	34 467	193 448	261 725	169 853	166 522	229 067	227 550	321 482	295373	257715
Balance											
Current account balance	319	81 743	34 297	(67 835)	(43 685)	(27 492)	(74 346)	(15 979)	(96 389)	78522	53366

Source: MOP, 1990 and 1995.

Table A-7

Percentage Distribution of Merchandise Exports by Main Sections

Years	1970	1974	1979	1984	1986	1988	1989	1990	1991	1992	1993
Crude Petroleum	83.2	94.3	93.9	86.6	73.0	60.3	66.4	74.1	78.1	78.8	75.5
Petroleum Products	16.5	5.5	5.2	10.0	17.0	22.6	18.4	16.2	13.3	10.2	15.6
Other	0.3	0.2	0.9	3.4	10.1	17.1	15.1	9.7	8.6	11.0	8.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: MOP, 1990 and 1995

APPENDIX 3

**Questionnaire and letters of request for Interviews and information
from the SIDF**

الدور التكنولوجي لصندوق التنمية الصناعية السعودي

THE TECHNOLOGICAL ROLE OF THE
SAUDI INDUSTRIAL DEVELOPMENT FUND (SIDF)

الباحث

خالد عبد العزيز السهلاوي

جامعة شمال ويلز

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

حفظه الله

المكرم الأخ العزيز

السلام عليكم ورحمه الله وبركاته .

وبعد ، ،

إن مساهمة البنوك الصناعية في خلق قاعدة التنمية الحقيقيه والأمنه للدول أمر مؤكد . لذلك فإن دراسة الدور التكنولوجي لهذه البنوك يعد خطوة في زيادة وتطوير تلك المساهمه . والاستبانه التي بين يديك تهدف إلى إستطلاع رأيك كمستول في هذه الشركه للمساعده في التعرف على الدور التكنولوجي الذي يقوم به صندوق التنمية الصناعي السعودي والعوامل المؤثرة فيه .

أخي الكريم أن تكرمك بجزء قصير من وقتك الثمين لتعبئة هذه الاستبانه سيساعد كثيراً في تحقيق أهداف الدراسة . كما لايفوتني أن أؤكد لك على سرية المعلومات التي ترد في الاستبانه وإنها لن تستخدم في غير الاغراض العلمية للدراسة ، ومع شكري وتقديري فأنتني أرجو من سعادتكم حال الانتهاء من تعبئة هذه الاستبانه سرعة إرسالها على العنوان التالي : - (جامعة الملك فيصل - كلية العلوم الادارية والتخطيط - ص . ب (١٧٦٠) الاحساء ٣١٩٨٢) والسلام عليكم ورحمه الله وبركاته .

Dear Brother :

Banks exert an important and largely noticable influence in the process of technological change , and for this reason Iam currently conducting doctoral research on the role of finance in promoting technological change in Saudi Arabia . In order to continue my research , this questionnaire form has been designed to help examine the role of the Saudi Industrial Development Fund (SIDF) in promoting technological change in Saudi Arabia .

Your opinion is very important as a preliminary step towards the assessment of the SIDF 's technological role .

Your responses to the questions in the questionnaire will be treated as confidential and ononymous and will be reported only in the form of statistical analyses .

I will be extremely grateful if you could spare the time to complete the enclosed questronnaire as soon as possible and return it to me at the following address .

Yours faithfully
Khalid A . ALSahlawi, Phd Student at
Universsity of North Wales at Bangor
School of accounting , Banking , and Economics

Khalid A . Alsahlawi
King Faisal University
College of Management Science and
Planning
P . O . Box 1760
AL Hassa , 31982

معلومات عامه حول الشركة
General information about the firm

The name of the firm : أسم الشركة :

Date of establishment : سنه التأسيس :

Total of capital investment : إجمالي رأس المال :

Source (s) of finance : مصادر التمويل :

Private خاص

Private + Loans from the SIDF خاص + قروض من صندوق التنمية الصناعيه السعودي

Private + Loans from commercial banks خاص + قروض من بنوك تجارية

Private + loans from the SIDF + Commercial banks خاص + قروض من صندوق التنمية الصناعيه السعودي + بنوك تجاريه

Joint venture تمويل خاص + شريك أجنبي

Joint venture + SIDF تمويل خاص + شريك أجنبي + قروض من صندوق التنمية الصناعيه السعودي

Joint venture + Commercial banks تمويل خاص + شريك أجنبي + بنوك تجارية

Other (please specify) أخرى (أرجو التحديد)

Date of obtaining SIDF's loan (s) : تاريخ الحصول على قرض من صندوق التنمية الصناعيه السعودي :

The products of the firm are destined for : إنتاج الشركة موجه لـ :

Export التصدير

Local market السوق المحلي

Both export and local market التصدير + السوق المحلي

س ١ : كيف تم التعرف على تقنية الانتاج بالشركة ؟

- مجهودات الشركة الذاتية
 مجهودات الشركه وبمساعدة صندوق التنمية الصناعي السعودي
 ترخيص من شركة أجنبية
 أخرى (أرجو التحديد)

1- Indicate the original source(s) of production technique

- The firm's R & D activity
 Indigenous R & D activity in coordination with SIDF
 Licensing from international firm
 Other (please specify)

س ٢ : من أين تم الحصول على الآلات والمعدات المستخدمة في الشركة ؟

- من الخارج وحسب طلب الشركه
 من الخارج وحسب طلب الشركه وبتوجيه من صندوق التنمية الصناعي السعودي
 أخرى (أرجو التحديد)

2- Indicate the initial source(s) of the firm's machinery and equipment

- Foreign suppliers of our choice
 Foreign suppliers of our choice in coordination with the SIDF
 Other (please specify)

س ٣ : هل تعتقد أن توجيه صندوق التنمية الصناعي السعودي أمر مفيد في تحديد مصادر الآلات والمعدات المستخدمة في الشركة ؟

- لا نعم

3-Do you think that your coordination with the SIDF is important in determining the initial source(s) of your firm's machinery and equipment ?

- yes no

س ٤ : إذا كنت تعتقد أن توجيه الصندوق أمر مفيد في تحديد مصادر الآلات والمعدات المستخدمة في الشركة ، فأرجوا تحديد أسباب ذلك ؟

- مساعدة الشركة في التعرف على أفضل المصنعين لهذه الآلات والمعدات .
- مساعدة الشركة في التعرف على ماهو متاح من آلات ومعدات داخل المملكة .
- مساعدة الشركة في الحصول على أفضل الآلات والمعدات من حيث النوع .
- مساعدة الشركة في الحصول على أفضل الآلات والمعدات من حيث السعر .
- أخرى (أرجو التحديد) .

If you think that your coordination with the SIDF is important in determining the initial source of your firm's machinery and equipment , please specify why ?

- Helping our firm knowing the best producers of this machinery and equipment .
- Helping our firm knowing what machinery and equipment produced in saudi arabia.
- Helping our firm knowing the best kind of machinery and equipment can be used.
- Helping our firm knowing the best price of machinery and equipment that can be used.
- Other (please specify)

س ٥ : هل لدى الشركة إدارة خاصة لتصميم وتطوير منتجات جديدة ؟

لا

نعم

- Do you have special department for designing and developing new products ?

yes

no

س ٦: هل حدث وأن قامت الشركة بتطوير أو ابتكار منتج ما ؟

لا

نعم

6- Has your firm ever been involved in new product development and / or upgrading of existing products ?

yes

no

س ٧ - إذا كانت الاجابة بنعم ، متى يحدث ذلك ؟

بصفة مستمره

حسب الحاجه

7- If your answer to the previous question is yes , how often these activities been carried out ?

Regularly and systematically , or

On an adhoc basis , and as and when the need arises

س ٨ : إذا حدث وأن قامت الشركة بتطوير أو ابتكار منتج ما ، فإين يتم ذلك ؟

إدارة البحوث والتطوير بالشركه

مراكز بحوث وتطوير أخرى مرتبطه بالشركه

أخرى (أرجو التحديد)

8- If your firm has been involved in new product development , where does this activity usually take place ?

In our R & D department

In other establishment's R & D

Other (please specify)

س ٩- هل طرق الانتاج المستخدمه في الشركه هي ذاتها الموجوده وقت تأسيس الشركه ؟

لا

نعم

9- Are the production methods being used now similar to those been used at the time of establishment of the firm ?

yes

no

س ١٠ : إذا كانت الإجابة بالنفي ، ماهي أوجه الاختلاف ؟ (أرجو عدم وضع إشاره حول النقاط التي ليس لها علاقة)

الوقت اللازم للإنتاج أقل مما كان عليه

تطور في نوعية المنتج

توفير في عدد العماله

توفير في تكاليف الانتاج

10 -If your reply to the previous question is no , what are the differences ? Please leave blank those activities which are not related .

The time of production is less

Better quality

Less manpower are used

Reduction in production costs

س ١١ - هل تعاني الشركة من أي صعوبه في تطوير طرق الانتاج المستخدمة في الوقت الحاضر ؟

لا

نعم

11- Are there any difficulties at this time preventing your firm from developing the current production methods ?

yes

no

س ١٢ : إذا كانت الإجابة بنعم ، هل حدث وأن حاولت الشركة الاستفادة من الخبرات التقنيه لصندوق التنمية الصناعيه السعودي ؟

لا

نعم

12- If your answer to the previous question is yes , have you ever sought technical assistance from the SIDF ?

yes

no

س ١٣ : هل في أي وقت من الأوقات ومنذ تأسيس الشركة حدث وإن قامت الشركة بتطوير أو رفع مستوى ونوعية الآلات والمعدات المستخدمه بالشركة ؟

لا

نعم

13- Have you ever , since the establishment of your firm , been involved in developing and , or upgrading any of the firm's machinery and equipment ?

yes

no

س ١٤ : إذا كانت الإجابة بنعم ، أرجو تحديد أين تم ذلك ؟

- إدارة البحوث والتطوير بالشركة
 مراكز بحوث وتطوير أخرى مرتبطة بالشركة
 أخرى (أرجو التحديد)

14- If your answer to the previous question is yes , where it has been taken place ?

- In our R & D department
 In other establishment's R & D
 Other (please specify)

س ١٥ : ماهي نسبة المعدات والآلات التي أنتجت أو طورت بواسطة الشركة إلى إجمالي معدات وآلات الشركة ؟

- أقل من ٥%
 ٥% إلى أقل من ١٠%
 ١٠% إلى أقل من ٢٠%
 ٢٠% إلى أقل من ٤٠%
 ٤٠% إلى ٦٠%
 أكثر من ٦٠%

15- What % of your total productive machinery and equipment is produced or developed by your own Firm ?

- Less than 5%
 5% - Less than 10%
 10% - Less than 20%
 20% - Less than 40%
 40% - 60%
 More than 60%

س ١٦ : أثناء هذا التطوير هل حدث وإن استفادت الشركة من الخبرات التقنية لصندوق التنمية الصناعي السعودي ؟

- لا
 نعم

16- In the process of this development , have you ever received any sort of technical assistance from the SIDF ?

- yes
 no

س ١٧ : إذا كانت الإجابة بنعم ، فما طبيعة هذه الاستفادة ؟

17- If your reply to the previous question is yes , please give details of the kind of assistance you have received ?

س ١٨ : هل في أي وقت مضى حدث وإن واجهت الشركة أي مشكلات تقنية ؟

لا نعم

18 - Has your firm, in the past few years , experienced any technical problems ?

yes no

س ١٩ : إذا كانت الإجابة بنعم ، هل صندوق التنمية الصناعي السعودي يمكن تصنيفه من ضمن الجهات التي تم الاستفادة منها لمعالجة مثل هذه المشكلات ؟

لا نعم

19- If your answer to the previous question is yes ,Have you ever sought technical assistance from the SIDF ?

yes no

س ٢٠ : إذا كانت الإجابة بنعم ما طبيعة هذه الاستفادة ؟

20- If your reply to the previous question is yes , please specify the nature of such technical assistance ?

س ٢١ : حدد درجة أهمية كل من النشاطات التالية التي تقوم بها الشركة من أجل دعم وتطوير التقدم التكنولوجي بها؟

العملية	مهم جداً	مهم	مهم إلى حد ما	غير مهم	غير مهم على الإطلاق
البحث لإيجاد منتجات وطرق إنتاج جديدة					
البحث لتطوير ورفع مستوى المنتجات ووسائل الانتاج المتاحة					
البحث لتوظيف المنتجات وطرق الانتاج لما يتناسب ورغبات السوق المحلي					
البحث لتخفيض تكاليف الإنتاج					
البحث لتحقيق أقصى إستفادة ممكنه من نفس الطاقه الانتاجيه					
البحث لتحقيق أقصى إستفادة ممكنه من القوى العامله المتاحة بالشركه					

21-What is the relative importance of each of the following technological change activities in your firm ?

The activity	very important	important	slightly important	not important	not important at all
Search for new products and processes					
Search in order to upgrade the existing products and processes					
Search in order to adapt the products and processes to local conditions					
Search in order to reduce the production cost					
Search in order to maximise the yield from existing plant capacity					
Search in order to maximise the technical skills of firm's labour					

س ٢٢ : إذا جاز لنا أن نعرف التقدم التكنولوجي ليشتمل جميع النشاطات التي تم ذكرها في السؤال السابق ، فما هي نسبة إنفاق الشركة على هذه النشاطات إلى إجمالي مبيعات الشركة السنويه ؟

- أقل من ٢% ٥% إلى ٧%
 ٢% إلى أقل من ٥% أكثر من ٧%

22- If we defined technological change activities to include all the activities mentioned in the previous question , what % do you spend on these activities as a proportion of the firm's annual sales?

- less than 2% 2% - less than 5%
 5% - 7% More than 7%

الجزء الثاني

هذا الجزء ارجو الاجابه عليه في حاله حصول شركتكم على تمويل من صندوق التنمية الصناعي السعودي
 . اما في حالة عدم حصول شركتكم على اي مساعدة من الصندوق فأرجو إعادة الاستبانة مع جزيل

الشكر

Part Two

" If you have received assistance from the SIDF , please complete part two of the questionnaire . If not please return the questionnaire and thank you for your assistance "

س ١ : هل دعم وتطوير التقدم التكنولوجي في المملكة من بين أهداف صندوق التنمية الصناعي السعودي ؟

لا

نعم

1 - Do you think the SIDF is truly committed to fostering technological change in SA ?

yes

no

س ٢ : أيهما في أعتقادك أكثر أهمية بالنسبة لصندوق التنمية الصناعي السعودي ؟

الحصول على عائد مالي جيد أو

نوعية الخدمات التقنيه التي يقدمها لعملاء

2-Which is more important for the SIDF

Having a good and a high profitability , or

Concentrating on the quality of its technological advice and assistance to entrepreneurs .

س ٣ : كم مشروع حاصل على تمويل من صندوق التنمية الصناعي السعودي ، حدد المصدر الذي من خلاله تم إستنباط فكرة المشروع (يمكن إختيار أكثر من مصدر)

خطط التنمية السعودية

صندوق التنمية الصناعي السعودي

أصحاب المشروع بالتعاون مع الصندوق

الدار السعودية للاستشارات الفنية

أخرى (أرجو التحديد)

3- As a project recieved financial assistance from the SIDF , Please indicate the main source(s) of your project's idea

The Saudi Development Plans

The SIDF

The intereaction between the SIDF and the owners of your firm

The Saudi Consulting House

Other (Please specify)

س ٤ : أي من الاعتبارات التالية في رأيكم تم التركيز عليها من قبل الصندوق عند دراسة طلب الشركة الحصول على قرض مالي ؟

مصدر الآلات والمعدات المقترح شراؤها

نوع هذه الآلات والمعدات

سعر هذه الآلات والمعدات

قدرة المشروع على إستخدام الآلات والمعدات المقترحة

دور هذه الآلات والمعدات في تنمية القدرات الفنية المحلية (سعوديين)

أخرى (أرجو التحديد)

4 - Which of the following do you believe are considered by the SIDF to be important in their evaluation of your project ?

The source of technology used

The kind of technology used

The price of technology used

The fitness of technology used with the project

The possibility that the technology used should promote the saudi technical skill

Other (please specify)

س ٥ : من لعب دور أكبر في إختيار الآلات والمعدات المستخدمه في المشروع - الصندوق أم الشركة ؟

5- Who plays more important role in chosing the needed technology , the SIDF or the firm ?

س ٦ : هل أنت راضى عن الدور التكنولوجي الذي يلعبه صندوق التنمية الصناعي السعودي ؟

لا

نعم

6 - Are you satisfied with the technological role played by the SIDF ?

yes

no

س ٧ : أياً كانت الاجابه ، ماأسباب ذلك ؟

7- What ever your answer , Please give your reasons ?

س ٨ : كيف من فضلك تعتقد أنه يمكن للصندوق أن يطور من قدرته ومساهمته في دعم وتطوير التقدم التكنولوجي في المملكة ؟

8- How do you think the SIDF can improved its ability to promote technological change in SA ?



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Bangor, Gwynedd LL57 2DG.
Ffôn: (01248) 351151
Llinell Uniongyrchol: (01248) 382158
Ffacs: (01248) 364760

Our ref: EPMG/EAF

5 December 1995

To whom it may concern

Khalid Alsahlawi

This letter is to certify that Khalid A.M. Alsahlawi who is reading for a PhD in Finance under my supervision, will need to undertake some field study work in Saudi Arabia. His PhD research is analysing the financial role of the Saudi Industrial Development Fund and this research will necessitate collecting some relevant data in Saudi Arabia.

Professor E.P.M. Gardener

KINGDOM OF SAUDI ARABIA

Ministry of Higher Education

KING FAISAL UNIVERSITY



المملكة العربية السعودية
وزارة التعليم العالي
جامعة الملك فيصل

الرقم: ١٧/٤٠ التاريخ: ١٤٢٣/١٥ المرققات:

الموضوع: كفاية ابراهيم على الجواسر

حفظه الله

سعادة الاستاذ صالح عبدالله النعيم
مدير عام صندوق التنمية الصناعية السعودي

السلام عليكم ورحمة الله وبركاته - وبعد

أفيد سعادتكم الى أن الاخ خالد بن عبدالعزيز السهلاوي أحد منسوبي كلية العلوم الادارية والتخطيط بجامعة الملك فيصل • وهو الآن يقوم بالأعداد لدرجة الدكتوراه تخصص تمويل • ونظرا الى أن مجال بحث المذكور بدور حول صندوق التنمية الصناعية السعودي •

لذا ارجو من سعادتكم التكرم بمساعدته في توفير ما يحتاجه من معلومات
يمكنه .

وتفضلوا سعادتكم بقبول خالص تحياتي وتقديري ،

عميد كلية العلوم الادارية
والتخطيط المكمل في

د. عبدالرحمن بن عبدالعزيز الحماد

١٥م/٤

APPENDIX 4

Regression Analysis of Chapter Eight

Chemical Industry

Table A-8
List of Explanatory (Independent) Variables

No	Variable	Definition
1	CFA	The SIDF's financial assistance to the chemical industry
2	IR	The Saudi interest rate
3	CJVF	The percentage of joint-venture firms established in the chemical industry to the total number of industrial chemical firms
4	SSL	Growth in the Saudi skilled-labour force
5	VCPI	The value of chemical products imported to SA
6	OGDP	Saudi oil-gross domestic product
7	M2	Saudi currency in circulation, demand deposits, and time and saving deposits

Table A-9
Simple Correlation Coefficients for the Independent Variables

	OGDP	VCPI	CFA	IR	CJVF	M2
VCPI	-0.283					
CFA	-0.036	0.656				
IR	0.170	-0.709	-0.599			
CJVF	0.359	-0.845	-0.506	0.473		
M2	0.475	-0.129	-0.164	0.209	0.146	
SSL	0.005	0.479	0.168	-0.328	-0.356	0.067

Table A-10
Results of OLS Estimations When the Dependent Variable is the Number of New Chemical Firms Established

Predictor	Coefficient	Stdev	t-ratio	Mean
Constant	-2.873	3.380	-0.85	-----
OGDP	0.00003932	0.00000783	5.02*	110680
VCPI	0.0018882	0.0004598	4.11*	2345
CFA	0.015125	0.002229	6.79*	163.2
IR	-0.3119	0.1810	-1.72***	7.910
CJVF	13.618	6.234	2.18**	0.2614
M2	0.00004528	0.00006927	0.65	4140
SSL	-0.0002618	0.0001939	-1.35	1418

R-Squared (adj)	0.8890	F-statistic F(7,34)	47.8162
Residual Sum of Squared	60.1753	Mean of Dependent Variable	9.2857
S.D. of Dependent Variable	3.9895	Maximum of Log-likelihood	-67.1469
DW-statistic	1.7303		

* Significant at the 1% level

** Significant at the 5% level

*** Significant at the 10% level

Table A-11
Regression Diagnostic Tests

Test Statistics	LM Version	F Version
A: Serial Correlation	CHI-SQ (2) = 0.73753	F (2,32) = 0.28599
B: Functional Form	CHI-SQ (1) = 19.1667	F (1,33) = 27.7009
C: Normality	CHI-SQ (2) = 0.18913	Not applicable
D: Heteroscedasticity	CHI-SQ (1) = 3.7312	F (1,40) = 3.9000

- A: Lagrange multiplier test of residual serial correlation
 B: Ramsey's REST test using the square of the fitted values
 C: Based on a test of skewness and kurtosis of residuals
 D: Based on the regression of squared on residuals on squared fitted values

Engineering Industry

Table A-12
List of Explanatory (Independent) Variables

No	Variable	Definition
1	EFA	The SIDF's financial assistance to the engineering industry
2	IR	The Saudi interest rate
3	EJVF	The percentage of joint-venture firms established in the engineering industry to the total number of industrial engineering firms
4	SSL	Growth in the Saudi skilled-labour force
5	VEPI	The value of engineering products imported to SA
6	OGDP	Saudi oil-gross domestic product
7	M2	Saudi currency in circulation, demand deposits, and time and saving deposits

Table A-13
Simple Correlation Coefficients for the Independent Variables

	OGDP	VEPI	EFA	IR	EJVF	M2
VEPI	-0.065					
EFA	0.169	0.506				
IR	0.170	-0.243	-0.286			
EJVF	0.104	-0.543	-0.510	0.658		
M2	0.475	-0.026	0.062	0.209	0.049	
SSL	0.005	0.119	0.183	-0.328	-0.514	0.067

Table A-14

Results of OLS Estimations When the Dependent Variable
is the Number of New Engineering Firms Established

Predictor	Coefficient	Stdev	t-ratio	Mean
Constant	7.620	4.363	1.75***	-----
OGDP	0.00000739	-.00001069	0.69	110680
VEPI	0.00015697	0.00004977	3.15*	17496
EFA	0.037952	0.005900	6.43*	135.9
IR	-0.4700	0.2350	-2.00**	7.910
EJVF	-3.06	16.27	-0.19	0.25786
M2	0.00041331	0.00009964	4.15*	4140
SSL	-0.0004363	0.0002844	-1.53	1418

R-Squared (adj)	0.7980	F-statistic F(7,34)	24.1232
Residual Sum of Squared	129.184	Mean of Dependent Variable	12.9286
S.D. of Dependent Variable	4.3359	Maximum of Log-likelihood	-83.1905
DW-statistic	1.3737		

* Significant at the 1% level

** Significant at the 5% level

Table A-15
Regression Diagnostic Tests

Test Statistics	LM Version	F Version
A: Serial Correlation	CHI-SQ (2) = 4.4726	F (2,32) = 1.9069
B: Functional Form	CHI-SQ (1) = 3.9655	F (1,33) = 3.4406
C: Normality	CHI-SQ (2) = 4.6238	Not applicable
D: Heteroscedasticity	CHI-SQ (1) = 0.21646	F (1,40) = 0.20722

A: Lagrange multiplier test of residual serial correlation

B: Ramsey's REST test using the square of the fitted values

C: Based on a test of skewness and kurtosis of residuals

D: Based on the regression of squared on residuals on squared fitted values

APPENDIX 5

Data and Probit Regression Analysis of Chapter Nine

Excerpts from the Original Data

Row	Industry	Year	Cap(000)	Group	Product	Q1 (A)	1B	1C	1D	Q2 (7.)
1	1	1983	56000	1	3	1	0	0	1	1
2	1	1980	80000	1	3	1	0	0	0	0
3	1	1987	70000	1	3	0	0	1	0	1
4	1	1976	100000	1	3	0	0	1	0	1
5	1	1978	19000	1	3	0	1	0	0	1
6	1	1983	186600	1	3	0	0	1	0	1
7	1	1959	166200	1	3	1	0	1	0	1
8	1	1978	239900	1	3	0	0	1	0	1
9	1	1982	242000	1	3	1	0	0	0	1
10	1	1988	368000	1	3	1	0	0	0	0
11	1	1981	441800	1	3	1	0	0	0	1
12	1	1978	409900	1	3	1	0	0	0	1
13	1	1981	160000	1	3	1	0	1	0	1
14	1	1984	95000	1	3	1	0	0	0	1
15	1	1986	35000	1	3	1	0	0	0	1
16	1	1982	36600	1	3	1	1	1	1	1
17	1	1978	33000	1	3	1	0	0	0	1
18	1	1984	32000	1	3	1	0	0	0	1
19	1	1979	32000	1	3	1	0	0	0	1
20	1	1975	31000	1	3	1	0	0	0	1
21	1	1977	30000	1	3	1	0	0	0	1
22	1	1979	31000	1	3	1	0	0	0	1
23	1	1985	29000	1	3	1	0	0	0	1
24	1	1976	29000	1	3	1	0	0	0	1
25	1	1981	54640	1	2	1	0	0	0	1
26	1	1973	57100	1	3	0	0	1	0	1
27	1	1983	57300	1	3	0	0	1	0	1
28	1	1976	68610	1	3	1	0	1	0	1
29	1	1980	71880	1	3	1	0	0	0	1
30	1	1978	70300	1	3	0	0	1	0	1
31	1	1981	68200	1	3	1	0	0	0	1
32	1	1967	67350	1	3	1	0	0	0	1
33	1	1986	67300	1	3	1	0	0	0	1
34	1	1983	67200	1	3	1	0	0	0	1
35	1	1986	149000	1	3	1	0	0	0	1
36	1	1976	79000	1	3	1	0	0	0	1
37	1	1989	74000	1	3	1	0	1	0	1
38	2	1989	34000	1	3	1	0	0	0	1
39	2	1993	46000	1	3	1	0	0	0	1
40	2	1973	97000	1	3	0	0	0	1	1
41	2	1988	92000	1	3	1	0	1	0	1
42	2	1984	27000	1	2	0	0	1	0	1
43	2	1978	20000	1	3	1	0	0	0	1
44	2	1989	54000	1	3	1	0	0	0	1
45	2	1975	200000	1	3	1	0	0	0	1
46	2	1977	214800	1	3	0	0	1	0	1
47	2	1981	222200	1	3	1	0	0	0	1
48	2	1974	189400	1	3	1	0	0	0	1
49	2	1981	152000	1	3	1	0	1	0	1
50	2	1984	94000	1	3	1	0	1	0	1
51	2	1980	48100	1	3	0	0	1	0	1
52	2	1990	118950	1	3	0	0	1	0	1
53	2	1980	69000	1	3	0	0	1	0	1
54	2	1983	135000	1	3	0	0	1	0	1
55	2	1970	30400	1	3	1	0	1	0	1
56	2	1984	31000	1	3	1	0	0	0	1
57	2	1986	33700	1	3	1	0	0	0	1
58	2	1989	42000	1	3	1	0	0	0	1
59	2	1971	40000	1	3	1	0	0	0	1
60	2	1977	37000	1	3	1	0	1	0	1

256	4	1980	24500	2	3	1	0	1	0	1	0	1	0	1
257	4	1977	23750	2	2	1	0	0	0	0	0	0	0	1
258	4	1989	23000	2	2	1	0	0	0	0	0	0	0	1
259	4	1976	84000	2	3	1	0	0	0	0	0	0	0	1
260	4	1990	22000	2	2	1	0	0	0	0	0	0	0	1
261	4	1978	99000	2	3	1	0	0	0	0	0	0	0	1
262	4	1977	25000	2	2	1	0	0	0	0	0	1	1	1
263	4	1992	33000	2	3	0	0	0	0	0	0	1	1	1
264	4	1979	66000	2	3	1	0	0	0	0	0	0	0	1
265	4	1981	187000	2	3	1	0	0	0	0	0	0	0	1

Row	2B	2C	Q3	Q4	(A)	4B	4C	4D	4E	Q5	Q6	Q7	(A)	7B	Q8	(A)
1	0	1	1		1	1	1	1	0	2	2		0	0		0
2	0	0	2		0	0	0	0	0	1	1		1	0		1
3	0	0	1		0	0	1	1	0	1	1		1	0		0
4	0	0	2		0	0	0	0	0	1	1		1	0		1
5	0	0	1		1	1	0	0	0	2	1		0	1		1
6	0	0	1		1	1	1	1	0	1	1		1	0		0
7	0	0	1		1	1	1	1	0	1	1		1	0		0
8	0	0	1		1	1	1	1	0	1	1		1	0		0
9	0	0	1		1	0	1	1	0	1	1		1	0		0
10	0	0	1		1	1	1	1	1	1	1		1	0		1
11	0	0	1		1	1	1	1	0	1	1		1	0		1
12	0	0	1		1	1	1	1	1	1	1		1	0		1
13	0	0	1		1	1	1	1	0	1	1		1	0		1
14	0	0	2		0	0	0	0	0	1	2		0	0		0
15	0	0	1		0	0	1	1	0	1	1		0	1		1
16	0	0	1		1	1	1	1	0	2	1		0	1		0
17	0	0	1		0	1	1	1	0	2	1		0	1		0
18	0	0	1		1	0	1	1	0	2	1		0	1		0
19	0	0	1		1	0	0	0	0	2	2		0	0		0
20	0	0	2		0	0	0	0	0	2	1		0	1		0
21	0	0	1		1	1	1	1	0	1	1		0	1		1
22	0	0	1		0	1	1	0	0	2	1		0	1		1
23	0	0	1		0	0	1	1	0	2	1		0	1		0
24	0	0	1		0	0	1	1	0	1	1		0	1		0
25	0	0	1		0	0	1	1	0	2	1		0	1		0
26	0	0	1		1	1	1	1	0	1	1		0	1		0
27	1	0	2		0	0	0	0	0	1	1		0	1		0
28	0	0	1		1	0	1	1	0	1	1		1	0		1
29	0	0	1		1	1	0	0	0	1	1		0	1		1
30	0	1	1		0	1	1	0	0	1	1		0	1		0
31	0	0	1		1	1	1	1	0	1	1		0	1		1
32	0	0	1		1	1	1	0	0	1	1		1	0		1
33	0	0	2		1	0	1	1	0	1	1		0	1		1
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35	0	0	1		0	0	1	1	0	1	1		1	0		1
36	0	0	2		0	0	0	0	0	2	1		1	0		0
37	0	0	2		0	0	0	0	0	1	1		0	1		1
38	0	0	1		1	0	1	1	0	2	1		0	1		0
39	0	0	1		0	0	1	1	0	1	1		0	1		1
40	0	0	2		0	0	0	0	0	1	1		0	1		1
41	0	0	1		0	0	1	1	0	1	1		1	0		1
42	0	0	2		0	0	0	0	0	2	1		0	1		0
43	0	0	1		0	1	0	0	0	1	1		1	0		1
44	0	0	1		0	0	1	1	0	1	1		0	1		1
45	0	0	1		1	1	1	1	0	1	1		1	0		1
46	0	0	2		0	0	0	0	0	1	1		1	0		0
47	0	0	1		1	0	1	1	0	1	1		1	0		1
48	0	0	1		1	0	0	0	0	1	1		0	1		1
49	0	0	1		1	0	1	1	0	1	1		1	0		1
50	0	0	1		1	1	1	1	0	1	1		1	0		1
51	0	0	1		1	1	1	1	0	1	1		0	1		1

247	0	1	1	1	1	1	1	0	2	1	0	1	0
248	0	1	1	1	1	1	1	0	2	1	0	1	0
249	0	0	1	0	0	1	1	0	2	1	0	1	0
250	0	0	1	1	0	1	1	0	2	1	0	1	0
251	0	0	1	0	0	0	0	0	2	1	0	1	0
252	0	0	2	0	0	0	0	0	2	1	0	1	0
253	0	0	2	1	1	1	1	0	2	1	0	1	0
254	0	0	1	0	0	0	0	0	2	2	0	0	0
255	0	0	2	0	0	1	1	0	2	1	1	0	0
256	0	0	1	0	0	0	0	0	2	2	0	0	0
257	0	0	2	0	0	0	0	1	2	1	0	1	0
258	0	0	2	0	0	0	0	0	2	2	0	0	0
259	0	0	2	0	0	0	0	0	1	1	0	1	1
260	0	0	1	1	0	1	1	0	2	1	0	1	0
261	0	0	1	1	1	1	1	0	1	1	0	1	1
262	0	0	1	0	0	1	1	0	2	1	0	1	0
263	0	0	2	0	0	0	0	0	2	2	0	0	0
264	0	0	1	1	1	1	1	0	2	1	0	1	0
265	0	0	1	1	1	1	1	0	1	1	1	0	1

Row	8B	8C	Q9	Q10	(A)	10B	10C	10D	Q11	Q12	Q13	Q14 (A)	14B
1	0	0	1		0	0	0	0	2	0	1	0	0
2	0	0	2		0	1	0	1	2	2	1	1	0
3	1	0	2		0	1	0	0	2	0	1	0	1
4	0	0	2		1	1	1	1	2	0	1	1	0
5	0	0	2		0	1	0	0	2	0	1	1	0
6	1	0	2		1	1	1	1	2	0	1	0	1
7	1	0	2		1	1	1	1	2	0	1	0	1
8	1	0	2		0	2	0	0	2	0	1	0	1
9	0	0	2		1	1	1	1	2	0	1	1	0
10	0	0	2		1	1	0	1	2	0	1	1	0
11	0	0	2		1	1	1	1	1	2	1	1	0
12	0	0	2		1	1	1	1	2	0	1	1	0
13	0	0	2		1	1	0	0	2	0	1	1	0
14	0	0	2		1	1	1	1	2	0	1	1	0
15	0	0	2		0	1	0	0	2	0	1	1	0
16	0	1	1		0	0	0	0	2	0	1	0	0
17	0	1	1		0	0	0	0	2	0	1	0	0
18	0	0	1		0	0	0	0	2	0	1	0	0
19	0	1	1		0	0	0	0	2	0	1	0	0
20	0	1	1		0	0	0	0	2	0	1	0	0
21	0	0	1		0	0	0	0	2	0	1	1	0
22	0	1	1		0	0	0	0	1	2	1	1	0
23	0	0	1		0	0	0	0	2	0	1	0	0
24	0	1	1		0	0	0	0	2	0	1	0	0
25	0	1	2		0	1	0	0	1	2	1	0	0
26	1	0	2		0	1	0	1	2	0	1	1	0
27	0	0	2		0	1	0	0	2	0	1	0	1
28	1	0	2		0	1	0	1	1	2	1	0	1
29	0	0	2		0	1	0	0	2	0	1	1	0
30	1	0	2		0	1	0	1	2	0	1	0	1
31	0	0	2		1	1	0	0	2	0	1	1	0
32	0	0	2		0	1	0	1	2	0	1	1	0
33	0	0	2		0	1	0	1	2	0	1	1	1
34	0	0	2		0	1	0	1	2	0	1	1	0
35	0	0	2		0	1	0	0	2	0	1	1	0
36	0	1	2		1	1	1	1	2	0	1	0	0
37	1	0	2		0	1	0	0	1	2	1	0	1
38	0	1	1		0	0	0	0	2	0	1	0	0
39	0	0	1		0	0	0	0	2	0	2	0	0
40	0	1	1		0	0	0	0	2	0	1	0	0
41	0	0	2		0	1	0	0	2	0	1	0	1
42	1	0	1		0	0	0	0	2	0	2	0	0

238	0	0	2	0	1	0	0	2	0	1	1	0
239	1	0	2	1	1	1	1	2	0	1	0	1
240	1	0	2	0	1	0	1	2	0	1	0	1
241	0	0	2	0	1	0	1	2	0	1	1	0
242	0	0	1	0	0	0	0	2	0	1	0	0
243	0	0	1	0	0	0	0	2	0	1	1	0
244	0	1	1	0	0	0	0	2	0	2	0	0
245	0	1	2	0	1	0	1	2	0	1	0	0
246	0	1	2	0	1	0	0	2	0	1	0	1
247	0	1	1	0	0	0	0	2	0	1	0	0
248	0	1	1	0	0	0	0	1	2	1	0	0
249	0	1	1	0	0	0	0	2	0	1	0	0
250	0	1	2	0	1	0	0	2	0	1	0	0
251	0	1	1	0	0	0	0	2	0	1	0	0
252	0	1	1	0	0	0	0	2	0	1	0	0
253	0	1	2	0	1	0	0	2	0	1	0	0
254	0	0	1	0	0	0	0	2	0	1	0	0
255	0	1	1	0	0	0	0	2	0	1	0	0
256	0	0	1	0	0	0	0	2	0	2	0	0
257	0	1	1	0	0	0	0	2	0	2	0	0
258	0	0	1	0	0	0	0	2	0	2	0	0
259	0	0	1	0	0	0	0	1	0	1	1	0
260	0	1	1	0	0	0	0	2	0	1	0	0
261	0	0	2	0	1	0	1	2	0	1	1	0
262	0	1	1	0	1	0	0	2	0	1	0	0
263	0	0	1	0	0	0	0	2	0	1	0	0
264	0	1	2	0	1	1	0	2	0	1	0	0
265	0	0	2	1	1	1	1	2	0	1	1	0

Row	14C	Q15	Q16	Q18	Q19	Q21 (A)	21B	21C	21D	21E	21F	Q22
1	1	2	2	2	0	4	3	4	3	3	3	1
2	0	3	2	2	0	4	4	3	4	3	4	3
3	0	2	2	1	2	4	4	3	3	3	4	2
4	1	3	2	1	2	5	4	4	5	5	5	4
5	0	2	2	2	0	4	3	3	2	3	2	3
6	0	3	2	1	2	5	5	5	5	5	5	3
7	0	4	2	1	2	5	5	5	5	5	5	4
8	0	2	2	1	2	5	5	5	5	5	4	4
9	0	3	2	1	2	5	5	5	5	4	4	3
10	0	3	2	1	2	5	5	5	5	5	5	4
11	0	4	2	2	0	5	5	5	5	5	5	4
12	0	3	2	1	2	5	5	5	5	5	5	4
13	0	4	2	2	2	5	5	5	5	5	4	4
14	0	4	2	2	0	4	5	4	5	4	4	2
15	0	1	2	1	2	3	3	3	3	3	2	2
16	1	1	2	1	2	3	3	3	3	3	2	1
17	1	1	2	1	2	3	3	3	3	3	2	1
18	1	1	2	2	0	4	4	3	4	3	2	2
19	1	1	2	1	2	4	4	4	5	3	3	1
20	1	1	2	1	2	4	4	3	3	3	2	1
21	0	2	2	1	2	4	4	4	3	3	2	2
22	0	1	2	1	2	4	4	3	2	3	2	1
23	1	1	2	1	2	4	3	4	3	2	2	2
24	1	1	2	1	2	4	3	3	3	2	2	1
25	1	2	2	1	2	4	3	3	3	3	3	2
26	0	4	2	1	2	4	4	4	5	3	3	2
27	0	2	2	1	2	4	4	4	4	4	3	3
28	0	3	2	2	0	4	4	4	3	3	3	2
29	0	3	2	1	2	4	4	4	3	4	4	3
30	0	2	2	1	2	4	4	4	4	3	3	2
31	0	3	2	1	2	4	4	4	3	4	3	3
32	0	4	2	2	0	4	4	4	5	4	3	3
33	0	3	2	1	2	4	3	4	4	5	3	3

229	1	2	2	1	2	4	4	3	3	3	4	2
230	1	2	2	1	2	4	3	3	3	3	3	1
231	1	1	2	1	2	4	4	4	4	3	3	2
232	0	3	2	1	2	4	4	5	3	3	4	2
233	0	2	2	2	0	4	4	3	5	3	4	3
234	0	2	2	1	2	4	4	5	5	4	5	2
235	0	4	2	1	2	5	5	5	5	5	5	4
236	0	4	2	1	2	5	5	5	5	4	5	3
237	0	3	2	1	2	5	5	5	5	5	5	2
238	0	3	2	1	2	5	4	4	3	3	3	2
239	0	3	2	1	2	4	4	4	4	3	3	3
240	0	2	2	1	2	4	5	4	3	3	3	3
241	0	2	2	2	0	4	3	4	3	3	3	2
242	1	2	2	2	0	4	4	3	3	3	4	2
243	0	2	2	2	0	4	4	4	3	3	3	2
244	0	0	0	1	2	4	4	4	3	3	3	2
245	1	2	2	1	2	4	3	4	2	3	2	2
246	1	2	2	2	0	4	4	3	3	3	2	2
247	1	2	2	2	0	3	3	3	4	3	2	2
248	1	2	2	1	2	3	3	3	3	3	3	2
249	1	1	2	2	0	4	4	4	3	2	2	2
250	1	1	2	1	2	3	3	3	2	2	2	1
251	1	1	2	2	0	3	3	3	2	2	2	1
252	1	1	2	1	2	3	3	3	4	2	2	1
253	1	2	1	1	1	4	3	3	2	3	2	2
254	1	1	2	1	2	4	4	3	2	2	2	1
255	1	1	2	1	2	4	4	3	3	3	2	1
256	0	0	0	2	0	4	3	3	3	2	2	1
257	0	0	0	2	0	4	4	4	3	3	3	1
258	0	0	0	2	0	4	4	3	3	3	3	1
259	0	2	2	2	0	4	3	4	3	3	2	3
260	1	1	2	1	2	4	3	4	3	2	3	1
261	0	2	2	2	0	4	4	4	4	3	3	2
262	1	1	2	2	0	3	3	3	2	2	2	1
263	1	3	2	2	0	4	4	4	5	5	5	1
264	1	2	2	2	0	4	3	4	3	3	3	1
265	0	3	2	1	2	5	5	5	4	4	4	3

Row	Q23	Q24 (A)	24B	Q25 (A)	25B	25C	25D	25E	Q26 (A)	26E	26C
1	1	1	0	1	0	0	0	1	0	1	1
2	1	1	0	0	0	0	1	0	0	1	1
3	1	1	0	0	1	0	0	1	0	1	1
4	1	C	1	0	0	0	0	0	0	1	1
5	1	0	1	0	0	0	0	0	1	1	1
6	1	1	0	1	0	0	0	0	0	1	0
7	1	1	0	0	0	0	1	0	0	1	0
8	1	1	0	0	0	0	0	1	0	1	0
9	1	1	0	0	0	0	0	1	0	1	0
10	1	1	0	0	0	0	0	1	0	0	1
11	1	1	0	1	0	0	1	0	0	1	1
12	1	1	0	0	0	0	1	0	0	1	0
13	1	0	1	1	0	0	1	0	0	1	0
14	2	1	0	1	0	0	1	0	0	1	0
15	1	1	0	0	0	0	0	1	1	C	1
16	1	1	0	1	0	0	1	1	1	1	0
17	1	1	1	1	0	0	1	1	1	1	0
18	1	1	0	0	0	0	0	1	0	1	0
19	1	0	1	1	0	0	1	0	0	1	1
20	1	0	1	0	0	0	0	1	0	1	0
21	1	1	0	1	0	0	1	0	0	1	1
22	1	1	0	0	0	0	1	1	0	1	0
23	1	1	0	1	0	0	1	0	0	1	0
24	1	0	1	1	0	0	1	0	0	1	1

Table A-16
List of Technological Change Activities
(Dependent Variables)¹

No	Definition	
1	The existence of a special department for designing and developing new products	Y ₁
2	Involvement in new product development or upgrading existing products	Y ₂
3	Developing or upgrading the firm's production methods	Y ₃
4	Involvement in developing or upgrading the firm's machinery and equipment	Y ₄
5	Attempting for ways in order to adapt the existing products and processes to local conditions	Y ₅
6	Searching in order to reduce the production cost	Y ₆
7	Looking for new ways to maximise the yield from existing plant capacity	Y ₇
8	Seeking new methods in order to maximise the technical skills of the firm's labour	Y ₈
9	Spending on research and development as a proportion of the firm's annual sales	Y ₉

Table A-17
List of the Explanatory Variables

Variable Name	Definition
FIN	SIDF's finance, a dummy variable equal to unity if the firm has received finance from SIDF and zero if it has not
SIZE	The capital investment of the firm
MKT	The firm's products, a dummy variable equal to unity if the products of the firm are destined for both export and local markets and zero if they are destined for local market only
TYPE	A dummy variable equal to unity if the firm is joint-venture and zero if it is a Saudi firm
AGE	The age of the firm since the date of its establishment

Table A-18
Simple correlation coefficients for the Independent Variables

	FIN	AGE	SIZE	MKT
AGE	-0.48830E-01			
SIZE	-0.10657	0.31478		
MKT	-0.86731E-01	-0.40747E-01	0.16231	
TYPE	-0.73228E-01	0.10243	0.18822E-01	0.91423E-01

¹ These variables are binary, taking the values of unity or zero (except variable Y₉). Each dependent variable was used to explain the existence or non-existence of a particular technological change activity.

Table A-19
Probit Regression (Y₁)

Variable	Coeff	Std.Error	t-ratio	P-value	Mean of x	Std. Dev
Constant	-7.2833	1.103	-6.603*	0.00000		
FIN	0.240E-01	0.1716	0.140	0.88851	1.4487	0.49831
AGE	-0.12E-01	0.13E-01	-0.880	0.37883	14.734	6.6812
SIZE	1.4112	0.2260	6.244*	0.00000	4.7394	0.43574
MKT	0.99665	0.2540	3.923*	0.00009	0.84030	0.36702
TYPE	0.24130	0.2256	1.069	0.28491	0.17490	0.38061
Log -Likelihood	-145.5114					
Chi -Squared (5)	70.36848					
Significance Level	0.1000000E-06					
* Significant at the 1% level						
** Significant at the 5% level						
*** Significant at the 10% level						

Table A-20
Probit Regression (Y₂)

Variable	Coeff	Std.Error	t-ratio	P-value	Mean of x	Std. Dev
Constant	-2.4125	1.142	-2.0113*	0.03459		
FIN	0.23E-01	0.1969	0.151	0.87982	1.4487	0.49831
AGE	0.15E-01	0.17E-01	0.868	0.38561	14.734	6.6812
SIZE	0.61234	0.2423	2.527*	0.01150	4.7394	0.43574
MKT	0.40921	0.2430	1.68***	0.09222	0.84030	0.36702
TYPE	0.22E-02	0.2636	0.008	0.99333	0.17490	0.38061
Log -Likelihood	-105.0778					
Chi -Squared (5)	14.08838					
Significance Level	0.1505765E-01					

Table A-21
Probit Regression (Y₃)

Variable	Coeff	Std.Error	t-ratio	P-value	Mean of x	Std. Dev
Constant	-5.00719	1.036	-4.898*	0.00000		
FIN	0.86E-02	0.1667	0.051	0.95898	1.4487	0.49831
AGE	-0.52E-02	0.13E-01	-0.412	0.68031	14.734	6.6812
SIZE	0.94686	0.2129	4.448*	0.00001	4.7394	0.43574
MKT	0.95339	0.2418	3.942*	0.00008	0.84030	0.36702
TYPE	0.17668	0.2200	0.803	0.42192	0.17490	0.38061
Log -Likelihood	-156.7522					
Chi -Squared (5)	45.86832					
Significance Level	0.8929464E-08					

Table A-22
Probit Regression (Y₄)

Variable	Coeff	Std.Error	t-ratio	P-value	Mean of x	Std. Dev
Constant	-3.7063	1.836	-2.01**	0.04356		
FIN	-0.24234	0.2807	-0.863	0.38789	1.4487	0.49831
AGE	0.11E-01	0.24E-01	0.458	0.64700	14.434	6.6812
SIZE	1.0383	0.4181	2.484*	0.01300	4.7394	0.43574
MKT	0.94801	0.2935	3.230*	0.00124	0.84030	0.36702
TYPE	0.56E-01	0.4040	0.138	0.89001	0.17490	0.38061
Log -Likelihood		-48.78814				
Chi -Squared (5)		28.42438				
Significance Level		0.3006458E-04				

Table A-23
Probit Regression (Y₅)

Variable	Coeff	Std.Error	t-ratio	P-value	Mean of x	Std. Dev
Constant	-6.6638	1.135	-5.870*	0.00000		
FIN	-0.58E-01	0.1693	-0.345	0.73043	1.4487	0.49831
AGE	0.19E-01	0.14E-01	1.322	0.18617	14.734	6.6812
SIZE	1.3381	0.2360	5.670*	0.00000	4.7394	0.43574
MKT	0.51414	0.2327	2.20**	0.02715	0.84030	0.36702
TYPE	-0.89E-01	0.2221	-0.400	0.68916	0.17490	0.38061
Log -Likelihood		-150.3679				
Chi -Squared (5)		54.67678				
Significance Level		0.1000000E-06				

Table A-24
Probit Regression (Y₆)

Variable	Coeff	Std.Error	t-ratio	P-value	Mean of x	Std. Dev
Constant	-8.1680	1.208	-6.759*	0.00000		
FIN	-0.65E-01	0.1698	-0.383	0.70175	1.4487	0.49831
AGE	0.69E-02	0.14E-01	0.486	0.62720	14.734	6.6812
SIZE	1.6654	0.2545	6.543*	0.00000	4.7394	0.43574
MKT	0.36709	0.2419	1.518*	0.12910	0.84030	0.36702
TYPE	0.13950	0.2266	0.616	0.53807	0.17490	0.38061
Log -Likelihood		-145.2808				
Chi -Squared (5)		65.93876				
Significance Level		0.1000000E-06				

Table A-25
Probit Regression (Y₇)

Variable	Coeff	Std.Error	t-ratio	P-value	Mean of x	Std. Dev
Constant	-8.9953	1.241	-7.247*	0.00000		
FIN	-0.22904	0.1757	-1.304	0.19236	1.4487	0.49831
AGE	0.61E-02	0.14E-01	0.442	0.65841	14.734	6.6812
SIZE	1.7231	0.2467	6.984*	0.00000	4.7394	0.43574
MKT	0.95694	0.3125	3.062*	0.00220	0.84030	0.36702
TYPE	0.12411	0.2237	0.555	0.57910	0.17490	0.38061
Log -Likelihood		-138.1099				
Chi -Squared (5)		82.57106				
Significance Level		0.1000000E-06				

Table A-26
Probit Regression (Y₈)

Variable	Coeff	Std.Error	t-ratio	P-value	Mean of x	Std. Dev
Constant	-10.435	1.357	-7.691*	0.00000		
FIN	-0.11320	0.1772	-0.639	0.52299	1.4487	0.49831
AGE	-0.18E-02	0.14E-01	-0.126	0.89940	14.734	6.6812
SIZE	2.1185	0.2852	7.428*	0.00000	4.7394	0.43574
MKT	0.44123	0.2740	1.6***	0.10731	0.84030	0.36702
TYPE	0.36583	0.2288	1.6***	0.10989	0.17490	0.38061
Log -Likelihood		-135.9751				
Chi -Squared (5)		88.98272				
Significance Level		0.0000000				

Table A-27
OLS Regression (Y₉)

Variable	Coeff	Std.Error	t-ratio	P-value	Mean of x	Std. Dev
Constant	-3.5309	0.5698	-6.197*	0.00000		
FIN	-0.60E-01	0.98E-01	-0.609	0.54327	1.4487	0.49831
AGE	0.42E-02	0.77E-02	0.557	0.57826	14.734	6.6812
SIZE	1.0793	0.1197	9.021*	0.00000	4.7394	0.43574
MKT	0.54524	0.1354	4.027*	0.00007	0.84030	0.36702
TYPE	-0.24E-01	0.1289	-0.188	0.85131	0.17490	0.38061
Log-likelihood =	-0.30616E+03					
R -squared =	33.60		R -squared (adj) = 32.30			
F(5,257) =	26.01		Durbin-Watson stat. = 1.377			

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