AN EMPIRICAL STUDY OF THE KEY KNOWLEDGE ECONOMY FACTORS FOR SUSTAINABLE ECONOMIC DEVELOPMENT IN OMAN

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I wish to thank my beloved parents, my wife and children, brothers and sisters, and friends for their generous support, understanding, encouragement and patience. Last, but not least, I would like to dedicate this thesis to my beloved country, Oman.

Declaration

I, Ibrahim Abdullah Al-Rahbi, declare that the DBA thesis entitled *An Empirical Study of the Key Knowledge Economy Factors for Sustainable Economic Development in Oman* is no more than 65,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Signature  Date 26-8-2008

Abstract

Heavy economic dependence on oil revenues has come under scrutiny in most oil producing countries, including the Sultanate of Oman. The main catalysts for this have been the gradual decline of oil production, depletion of oil reserves, fluctuations in oil price and high rates of population growth in many of these countries. The Omani government has initiated economic strategies with the aim of diversifying Oman's economy.

In the absence of any previous studies on this aspect of Oman's economy, the aim of this research is to explore the prospects for the development of the knowledge economy and to identify the key knowledge economy factors for achieving sustainable economic development in Oman. The analytical framework used consisted of three distinct phases. First, a benchmarking process was used for assessing Oman's readiness in relation to the knowledge economy. This phase revealed a low level of readiness in respect of the key knowledge economy pillars. Secondly, interviews of nine relevant senior government officials resulted in the identification of five knowledge economy drivers that could lead Oman into successfully establishing a knowledge economy. Finally, a non-parametric quantitative approach was used on a data set collected through a survey targeting 310 major service companies in Oman. The results of this analysis appear to complement those of the previous two phases of analysis in emphasizing the importance of the four main knowledge economy pillars. Even though two additional factors namely training support and ICT status were also identified as being important for Oman, the additional factors are not outside the four pillars of the knowledge economy, but represent specific dimensions of Oman's economy.

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List of Acronyms

ABS	Australian Bureau of Statistics
APEC	Asia Pacific Economic Cooperation
CRA	Charles River Association
CEO	Chief Executive Officer
DITS	Department of Industry, Tourism and Science
ESCWA	Economic and Social Commission for Western Asia
EU	European Union
EC	European Countries
ECIS	European Commission Information Society
FDI	Foreign Direct Investment
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IDA	Ireland Industrial Development Authority
ILO	International Labor Organization
IIMD	International Institute of Management Development
IMF	International Monetary Fund
IORSARC	Indian Ocean Rim States Association for Regional Cooperation
ITA	Information Technology Authority
KAM	Knowledge Assessment Methodology
KEI	Knowledge Economy Index
KOM	Knowledge Oasis Muscat
KMO	Kaiser-Meyer-Olkin
LNG	Liquefied Natural Gas
MNE	Ministry of National Economy
MENA	Middle East and North Africa
MSA	Measure of Sampling Adequacy
OECD	Organization of Economic Cooperation and Development
PDO	Petroleum Development of Oman
R&D	Research and Development
SGRF	State General Reserve Fund
SME	Small and Medium Enterprises
SPSS	Statistical Package for Social Science
TRC	The Research Council
TFP	Total Factor Productivity
TRA	Telecommunication Regulatory Authority
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
WB	World Bank
WBI	World Bank Institute
WIID	World Income Inequality Database
WIPO	World Intellectual Property Organization
WEF	World Economic Forum
WTO	World Trade Organization

Chapter 1. Introduction

1.1 Introduction

According to His Excellency Mohammad Al Zubair, a leading businessman in Oman and the Sultan's Advisor for Economic Planning, Oman faces:

> …the likely doubling of the Omani population by 2020; diminishing oil yields; and uncertainty in the price of a barrel of oil. Each one is serious in its own right: a combination of all three is disastrous for Oman in the absence of major progress in meaningful, non-oil-based diversification into other comparable source of revenue. (Mcbrierty and Al Zubair, 2004, p.158)

> In the 21st century, comparative advantage will become much less a function of natural resource endowments and capital-labour ratios and much more a function of technology and skills. Mother nature and history will play a much smaller role, while human ingenuity will play a much bigger role. (Thurow, 1991, p. 101)

Oman is an oil and gas producing country. Gas and oil account for 79 per cent of its budgetary revenue and 48.8 per cent of its GDP (MNE, 2006). According to the current level of extraction, oil is expected to last for less than twenty years, and thus, different and more dynamic economic development approaches must be explored to tackle and face future challenges and uncertainties (Mcbrierty and Al Zubair, 2004). One possible and most feasible alternative at this stage is pursuing a knowledge economy development strategy (World Bank, 2004).

The theme of the knowledge economy has been gaining importance in recent years in policy discussions on economic growth, globalisation and economic restructuring. In fact, governments in many developed and developing countries are engaged in the search for developing policies that promote essential elements of a knowledge economy manifested in: education and training; information and communication technologies; research and development, and innovation; and conducive governance and regulatory regimes that nurture such elements. International organisations such as the UN, OECD, World Bank and UNESCO are also actively spreading the message of

the knowledge economy and encouraging and facilitating the development of such policies (Al-Rahbi et al., 2008).

This optimism about the knowledge economy is based on empirical evidence indicating that the generation and exploitation of knowledge have come to play a predominant role in the creation of wealth. In fact, there is growing awareness worldwide that the knowledge economy offers new opportunities for growth resulting from the availability of information and communication technologies and from the advent of a new form of global economic development rooted in the concept of the knowledge economy, which is based on the creation, acquisition, dissemination and utilization of knowledge (World Bank, 2004).

Despite this attention being paid to the promotion of the knowledge economy as a potential economic development alternative, there is no ready-made framework from which an appropriate strategy can be developed to guide policy makers particularly in developing countries. While there is considerable experience accumulated in the field mainly from developed economies perspective, much of this is not directly applicable to developing countries because of their socio-economic development levels and the nature of the challenges they are facing (World Bank, 2004).

There are two important characteristics in the knowledge economy literature. First, it is relatively new compared to traditional economic studies (Foray and Lundvall, 1996; Neef, 1998; Houghton and Sheehan, 2000); and second it is biased towards developed countries as most studies concentrate on developed economies (OECD, 1996, 1997, 1999, 2001; World Bank, 1998; APEC, 2003). Only recently has there been an interest in extending this literature by undertaking studies of developing countries. Nonetheless, the lion share of this latest extension has been devoted to studying the major and rapidly growing developing economies, such as China, Korea and India (Grewal et al., 2002; Aubert, 2005). The other developing countries, particularly in the Middle East and North Africa region, have been examined only marginally and often as part of regional studies (World Bank, 2004). Thus, Oman is yet to be individually and thoroughly studied. In fact, this is the gap that this research will try to explore and bridge. It does so by establishing the meaning of the knowledge economy

as used in this research, along with a description of the different concepts and theories of the knowledge economy that relates to its development.

Oman's embracement of the knowledge economy presents challenges as its readiness to undertake such an option is low, but it has a real opportunity to act now while its natural endowments are capable of supporting such a transition and evolve in a direction better suited to its current and future socio-economic needs. If Oman wishes to take advantage of these opportunities that lie within its reach, it must architect new institutions, and the promoters and regulators of the economy based on the effective acquisition, production, dissemination and use of knowledge. It appears that no country can afford to miss this opportunity, as in doing so, such a country risks becoming marginalized and may be left aside in this knowledge and information age (UNESCO, 2005a). In this context, it is the aim of this research to explore and identify key factors for knowledge economy development in Oman to assist in achieving a sustainable economic development.

In tackling this research problem, three data collection methods were utilized, starting with a benchmarking process identifying Oman's knowledge economy readiness which was then compared with relevant countries and regions. Knowledge economy literature as well as international agencies' databases were extensively explored to establish relevant and reliable indicators representing Oman's socio-economic and knowledge economy development levels. Secondly, a qualitative approach was used for interviewing relevant senior government officials to gain deeper insights on the issues under investigation. Finally, a non-parametric quantitative approach was also used on a data set collected through a survey targeting the main service companies in Oman.

1.2 The Particular Perspective of this Researcher

The researcher is a senior government official at the Muscat Municipality (Oman). He decided to conduct this research to reflect upon and add ways that complement his government's efforts in its quest for sustainable economic development. The specific reasons for conducting this research are:

- The researcher is deeply aware of the challenges facing his government and the urgent need required for exploring potential alternatives that assist in tackling such challenges.
- The researcher is intimately involved in the job creation arena in the government and is therefore in a good situation to understand the intricacies of the job generation importance.
- The researcher has access to many senior government officials, and thus can obtain information which is not accessible to other researchers.
- This research can help the researcher to understand, and be better able to analyse economic situations on the macro level particularly those related to sustainable economic development and suggest practical solutions to decision makers in his home country.
- The researcher is in a position to implement some of the policies that may emerge from this research within his jurisdiction.

1.3 Research Objectives

The objectives of this research can be stated as:

- to explore the literature of the knowledge economy and its relevance to developing countries in particular as a feasible sustainable economic development alternative;
- to examine Oman's readiness in undertaking the development of a knowledge economy through the examination of its current knowledge economy key drivers;
- to identify key knowledge economy factors (drivers) and understand their relevance to sustainable economic development; and
- to offer recommendations that could assist the government to pursue a practical strategy in developing a knowledge economy that would lead to sustainable economic development in Oman.

1.4 Research Questions

The main research questions are:

Q1. What is the current readiness of Oman's knowledge economy key drivers (pillars) in terms of the quality and effectiveness of:

a. government institutions and economic incentives;
b. education and training;
c. information and communication technologies (ICT); and
d. research and development and innovation.

The benchmarking process will provide an insight in answering this question.

Q2. What is the potential role of the government in Oman in enhancing knowledge economy development in terms of:

a. plans to stimulate the education and training outcomes;
b. mitigating obstacles that hinder optimal utilisation of ICT capabilities in Oman;
c. plans in regards to the research and development, and innovation systems that boost internal and external knowledge absorptive capabilities; and
d. enhancement of governance effectiveness to promote the above pillars?

The qualitative approach manifested in the interview of nine senior government officials who are involved in the socio-economic development planning will offer an answer to this question.

Q3. What are the potential key factors (drivers) of knowledge economy development in Oman?

The quantitative approach where 310 major service companies in Oman are surveyed, will provide an answer to this question. This question was divided into five sub-

questions that represent the knowledge economy four pillars and the knowledge economy outcome.

1.5 Importance of this Research

This research is important in four areas as discussed below.

1.5.1 Knowledge economy arena

Knowledge economy development studies are still at their infancy particularly in developing countries. Scholars in general have concentrated on developed countries specifically in the USA, Europe and Australia (OECD, 1996, 1999, 2000, 2001; Neef, 1998; Houghton and Sheehan, 2000; APEC, 2003). Only a handful of studies have looked at the knowledge economy from developing countries' perspectives, and in such cases concentration was on high and fast growing developing countries such as China, India, Singapore, and more recently Malaysia and South Korea (Hobday, 1996; Grewal et al, 2002; Goh 2004). Unfortunately, very few studies have tackled this issue in the Middle East and North Africa (MENA) region and in such case all of the countries in the region were collectively examined, but none have studied Oman individually and thoroughly (Mcbrierty and Al Zubair, 2004; World Bank, 2004).

1.5.2 Location

As indicated above the existing studies on the knowledge economy were mainly carried out in the USA, Europe, and to some extent in main developing countries (OECD, 2000; World Bank, 2004). This research will be the only one so far that will be conducted on Oman.

1.5.3 Methodology

Most of the current research on the knowledge economy is done from a comparative and benchmarking perspective, where researchers in developed countries benchmark intended countries against each other applying indicators with regards to the four main knowledge economy drivers. Secondary and short-term series data are used in this regard. Recently, international and national think-tanks and researchers have utilised survey approaches to gain in-depth and useful information on knowledge

creation, acquisition, dissemination and utilisation (Department of Statistics Malaysia, 2002; European Innovation Commission, 2002; Shapira et al., 2006). In the case of developing countries, mostly third party researchers are employed applying the same benchmarking technique using World Bank's database.

This research uses a mixed methodology approach where knowledge economy secondary and primary data are used. The researcher will apply a benchmarking process in analysing the secondary data. For generating the primary data, the researcher will interview nine senior government officials who have direct involvement in the decision-making process of socio-economic development. Furthermore, a questionnaire survey will be used targeting major service companies in Oman that could provide useful information and have direct interest in knowledge economy development. In fact, the World Bank asserts that knowing the government policy initiation and those who are going to be affected by it, is essential in the process of successful knowledge economy development (World Bank, 2004). Yin (1994) complements this approach when he suggests the use of a mixed methodology approach, where the issue under investigation is new and participants' role and ideas are essential in reaching useful results. The researcher's role as part of the decision-making body in his government's entity also adds to the richness of this study.

1.5.4 Application

This research could have an application, especially within the researcher's government entity provided that the government embarks on the recommendations extracted from this research. These research findings could be applicable to other Arab countries that share similar cultural, religious, and economic backgrounds with Oman, especially the GCC countries of which Oman is a member. In deed, this research may also form the basis for a knowledge economy development strategy within the GCC countries which are aiming for greater economic integration. Furthermore, this research lays down the foundation for further knowledge economy studies in other related economic industries in Oman, as this study is carried out in one segment of the service sector, major service companies.

1.6 Contribution to Knowledge

This study attempts to make a significant input to the existing knowledge on the subject by shedding new light on the importance of the knowledge economy for the developing countries in general and for Oman in particular. In fact, it is the first time that such a study of knowledge economy has been undertaken by combining three different data collection and analytical approaches for defining the robust knowledge economy drivers that suit a small developing country like Oman. More importantly, this study will create an awareness among decision makers and main service companies in Oman on the potential and the viability in pursuing knowledge economy initiatives as a sustainable economic development option that could respond positively to Oman's current economic challenges and future uncertainties.

The study should assist Oman and other countries with similar socio-economic characteristics, across key factors in the uptake and planning of knowledge economy development. Specifically, this research adds the following to knowledge, in that it is:

- the first study to explore the potential of knowledge economy pursuance in Oman as a potential sustainable knowledge economy development;
- the first study to combine three different data collection approaches in one study namely: a benchmarking process that gauges Oman's knowledge economy readiness against relevant countries and regions; a qualitative approach where socio-economic development senior government decision makers are interviewed; and a quantitative approach where decision makers of main service sector in Oman are surveyed;
- the first study where only knowledge economy input indicators are used that are relevant to Oman's current socio-economic development level which could provide a more practical foundation for the government in assessing and building future knowledge economy development plans; and
- the first study to provide a framework for knowledge economy development empirically tested in a small developing country like Oman.

1.7 Limitations of this Research

This is study is a first attempt to delineate key factors that may assist the government of Oman in developing a knowledge economy. Although the conceptual framework used to guide this study, the methodology conducted in collecting data, and the analysis techniques used to analyse such data are generated from different studies and experiences worldwide, the following limitations were encountered which should be considered in future knowledge economy development studies:

- The knowledge economy is still an evolving phenomenon and represents a new area of research to the majority of survey participants. This was evident during the interview and pre-testing phases where participants requested many terminologies, statements and questions to be explained and put in layman format.
- This research was conducted on one country. It may not be possible to generalise the findings based on this research, but it would serve as a foundation on which research on knowledge economy development in other countries particularly in the (GCC) states where similar socio-economic peculiarities exist, could be based.
- Only input indicators were used in the benchmarking process and the questionnaire survey which were representative of Oman's socio-economic development level and its specific peculiarities.
- The survey questions (elements) were extracted from the literature and from similar surveys in Europe and Malaysia both of which measured existing knowledge economy strategies and thus have not been tested in countries with less socio-economic development levels.
- The quantitative survey was biased and confined to only one segment of the services sector namely major services companies in Oman. Other business segments were excluded as they were less likely to provide useful information on knowledge economy development. In such a situation the results may not represent other business sectors.

It is hoped that this study will provide a foundation for the knowledge economy development in Oman and for future studies on specific industries. Such studies will not only substantiate this research but also offer new insights into understanding

thoroughly the pillars and factors influencing the successful implementation of knowledge economy policies and further contribute to knowledge in this area especially from developing countries' perspective.

1.8 Structure of the Thesis

This research investigated the key factors that could assist in developing a knowledge economy in Oman. The results from this study are presented starting from the background of the problem, the literature review on the knowledge economy, the conceptual framework and the research methodology; followed by analysis of the benchmarking process, the interview stage, and the questionnaire survey. There is also a chapter on the results and findings where conclusions and recommendations are presented. The arrangement of the chapters is expanded below.

- After this introduction in Chapter 1, Chapter 2 provides the background to the research problem where a description of the socio-economic situation in Oman is explained so that the reader can understand the problems faced and the potential that this research provides.
- Chapter 3 reviews the literature on knowledge as understanding knowledge is a pre-requisite for successfully utilizing it in a meaningful way. In addition this chapter reviews the theoretical foundation for the research and explores definitions of the knowledge economy and where this research fits in with the existing literature.
- Chapter 4 describes the framework that suits knowledge economy development in Oman. This is due to the lack of a universally agreed methodology to gauge knowledge economy development. As a result, a framework was developed that takes into account new input indicators which represent Oman's socio-economic development level and consider the inclusion of Oman specificities as safeguards against any undesirable consequences.
- Chapter 5 presents the methodology chosen to collect data that tackles this research problem. Given the intangible and evolving nature of the knowledge economy resulting in the non-existence of proper measurement to gauge the factors and elements that contribute to the new economic growth, tackling such problem required a combination of relevant indicators and measurement

tools. This is related to the fact that economic development and transition involves many facilitators and utilisers, and hence different stakeholders' inputs must be considered to yield robust and meaningful findings. In this context, a benchmarking process measuring Oman's knowledge economy readiness against relevant regions and countries was conducted, along with a qualitative approach seeking to gain insights of senior government officials who are involved in the policy formulation of socio-economic development in the country. In addition, a non-parametric quantitative approach was also used on a data set collected through a survey targeting main service companies in Oman as potential adopters of the knowledge economy and ones who could provide useful information on this new issue.

- Chapter 6 explores the analysis process of the benchmarking phase where the knowledge assessment methodology (KAM) was used as an assessment tool. This has been widely adopted by consultants and researchers for measuring knowledge economy readiness. The qualitative data collected to get insights of senior government officials as decision makers, and the quantitative data gathered from main service companies in Oman were also analysed applying different analysis techniques to answer the research questions.
- Chapter 7 provides a review of the whole research process as presented in this thesis. The results are compared to the existing literature. The conclusions and limitations of the research are presented along with some recommendations for the government, and with some other recommendations for future research.

Chapter 2. Background to the Research Problem

2.1 Introduction

Oman's economic development has been assessed as a successful process that in just 35 years has transformed the country from an agriculture and trade dependent society to a modern economic system. The well-being of Oman's population was reasonably established when Oman became an upper middle income country in less than 25 years, leapfrogging many old economies in the region and in the developing world. This was mostly due to the discovery and exportation of oil and gas as the chief economic activity which accounted for 79 per cent of the government's budgetary revenue in 2006. Sound economic policies along with prudent utilization of this wealth have resulted in the establishment of modern socio-economic infrastructures.

It is axiomatic in the economic sphere that over-dependence on natural resources will not produce sustainable economic development and growth. This is simply because natural resources are finite and depletable, which is particularly relevant in Oman's case as its main oil resource is expected to last less than 20 years (Mcbrierty and Al Zubair, 2004). In fact, Oman has recently started experiencing such symptoms, and calls for different and urgent economic approaches have been voiced by senior government officials, international bodies and reputable international consultants.

The urgency and vital importance of economic diversification in Oman's economic development could not be expressed better than by His Excellency Mohammad Al Zubair, a leading Omani businessman and Advisor to the Sultan for Economic Planning, when he warned that the likely doubling of Oman's population by 2020, diminishing oil and gas returns, oil price fluctuations; each one of them is a serious problem, and a combination of all would be disastrous to Oman's economy in light of the absence of a serious and meaningful long range non-oil based economic strategy (Mcbrierty and Al Zubair, 2004).

The purpose of this chapter is to provide an overview of the socio-economic development in Oman in the past 35 years. It also serves as a background to the

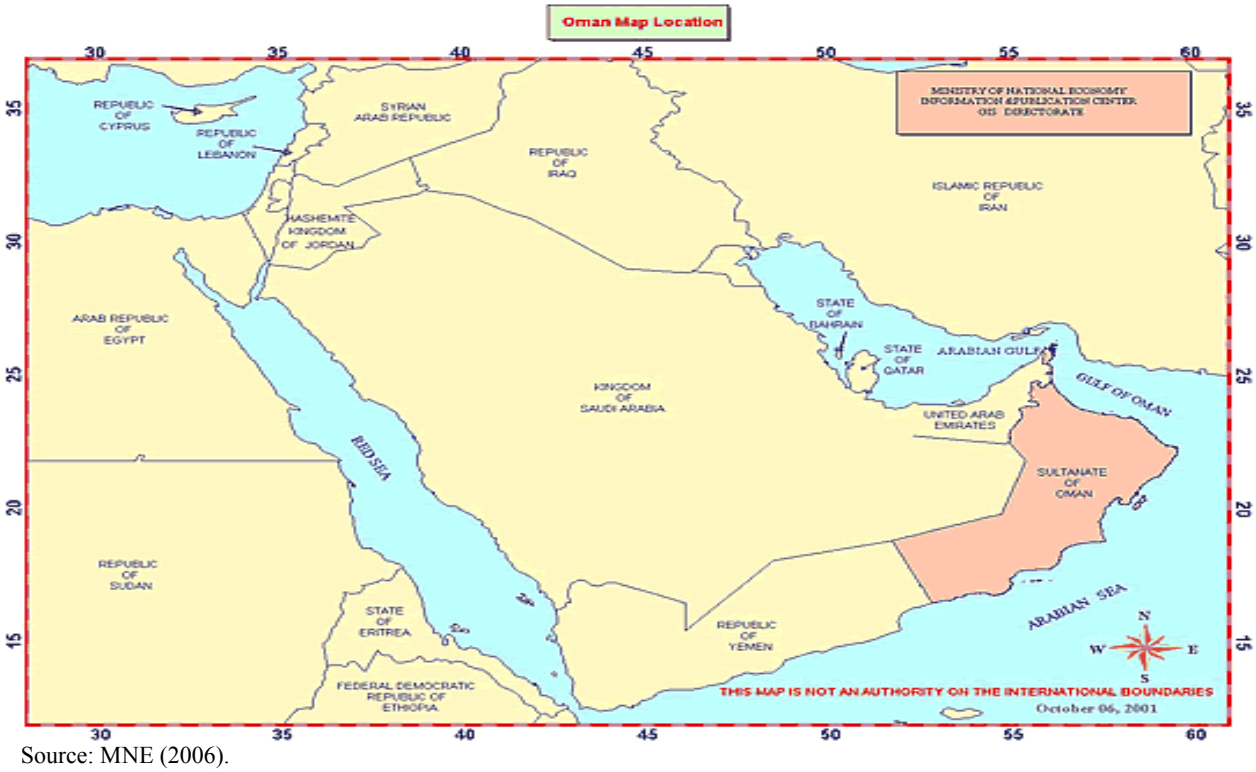
research problem and the reason why the researcher is undertaking this research project. The chapter is organized in the following manner. Section 2.2 describes Oman's location along with some important topographic information that assists in understanding Oman's geography. The importance of Oman's population, its composition and distribution are detailed in Section 2.3. This discussion is related to the fact that Oman's population represents both an opportunity as a potential driving force for the new economic development and a challenge for the government to lay down the foundation for rapid growth and for the creation of sufficient numbers of new jobs for the growing population. Section 2.4 highlights Oman's economy and its development in the last 35 years. Different economic strategies and plans are summarized with reference to their past contribution to the overall economic achievements. Oman's economic development vision Oman 2020, which represents its economic development framework and the government's blueprint for current and future economic development vision is discussed in Section 2.5.

The development and the importance of the private sector in Oman are presented in Section 2.6 where the potential of the service sector in particular to generate employment is also considered. The challenges of the next phase of economic development are discussed in Section 2.7 where the opportunities and challenges presented by the new economic approach are discussed. Section 2.8 provides the summary of the chapter.

2.2 Geography

The Sultanate of Oman occupies the south-eastern corner of the Arabian Peninsula as the third largest country in the peninsula. The total land area of 309,500 square kilometers is composed of varying topographic features: valleys and desert account for 82 per cent of the land mass; mountain ranges 15 per cent; and the coastal plain 3 per cent. Only 7 per cent of the total area is cultivable. Oman borders the Kingdom of Saudi Arabia and the United Arab Emirates in the west, the Republic of Yemen in the South, the Strait of Hormuz in the north and the Arabian Sea in the east. Figure 2.1 shows Oman's location.

Figure 2.1 Map and location of Oman



Source: MNE (2006).

Oman is categorised by the United Nations as a developing country. According to this classification, a developing country has a low average income compared to the world average and has not achieved a significant degree of industrialisation. Development entails building a modern infrastructure (both physical and institutional), and movement away from low value added sectors such as natural resource extraction. In contrast, a developed country is one that has achieved (currently or historically) a high degree of industrialisation, and enjoys a standard of living where wealth and technology are combined effectively and productively. A developed country usually has an economic system based on continuous, self-sustaining economic growth (Al-Wohaibi, 2006).

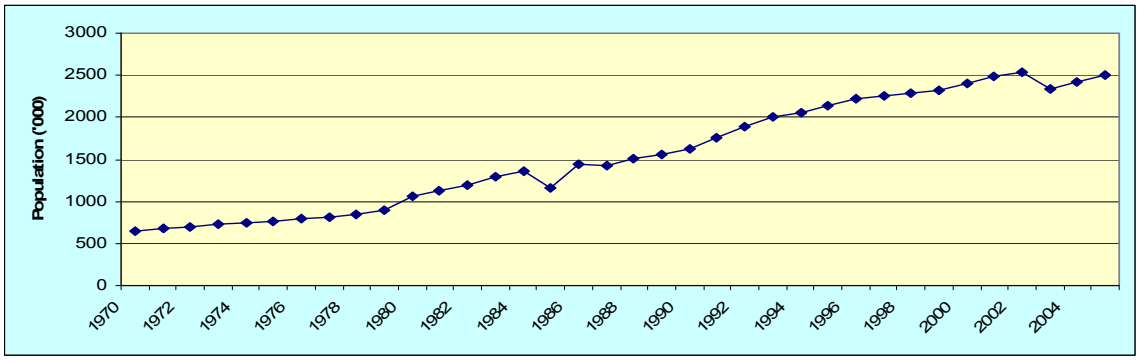
2.3 Population

Population statistics refer to the size, growth, composition and distribution of the population as well as the components that shape population change. Although population statistics are not in themselves indicators of well-being, they underpin the discussion of a wide range of issues relating to the population, including labor, ageing and population sustainability (World Bank, 2002).

The changing size and distribution of Oman's population have important implications for its economic development. These implications can be seen in the service provision and delivery in areas such as health, education, information and communication technologies, and the labor market. In fact, population trends underlie many social changes and impact on the planning of social and economic policies. The principal source of data on Oman's population is the actual results of the General Census of Population, Housing and Establishments, which is conducted every ten years. The first population census in Oman was carried out in 1993 and the latest census was conducted in 2003. Before 1993, population figures and related statistics were mainly estimations provided by the Ministry of National Economy (MNE) and the World Bank.

In 2006, Oman's population was 2.5 million. The rate of growth of Oman's population has been quite high partly due to the high birth rate and partly due to the high influx of an expatriate population (visiting workers). As a result, Oman's population has doubled twice between 1970 and 2004. Currently, expatriates account for more than a quarter (26.5 per cent) of Oman's total population. The high proportion of expatriate population is attributed to the rapid economic development in the country which has resulted in a better standard of living and the influx of expatriates to participate in this development after the discovery of oil in the 1960s and the rise of world oil prices in 1972. Figure 2.2 shows Oman's total population growth between 1970 and 2005.

Figure 2.2 Population growth in Oman, 1970-2005

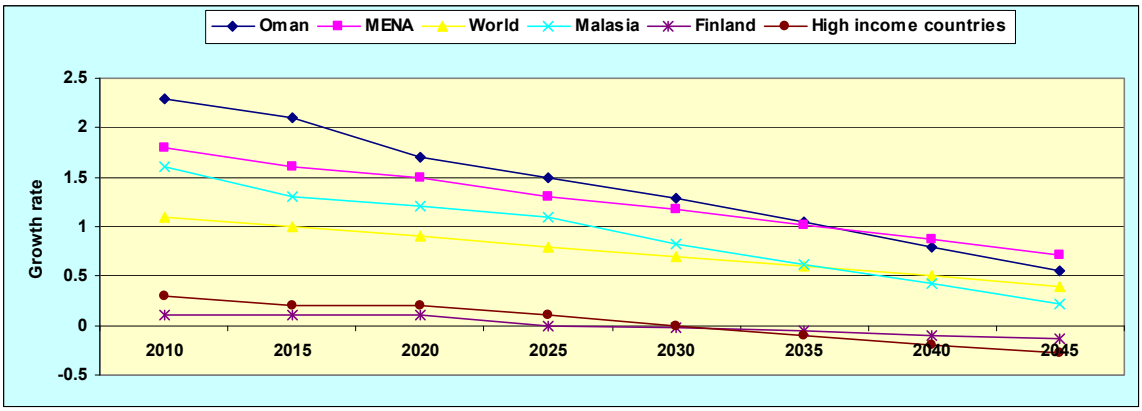


Source: MNE (2006).

As Figure 2.2 indicates, between 1980 and 1995 Oman experienced consistently high population growth, with an average rate of 3.6 per cent per annum, before it slowed down to 2.3 per cent between 1996 and 2003 due to improved health conditions, better education and staunch government campaigns to reduce the fertility rate (MNE, 2006).

The current rate of population growth in Oman is 2.3 per cent which is considerably higher than the world average of 1.6 per cent and the Middle East and North Africa (MENA) region average of 1.8 per cent. International Labor Organization projections indicate that the pace of population growth will slow down possibly close to the world average by 2045. The fertility rate is projected to decline to 4.8 per woman from its current level of 6.7 per woman. Studies show that government campaigns, financial constraints and better education are all contributing to the decline of the fertility rate in the country (MNE, 2004). Figure 2.3 shows some projected comparisons of population growth between Oman and selected regions, countries and groups of countries.

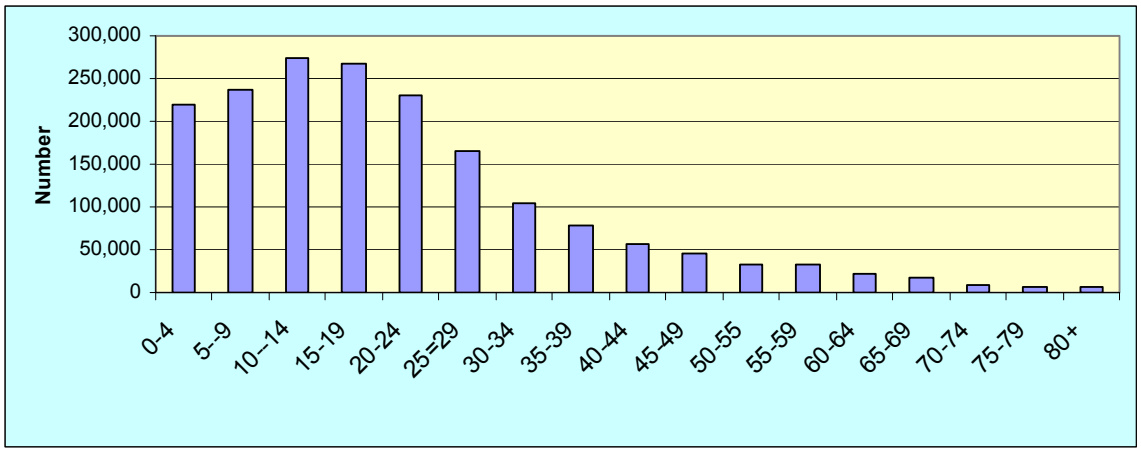
Figure 2.3 Comparison of projected population growth rates to 2045



Source: International Labor Organization (2006).

The most noticeable feature of Oman's indigenous population is that 40.4 per cent of them are under 15 years of age. This signifies that more than 738,903 nationals will enter the workforce within the next 4 to 18 years. In addition, 40.5 per cent, or about 767,614, of the national population are already part of the workforce in the country. Oman is, therefore, predominantly a young population country as depicted in Figure 2.4.

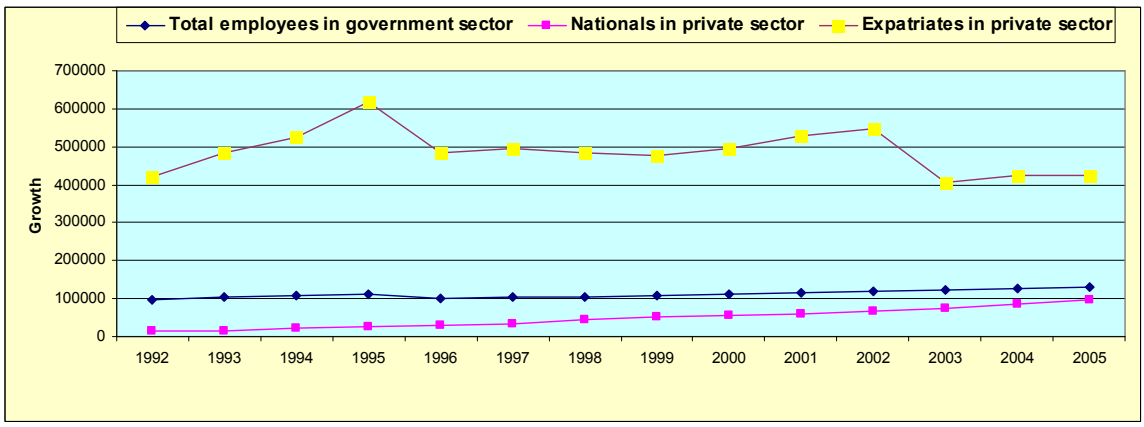
Figure 2.4 Age distribution of Oman's population, 2006



Source: MNE(2006).

This high growth rate of the indigenous population has led to rapid expansion of the working age population, which has been mainly absorbed to date by two main options of employment. The first is the government sector with more than 132,000 employees while the private sector employed only 98,500 employees as of 2005 (MNE, 2006). This heavy reliance on the public sector for employment has resulted in trapping human capital in unproductive jobs, thus limiting its contribution to overall economic growth. The second option for employment has been to gradually reduce the number of visiting workers from a peak level of 619,000 in 1995 to 425,000 in 2005, which represents a reduction of 31 per cent. Figure 2.5 depicts the growth of the work force in Oman (1992-2005).

Figure 2.5 Growth of workforce in the private and government sectors, 1992-2005.



Source: MNE (2006).

However, both these avenues of employment have failed to absorb the growing workforce and the official (conservative) unemployment rate has now reached an estimated 15 per cent. The situation is worse for first time job seekers who are mostly between 15 and 24 years of age and make up more than 50 per cent of the unemployed (Yousef, 2004). More importantly, the prospects of an improvement in the situation in the near future are not good, as the World Bank's population projections show that the population in Oman is expected to double again in the next 18 years for the third time since 1970, to exceed 5 million people by 2023. In the absence of commensurate growth in new jobs, this could severely hamper the government's efforts for better economic development and fuel social unrest (World Bank, 2004).

With regard to the population distribution by sex, Oman seems to be in a stable position at this stage as the ratio is 102 males for every 100 females as compared to 106 for the global average. This is primarily attributed to the dominance of male expatriates who outnumber female expatriates by a margin of roughly 3 to 1 (MNE, 2006). This signifies a comfort zone for the government in the short term as Oman's total workforce is predominantly male in composition, accounting for 83 per cent of the workforce. The under-representation of the local females in the domestic workforce can be attributed mainly to religious and cultural beliefs that favor house-related activities for women (Al-Lamki, 2007). This situation is changing, however, as female participation in the workforce has been increasing over the past two decades or so. Recent figures indicate that female nationals joining the government workforce have increased from 4 per cent in 1980 to more than 37 per cent in 2005. Similarly the private sector has registered an increasing trend as national female participation rose from 10 per cent in 1994 to 16.9 per cent in 2005 (MNE, 2006).

This increase in national female employment is related to the fact that the female enrollment ratio at tertiary education level - which qualifies them for better jobs - has increased from 0.8 per cent in 1984 to 12.9 per cent in 2005 (Al-Lamki, 2007). Increasing social openness to modernity and the rising cost of living have also contributed to females playing a more active and productive role in the national workforce. No doubt this gradual demographic development will add more pressure on the government's policy makers to accelerate their efforts for job creation. It is

estimated that more than 53,000 new jobs must be created annually in the next thirteen years to keep up with the pace of new entrants to the workforce (MNE, 1996). These projections suggest that more than 689,000 new jobs must be created by 2020 to accommodate the new labor force entrants and absorb those who are currently unemployed. Further, long-run forecasts suggest that the rates of labor growth will not ease until 2020 when they are expected to fall to more moderate levels allowing population growth to become reasonably controlled (ESCWA, 2003). It is clear from these figures that demographic pressures will continue to present a major challenge for Oman's economy and society in the near future. It is equally clear that the country needs to urgently implement new medium and long-term strategies for economic diversification and a sustained period of high rates of economic growth to reap the demographic dividend.

2.4 Economic Development

Oman's GDP was a mere US$110 million in 1970 of which 34 per cent was accounted for by agriculture and the rest by trade, fisheries and livestock. The per capita income was US$1760 dollars. Around 90 per cent of its 624,000 population depended upon agriculture and fisheries (McBrierty and Al Zubair, 2004).

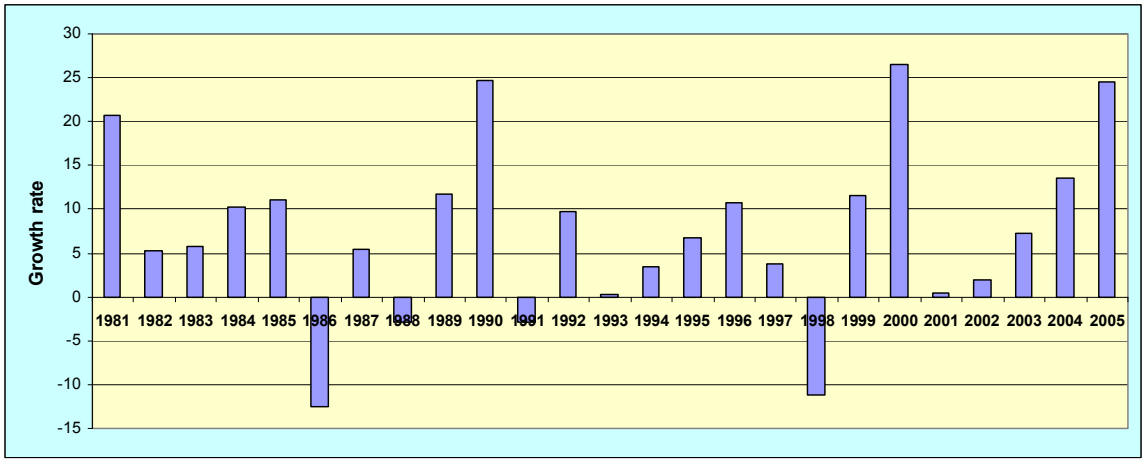
Oman's economic development in a true sense began in 1970 when modern economic records started. This was in fact the beginning of Oman's modern era when the current Sultan (Qaboos) took reign and started the overall development of the country especially on the economic front. Over the past 35 years, the economic outlook of Oman has undergone a transformational change. The country's socio-economic development indicators such as gross domestic product (GDP), per capita income, standard of living, economic diversification, infrastructure, and to some extent private sector development, have begun to display signs of real economic growth.

Commercial oil exploration in Oman began in 1964 and the first consignment of oil exports took place in 1967. However, only in the 1970s did oil become a valuable resource in Oman's economic development with a steady increase in crude oil production and exports, and the surge in oil prices. The exploration of oil put Oman's economy on a higher growth path and transformed it into a prosperous country. Rising

oil revenues allowed the government to develop social and physical infrastructure - with substantial investments undertaken in health, education, transportation, electric power, water supply and communications – which in turn contributed to further economic growth.

As a result, Oman recorded one of the highest GDP growth rates in the Middle East and North Africa region and in the world with an average annual growth rate of about 10.8 per cent between 1981 and 1990 and 12.4 per cent between 2000 and 2005; in spite of the rapid rates of population growth noted in the previous section (Figure 2.6).

Figure 2.6 GDP average growth rate, Oman, 1981-2005

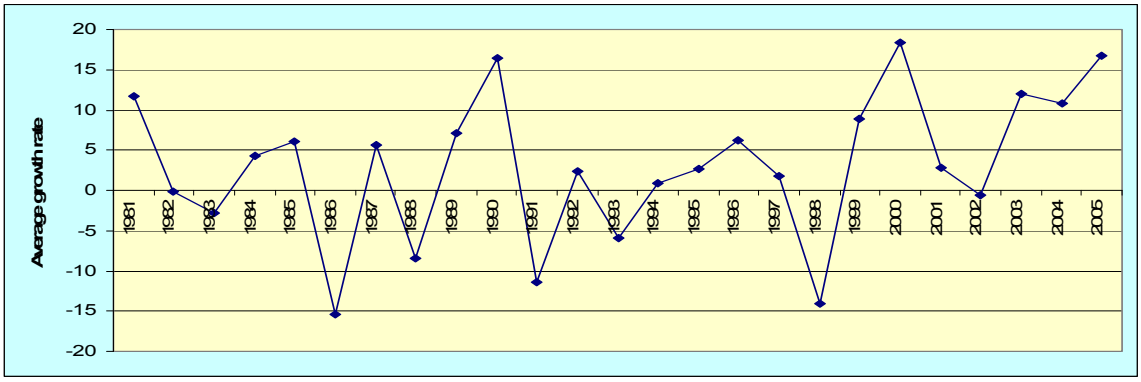


Source: MNE (2006).

Oman's per capita income rose to US$11,994 per capita making Oman a high middle income country where the GDP per capita growth rate grew at an average rate of about 2.0 per cent annually between 1991 and 2000 and 3.4 per cent between 2001 and 2005 (Figure 2.7).

Figures 2.6 and 2.7 make one fact about Oman's economic growth abundantly clear; the pattern of growth was marked by many fluctuations, which pushed the rates of growth of GDP into the negative territory four times (Figure 2.6) and the rates of GDP per capita six times (Figure 2.7) during the 1980s and the 1990s. Even when these growth rates were positive, the rates fluctuated widely from one year to the next.

Figure 2.7 GDP per capita average growth rate, Oman, 1981-2005

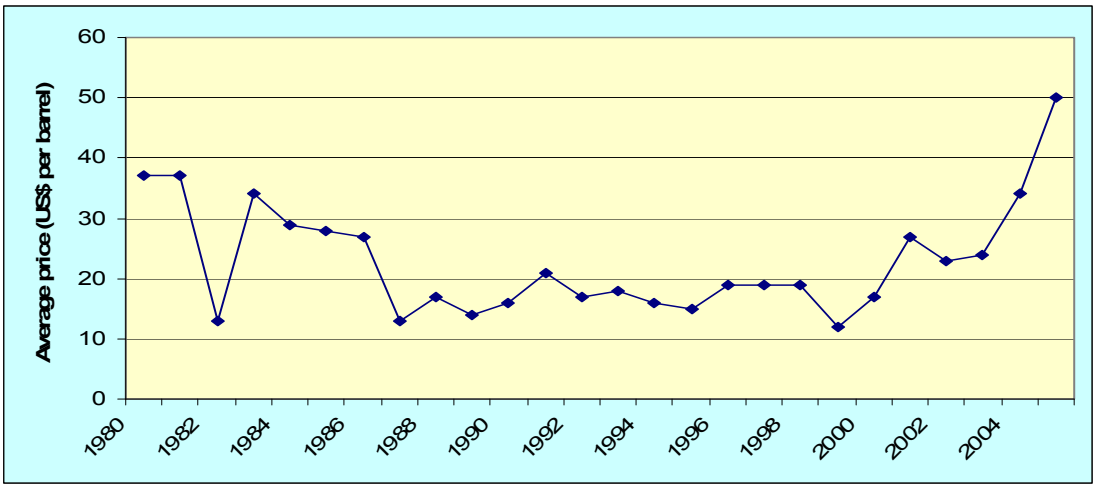


Source: MNE (2006).

Oman began laying the groundwork for a sound economic base in 1976, when the first Five-Year Plan (1976-1980) was launched with the aim of broadening the economic base of the country by investing heavily in economic and social infrastructure and by strengthening the country's institutions. Subject to fluctuations in the price of oil, sound achievements were generally secured and goals attained throughout each of the 6 five-year plans spanning 1976-2005. The exceptions were in the Second (1981-1986) and the Fifth Five-Year Plan (1996-2000) when the oil producing countries experienced their worst oil price decline. Oman's oil price average collapsed in 1986 to US$13 a barrel compared to US$27 a barrel in 1985 resulting in a negative 12.5 percent GDP growth in 1986. This was the first external economic shock that exposed the vulnerability of Oman's economy. Government revenue fell sharply resulting in a large fiscal deficit. Financing of this unsustainably large fiscal deficit while maintaining a reasonable economic development level, entailed a substantial drawdown of foreign and domestic investments from the State General Reserve Fund (SGRF) and a loss of foreign exchange reserves of the monetary authority, as well as the accumulation of more than US$5 billion of domestic and foreign debt.

The second economic shock occurred in 1998 when the world oil prices plunged to US$12 from US$19 per barrel in the previous year, resulting once again in a significant fall in oil revenues and a negative GDP growth of 11.1 percent. These external economic shocks were also evident to a lesser extent throughout the Third Five-Year Plan (1986-1990) and the Fourth Five-Year Plan (1991-1995). This can be clearly seen in Figure 2.8 which reflects the fluctuations of Oman's oil prices since 1980.

Figure 2.8 Oman oil price fluctuations, 1980-2005



Source: MNE (2006).

Due to the above circumstances which reflect the narrowness of the economic base, the government had limited choices, as external investments were mostly liquidated and had been used for countering the first oil price shock. Hence, the government started expenditure retrenchments mainly in the form of reduced civilian and military outlays as well as postponement of new development projects. These events exposed the reality that Oman's economy was excessively dependent on oil revenues.

The major oil price fluctuations and shocks presented a major challenge to the government's efforts to maintain positive economic growth and to broaden the economic base of the country. To overcome these challenges, technical help from the World Bank (WB) and the International Monetary Fund (IMF) was sought as the government initiated a strategy for more diversified growth which firstly promoted oil-related industries and strengthened the export base centered on the development of the country's 24.4 trillion cubic feet reserves of natural gas estimated to last for some forty-five years.

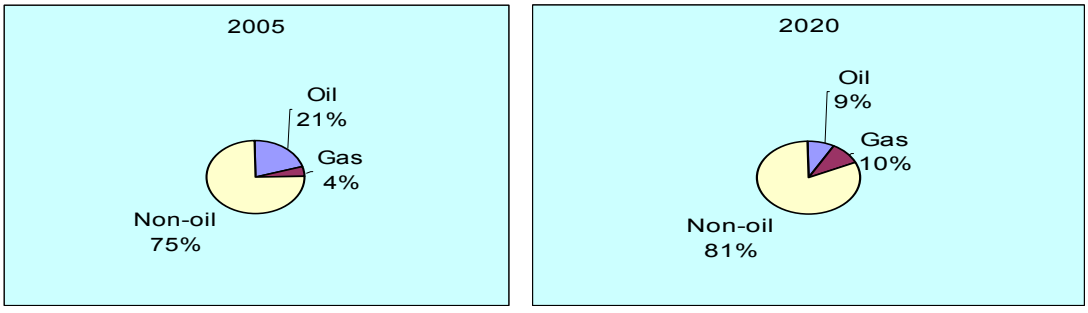
In addition, as part of the diversification strategy, the government initiated promotion of service industries such as trade, tourism, insurance, financial services and education as a second and parallel economic development strategy. This emphasis on economic diversification was part of a strategic long-term plan, termed *Oman 2020* aimed at developing sustainable economic solutions.

2.5 Oman 2020

The strategic socio-economic vision Oman 2020 was initiated in 1996 at the start of the Fifth Five-Year Plan (MNE, 1996). The principal aims of this plan were to shift gradually from an economy that depends on government spending, primary industries and foreign labor, to one that relies more on private initiative, national labor and renewable resources leading to the achievement of sustainable development.

The secondary aims were to achieve: an average GDP growth rate of 7.4 per cent between 2000 and 2020; enhancement of the private sector role to facilitate optimum utilisation of natural and human resources; adoption of sustainable financial policies; and promotion of balanced regional development (MNE, 1996). It was anticipated that by the year 2020, the Omani economy would no longer rely on oil, but would be diversified as national income from the non-oil sector would take the leading role. The oil sector's share of GDP would drop to around 9 per cent from 21 per cent in 2005, the gas sector would contribute around 10 per cent to GDP from 4 in 2005, and the non-oil sector's contribution would reach 81 per cent from 75 per cent in 2005. This is illustrated in Figure 2.9 which reflects a comparison between the current GDP activities and the anticipated share of these activities by 2020.

Figure 2.9 Percentage share in GDP of main economic activities, 2005 and 2020

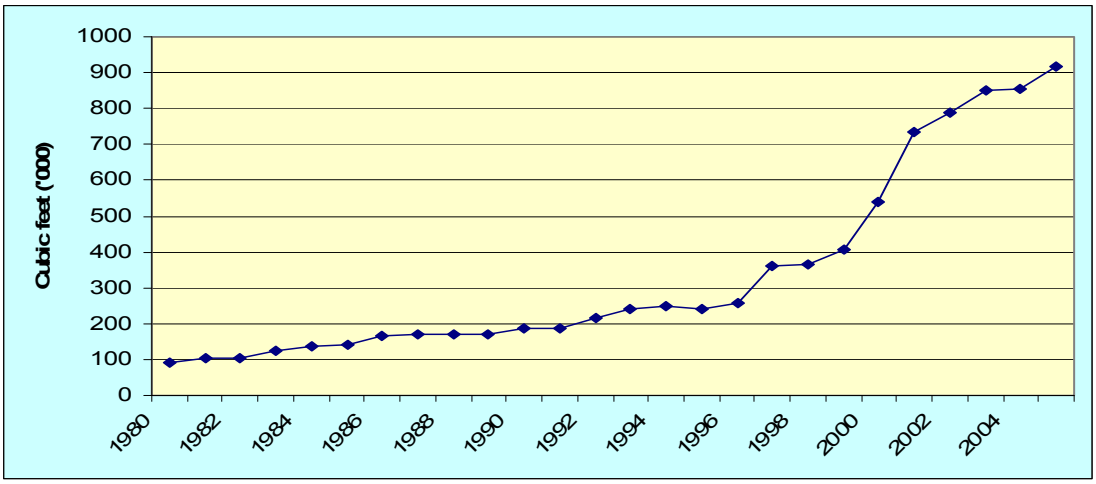


Source: MNE (1996).

In one decade since the inauguration of the economic diversification strategy, impressive progress has been made in several aspects of the economy. A major achievement was the completion and successful operation of a liquefied natural gas (LNG) plant in September 2000. In addition, future plans to establish industries based on natural gas which include petrochemical industries, fertilisers, an aluminium

smelter, etc., will provide additional scope for benefits. Figure 2.10 shows the significant increase in gas production between 1980 and 2005.

Figure 2.10 Growth in gas production, 1980-2005

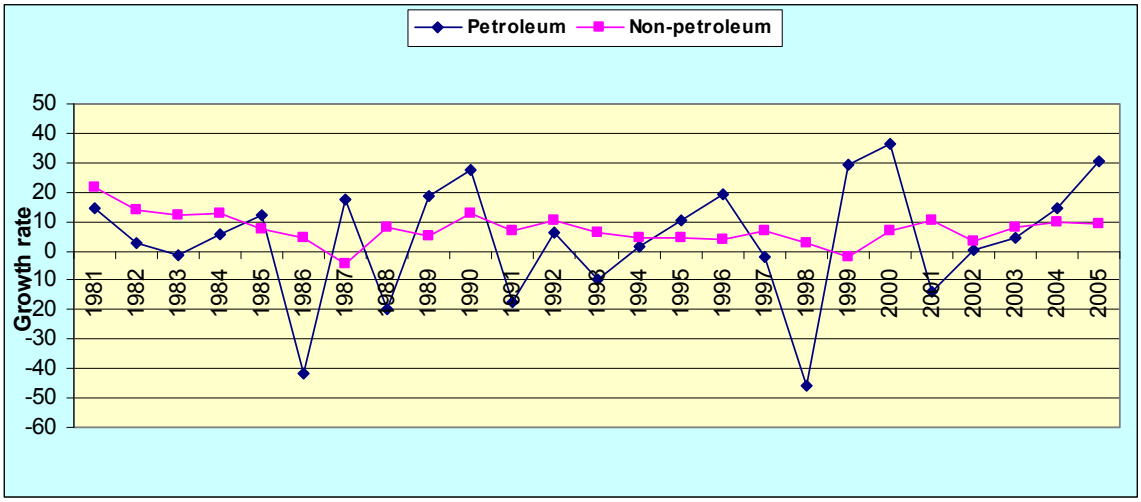


Source: MNE (2006).

Other important achievements in the non-oil sectors were the completion and operation in southern Oman of the Salalah Container Port in 1998, the inauguration and operation of major tourism projects in the Muscat area such as Bandar Al-Jessa, the Wave and the Blue City projects. A noticeable achievement of previous major projects was the government's success in convincing the private sector and foreign investors to play an increasing role in the financing of major projects. Consequently, total investment was boosted significantly to more than 20 per cent of GDP by 2004 up from 14 per cent during the 1990s.

Furthermore, recent statistics show that further progress has been made in the wake of a more than doubling of the oil price in the past three years, which has enabled the government to speed up the pace of executing its economic plans to invest in the diversification process. As a result, total GDP reached a record of US$30.9 billion in 2005. This GDP growth of about 24.8 compared to the previous year, was not only due to the oil price increase, but it was also boosted by growth (6.5 per cent) in non-petroleum activities. Figure 2.11 shows the growth of the non-oil sector compared to the oil sector.

Figure 2.11 Growth of petroleum and non-petroleum sectors, 1981-2005



Source: MNE (2006).

2.6 The Private Sector

As noted above, the development of the private sector is an important goal of the *Oman 2020*. Even though the government has tried with varying intensity and success to expand the private sector's activities through privatization, liberalisation of trade and favourable foreign direct investment laws, the public sector still continues to play a major role in driving the local economy. In fact, as Figure 2.11 shows, the volatile growth and decline of the non-oil sectors is closely related to the oil sector's performance, suggesting that oil revenues which are controlled by the government tend to lead the growth pattern of the non-oil sectors.

As globalisation has become a reality, not a choice, Oman's agreement with the World Trade Organisation (WTO) which enabled it to become the 139th full-fledged member in November 2000, is considered a vital step in its endeavour to integrate into the world economy. In addition, the country's membership of the Gulf Cooperation Council (GCC) since its creation in 1981, and its membership of the Indian Ocean Rim States Association for Regional Cooperation (IORARC) that consists of 19 Asian countries totalling 1.6 billion people, demonstrates the country's willingness to engage with the rest of the world, and in the process also provides a boost to the private sector.

To be consistent with the above open-door policies, the government has introduced and comprehensively revised the existing rules and regulations and introduced new regulations, with the aim of ensuring their compatibility with the requirements of the WTO membership. These initiatives include lifting the impediments to foreign direct investment (FDI), introduction of the intellectual property law, creation of a level playing field for foreign and local companies, and streamlining of regulations to improve the business climate. The benefits of these developments can be seen in the country's favourable investment environment where 100 per cent of foreign ownership is permitted in the services sector in activities such as banking, insurance and brokerages, and up to 70 per cent of foreign ownership is permitted in other activities. The privatization of the main telecommunications company, electrical and water utilities, cement companies and hotels is also anticipated to further boost growth in the private sector.

This rapid pace of business policy reform has resulted in a steady growth of new firms entering the private sector at the rate of about 6.2 per cent a year since 2002. In fact, the number of establishments registered at the Oman Chamber of Commerce and Industry (OCCI) increased from 97,093 in 2002 to 119,281 by the end of 2005 as depicted in Table 2.1 below.

Table 2.1 Classification, size and number of companies in the private sector, Oman, 2005

Company category	*Capital (Omani rials)*	*Number of companies*	*% of total number*
International	----------	298	0.3
Consultancy	----------	205	0.2
Grade 'Excellent'	250, 000 +	2151	2.0
Grade 'First'	100,000-250,000	5959	5.0
Grade 'Second'	50,000-100,000	7723	6.5
Grade Third'	5,000-50,000	7239	6.0
Grade 'Fourth'	5000 or less	95,707	80.0
Total	----------	119,281	100%

Source: MNE (2006).

This is also evident in the growth of the non-oil sector particularly the private service sector which surpassed the oil sector in its relative share of GDP to reach 39.3 percent in 1995 and is anticipated to grow further to almost 50 percent by 2020 (MNE, 1996). Table 2.2 presents sectoral shares in GDP of the main economic activities in Oman.

Table 2.2 Sectoral relative shares to GDP, 1995, 2000 and 2020, per cent

Activity	*1995*	*2000*	*2020*
Oil	33.5	25.9	9.0
Gas	1.5	3.0	10.0
Agriculture	3.0	3.4	3.1
Fishing	1.1	1.0	2.0
Mining & quarrying	0.6	0.6	2.0
Manufacturing	5.4	6.8	12.0
Electricity & water	1.7	4.4	2.0
Private service sector (building, construction & real estate, trade & tourism, transportation & communication, banks, insurance and financial services, education, health and consultancy)	39.3	42.3	49.9
Public service sector (government run transportation, communication, specialized banks and tourism projects)	13.9	12.6	10.0
Total	100%	100%	100%

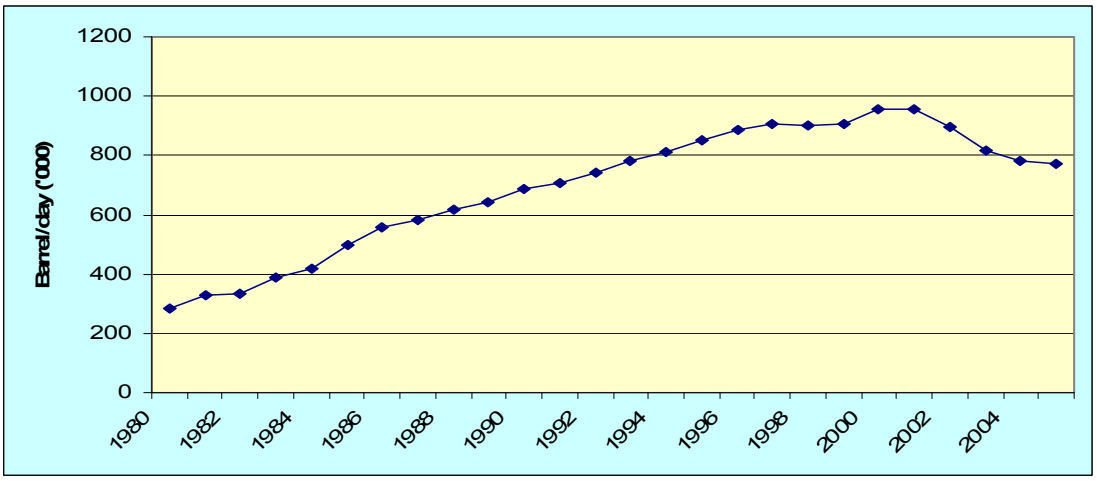
Source: MNE(1996).

The rising importance of the service sector has been the feature of most of the rapidly growing economies during the past two decades. The development of knowledge intensive activities such as banking, insurance, education, telecommunications and tourism has also been a common experience of many of these countries. In Oman, the services sector has registered 7.2 per cent average annual growth since 2000 which is second fastest growth rate after the industrial sector (12.9 per cent) for the same period. More importantly, the services sector contributes to more than 74 per cent of the total non-oil sectors making it the biggest segment of the private sector in Oman.

2.7 Challenges of the Next Phase of Economic Development

Despite this growth in the private sector aided by continuous government support, the World Bank (2003a) has expressed the view that Oman's current economic model is not sustainable. The current oil prices have eased the pressure on the government and enabled it to carry on with its economic development plans. However, the government is now facing a different worrying reality as the oil production reached its peak in 2001 of 956,000 barrel per day. Since then it has started to decline to its lowest level for 10 years when the production level reached 774,000 barrel per day in 2005 recording a more than 19 per cent decline compared to its peak 2001 production level. This trend of oil production decline was reaffirmed by recent official statements from the Ministry of Petroleum and Gas indicating the technical difficulties in reaching peak level of oil production in the coming years. A picture of Oman's oil production that peaked in 2001 and has been falling since then, is depicted in Figure 2.12.

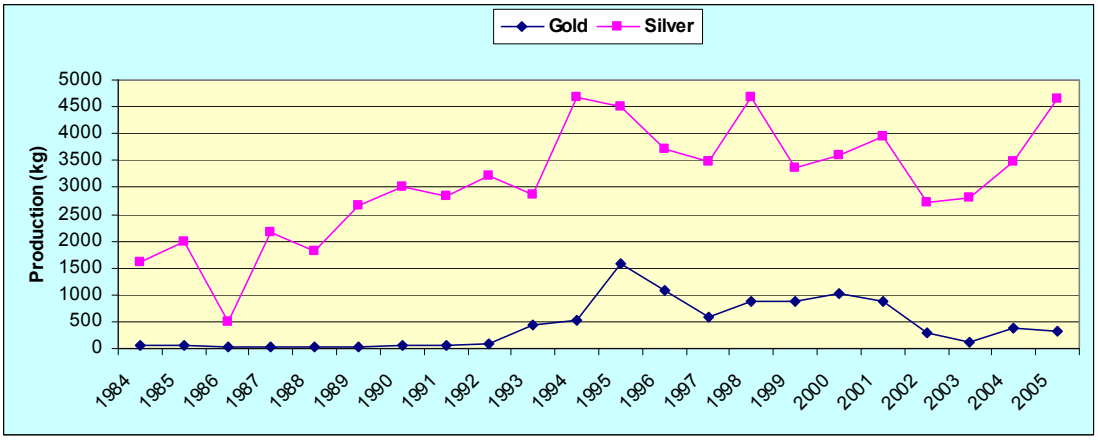
Figure 2.12 Daily oil production



Source: MNE (2006).

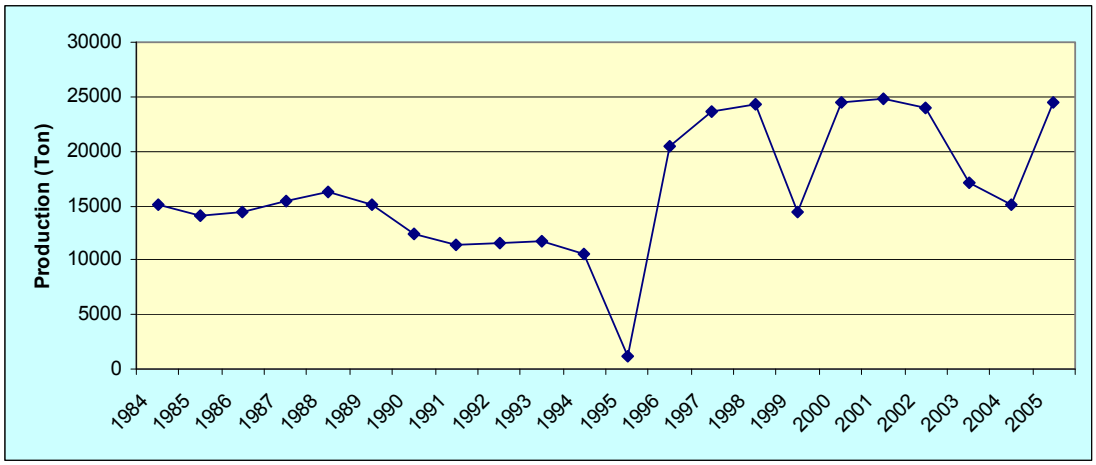
Furthermore, all new exploration efforts that were conducted by the main oil producing company in the country, Petroleum Development of Oman (PDO) and some other international oil companies were not promising. In fact, the Ministry of National Economy's figures indicate that Oman's proven oil reserves have not changed since 1995 at 5.5 billion barrels, which is expected to last for less than 20 years (to 2025) according to the current level of extraction (MNE, 2006). A similar situation exists in the mineral sector as production and exports have been inconsistent and are heading downward, as all explorations of new sites and possibilities of increasing production capacities of the existing ones were not feasible. Figures 2.13 and 2.14 show the inconsistencies and a general decline of production of major minerals between 1984 and 2005.

Figure 2.13 Gold and silver production, Oman, 1984-2005



Source: MNE (2006).

Figure 2.14 Copper production, Oman, 1984-2005



Source: MNE (2006).

In their studies, Mansur and Treichel (1999) indicate that the overall economic structural reforms currently under way in Oman are capable of sustaining the current growth momentum in the short term. This is because the current reforms and the development strategy in progress will reduce the country's reliance on oil only in a slow and gradual manner, while the positive results of the planned industrial and tourism projects cannot be fully realized in the immediate future as most of the new major projects have been granted generous tax holidays and economic incentives. For example, the liquefied natural gas (LNG) project's full economic potentials will only be realized in 2010 (McBrierty and Al Zubair, 2004)

Another difficult economic influence is about to challenge policy makers in Oman as the domestic economy will be more liberalized by 2010 when the grace period to fully integrate in the world economy according to the World Trade Organization (WTO) requirements comes to an end. At that point the country will be exposed to further international competitiveness and globalization. This is relevant to the fact that total factor productivity (TFP) is low in both in the government sector and the private sector. A number of studies have found that the output growth in Oman has occurred largely as a result of increases in capital and labor rather than in TFP (World Bank, 1994; Mellahi and Al-Hinai, 2000).

According to Abed (2003), it is difficult to sustain a rise in living standards if higher rates of accumulation of physical capital and labor are not accompanied by positive TFP growth. The importance of TFP in the process of economic growth cannot be

underestimated. Indeed, recent World Bank studies on some developing countries show that countries such as Malaysia, South Korea and Singapore have achieved positive TFP growth leading to high growth rates. Countries with negative TFP growth rates often tend to have relatively poor growth performance, as is the case with most of the Middle East and North Africa region (World Bank, 2004).

In this situation, more recent studies on Oman (Mcbrieirty and Al Zubair, 2004) and the MENA region (World Bank, 2004), (Yousef, 2004) suggest that the most feasible way forward to achieve sustainable economic growth and to remain globally competitive in the medium and longer-term is by promoting the local private sector assisted by enhancing the capabilities and skills of the national workforce. Countries in similar situations, like Ireland (Mcbrieirty, 1999), Korea (World Bank, 2000), Finland (Dahlman et al., 2005), Singapore (Ramcharan, 2006) and Malaysia (Jomo et al., 1999), all of which were resource driven economies that experienced similar economic challenges, have successfully adopted dynamic and innovative economic strategies. Such strategies were based on strengthening and giving the leading role to their local private sectors and developing human capacities through the creation, effective dissemination and utilization of knowledge. These strategies have enabled these countries to integrate in the global economy remarkably well and accelerated their progress.

2.8 Summary of the Chapter

There is no doubt that Oman has achieved impressive economic development in the past three and a half decades. The county's total population increased threefold, its GDP increased by more than 200 times as did its GDP per capita growth. During this period the government was the main driver of the economy as it depended heavily on its natural resources particularly oil to create and sustain reasonable economic development. As is the case with other GCC countries, Oman was challenged mainly by fluctuations in oil prices and initially solutions were based on fiscal policies on the macro level which were effective enough to tackle such problems at the early stages of the country's economic development.

More serious and complex challenges are yet to be addressed as the county's natural resources industries reach their production peak and start to decline. At the same time, while liberalization, modernization and globalization of the domestic economy are essential steps implemented by the government since the inauguration of its strategic economic plan *(Oman 2020)* in 1996, the nature of the new challenges is going to be centered on the development of human resources. This is supported by the fact that many developed and developing countries, irrespective of their location, geographical and demographical sizes, and abundance of natural resources, have achieved miraculous results. Their secret recipe has been a strong commitment to the comprehensive and vigorous development of knowledge economy strategies as a viable path that has contributed greatly to their impressive sustainable economic development. By failing to be a part of the new economic revolution, Oman cannot hope to achieve sustainable economic development, and may risk becoming even more marginalized.

The literature on the knowledge economy is reviewed in Chapter 3 with a view to exploring its evolution, development and the key drivers as a potential economic solution to Oman's socio-economic challenges.

Chapter 3. Literature Review

3.1 Introduction

The objective of this chapter is to review the existing literature relevant to the development of the knowledge economy in terms of its definition, origin, key drivers, measurement, economic and social impacts and application in today's world. Emphasis will be put on its application and empirical evidence in developing countries due to its relevance to this research.

There are two important characteristics of the literature on the knowledge economy in this context. First, it is relatively new compared to traditional economic studies (OECD, 1996), and second it is heavily based on the experience of the developed countries as most of the studies concentrate on developed economies (Foray and Lundvall, 1996). Only recently there has been an interest in exploring the relevance of the knowledge economy to developing countries. Even then, the focus of the current literature remains by far on the rapidly growing developing economies, such as Brazil, China and India. Other developing countries, particularly in the Middle East and North Africa region such as Oman are yet to be included in this literature. Indeed, one aim of this research is to fill this gap. It does so by first establishing the meaning of the knowledge economy as used in the literature along with a discussion of the different strategies and policies that are considered essential for the development of the knowledge economy in both developed and developing countries.

This chapter is organized as follows. Section 3.2 discusses different definitions of knowledge as well as its evolution. The importance of this section stems from the fact that there is a misconception emerging among developing countries' politicians and policy makers that portrays knowledge (in general and the new knowledge in particular) as a western phenomenon. The aim of the discussion is to examine the veracity of this misconception by exploring in depth the definitions and the different stages of progress of knowledge through human civilisation. Definition and description of different concepts and terminologies of knowledge economy that are commonly used interchangeably or associated with it will be discussed in Section 3.3.

Such description is essential in understanding the essence and relevance of the knowledge economy for developing countries specifically, and distinguishes it from other concepts that tend to describe advanced economies' current socio-economic status. This section also highlights the trends that have continued in the upsurge of knowledge economy development.

Section 3.4 presents different theoretical arguments, views and theories, that try to explain this new economic order which present a departure from the conventional economic view that sees economic development as a result of labour and capital inputs. Drivers (pillars) and enablers of the knowledge economy will be identified in Section 3.5. This section maps the knowledge economy's main pillars as preconditions that must be met before undertaking knowledge economy attempts and their potential significance in today's economic development. Social impacts of the knowledge economy on societies will be explored in Section 3.6. This is useful in the present context as preservation of social peculiarities is pivotal in the successful quest for sustainable economic development and in guarding against undesirable outcomes. Section 3.7 summarises the chapter.

3.2 Definition of Knowledge

Neef (1998) claims that understanding the nature of knowledge is a pre-requisite for successfully utilizing it in a meaningful way. In fact, while appearing to support such a claim, Hoppe (1997) goes further in asserting that the understanding of knowledge must be put into an evolutionary context that explains how and why the use of knowledge has spread in economic and social activities. Tackling such a definition from an evolutionary point of view also brings into the discussion those who believe that knowledge is not a new concept but it is as old as human existence (Mokyr, 2002)

According to Hoppe's view, knowledge accumulation is an old and endless evolving learning process that individuals and societies have been contributing to. This knowledge accumulation starts with individuals who make up the building blocks of societies by developing different skills through the accumulation and use of knowledge. Only individuals can know and what they know depends on their perceptions, experience, memory and inference. Knowledge is thus shaped, refined

and continually molded by the activities that individuals engage in during their lifetime, boosted by the curiosity and uncertainty that nurture the continuous knowledge creation process via everyday experience and interaction with others (Hoppe, 1997).

This type of knowledge accumulation is important as a basic way of learning. To operationalise, Mokyr (2002) specifically focuses on 'useful knowledge', that is, the equipment we use in our game against nature. In this sense, he differentiates between two types of useful knowledge: (a) 'propositional knowledge' which is embodied in scientific know how and focuses on how nature works; and (b) 'prescriptive knowledge' which is embodied in technical knowledge and focuses on how to use the techniques to build new or better products.

Metcalf and Ramlogan (2005) suggest that it is possible to achieve useful knowledge only when people are confronted by a problem or discontinuity in their outside world. In fact, it is a private way of making sense of the world, distinguishing facts, grouping related phenomena, finding connections and establishing cause and effect. Through this sense of different individual experiences along with the knowledge of others, individual states of knowledge become useful. To Loasby (1999), such state of knowledge accumulation and explanation is not enough and presents some limitation to knowledge creation and dissemination. He asserts that private knowledge informs private action but not social action which is essential for any community's successful knowledge evolution.

To overcome the limitation of private knowledge, advocates of this wider knowledge accumulation process claim that individuals as social beings exchange ideas and experiences. This, according to Hoppe (1997), necessitates mutual support and collaborative actions against nature that result in the creation of social interaction. Thus, communities transform private knowledge to a shared public understanding through institutions which create common interpretation and flows of information. This process is important to convey personal knowledge with sufficient accuracy to achieve commonality of understanding which is essential to be shared, transmitted, stored and even traded. Without this collaboration and connection between different

individuals, this would be a world in which knowledge is a meaningless concept (Hoppe, 1997; Loasby, 1999).

Notwithstanding that most civilizations and political and economic ideologies have understood this characteristic of knowledge accumulation and have tried to mold it according to their needs, it is believed that Adam Smith laid the foundation for the modern evolutionary process of knowledge when he suggested that the most fundamental aspect of the division of labor is the division of knowledge, and the consequential existence of roundabout and combinatorial ways of producing knowledge. This represents a unique feature of capitalism as a knowledge-based system which is believed to be one of the main factors that have contributed so far to the success of the recent knowledge revolution (Metcalefe and Ramlogan, 2005). In this system, people learn by doing and acquire new knowledge through the competitive market process. The market in this case is an institution for the coordination, exchange and utilization of the differential knowledge of individuals.

From this perspective, this competitive market process led to the beneficial interaction among market participants, which over time, reduced ignorance to manageable levels for economic agents and promoted the discovery and creativity of knowledge that was not previously available which contributed to economic growth (Hoppe, 1997). Hayek (1945) explicitly advanced the creativity side of knowledge when he asserted that what's important is not so much the actual products themselves (steel and wool for example) that enter into economic explanations but rather, the knowledge and experience that individuals hold about them. Similarly it is not knowledge itself but what people share in terms of their mutual understanding of certain things that makes a market economy viable.

The fundamental point that most scholars seem to emphasize thus far, is that a knowledge-based system is a creative system that should be understood in terms of evolution not equilibrium, as the accumulated experiences and the relentless learning processes have progressively shaped our current world. Historical records seem to support such an evolutionary process starting from the Agriculture Revolution which emerged about 10,000 years ago as a result of the invention of the wheel, the division of gender tasks (specialisation) and the sedentary lifestyle (Neef, 1998). This type of

knowledge specialization flourished and set the stage for the Industrial Revolution of the seventeenth century which was further fuelled by the discovery of coal in 1850 giving momentum to the development of steam-powered ships and railways, followed in the nineteenth century by the discovery of the internal combustion engine and electrical power generation (Drucker, 1994).

Propelled by the gains of the industrial revolution, and the advances in technology in general and the convergence between information and communications technologies in particular (Bankes and Builder, 1992), the so-called 'information revolution' began to shape the new global knowledge economy at the end of the twentieth century. Since then, constant developments producing generations of a wide range of new economic activities that have been attributed to today's shift in factors of production and innovation.

The uniqueness of the information revolution rests on the fact that for the first time in the history of mankind, the basic economic resource – the means of production to use the economist's term – is no longer capital, nor natural resources, nor labour. It is knowledge as value that is now created by productivity and innovation as new applications of knowledge to work (OECD, 1996). Drucker (1994) predicted that the leading social group in society will be the knowledge workers who know how to allocate knowledge to productive use, just as the capitalists knew how to allocate capital to productive use during the industrial revolution. It is believed that the economic challenge of the post industrialist era (information) will be the proper creation, dissemination and utilization of knowledge as a competitive edge and a key factor that countries should take advantage of (Grewal et al., 2002).

Studies seem to support such a shift in economic development. As late as 1910, most workers in the developed economies worked 3000 hours a year, but now, because of the efficient utilization of new knowledge, workers in countries such as Japan work 2000 hours a year, United States 1850 hours a year and Germany 1600 a year. Yet today's workers produce 50 per cent more products and work compared to 80 years ago (Drucker, 1998). This is also evident in the figures that show direct production of workers engaged in making and moving things was nine out of ten during the 1880s,

then shrunk to five out of ten in the 1990s, and it is expected to shrink further to reach only one out of ten by 2010 (Neef, 1998).

Today, new terminologies have surfaced as a result of the information revolution, and thus a distinction between them must be drawn and defined. Terminologies such as data, information and knowledge have been used indiscriminately and interchangeably. This distinction according to Bohn (1994) is essential in the lead up to knowledge economy transformation as each one of them represents a different layer in the knowledge economy block. Bohn (1994) defines data as elements in the form of numbers and figures that come directly from sensors reporting on the measured level of some variables. Information on the other hand, is data organized in a context that gives meaning. Knowledge, according to Bohn, goes further and uses information to allow the making of predictions, and relations that dictate what to do.

Davis and Botkin (1994), as the case with most statisticians, provide a similar but simpler definition when they refer to data as the basic building block of information in the form of numbers, words, sound and images. To them information are those data that have been arranged into meaningful patterns as is the case with numbers when arranged in tables to give us useful meaning, and sounds that can also be combined into meaningful songs. Subsequently they define knowledge as the application and productive use of information. A simple example in this context is the data in bank or credit card accounts that are converted into information as monthly bills which are used by department stores, banks, retailers and other businesses to generate knowledge that can be used to facilitate, improve and develop new customer services or products that generate huge businesses and profits (Davis and Botkin 1994; OECD, 1996; ABS, 2002).

No doubt that knowledge has become and will be a determinant factor in the well being of individuals and societies alike. This importance has been reflected in the gradual evolution of civilization as a direct result of knowledge creation, accumulation, dissemination and use. It is believed that knowledge refers to the effective creation and utilization of knowledge through the necessity to enhance the effectiveness of current economic activities and establish new and wide range of activities that serve the existing economic sectors and broaden their economic

contribution. Furthermore, the debate on knowledge is expected to get broader and deeper as empirical studies, especially in developed countries, start to reflect the positive relationship between economic development and the level of knowledge that countries can create, disseminate and use effectively. With such a determinant and positive role of knowledge in economic deployments, countries and specifically developing ones, are in a position to benefit greatly from this new development.

3.3 Definition of the Knowledge Economy

The knowledge economy revolution has expanded well beyond the cutting-edge high-tech sector. In fact, Drucker (1994), Neef (1998) and Grewal et al. (2002) assert that this revolution has shaken the very foundations of the old industrial and occupational order, redefined the rules of economic development and competition, and created an increasingly global marketplace for new goods, services and players that have been driven mainly by new knowledge.

The consensus (OECD, 1996; APEC, 2003; Bontis, 2002; Drucker, 1999; Houghton and Sheehan, 2000; Powell and Snellman 2004) seems to concentrate on broad trends and factors that have caused this knowledge economy upsurge:

- technological advancement particularly in communication, computing, transportation and information exchange;
- globalization of the world economy which requires countries and firms alike to integrate in the world economy and become more innovative and quicken the process of adaptability;
- the increasing importance of specialized knowledge as a tool in coping with the new trend of globalization;
- the shift in the awareness that knowledge has become a distinct factor of production more than any other traditional factors of production; and
- the creation of potential solutions to sustainable economic growth as well as new jobs generation.

The above broad trends indicate that the knowledge economy describes the positive effect of new knowledge in economic development, and point to the decline of traditional knowledge. Many different terminologies have come to surface to describe

this phenomenon which resulted in the lack of a universal definition to describe it convincingly.

Godin (2006) has identified more than seventy-five knowledge economy related terminologies, concepts and labels that have been used between 1950 and 1984 ranging from lonely crowd, new social class, knowledge economy, new service society, information revolution, to information and communication revolution. This number is expected to grow as economic and information developments are constantly developing.

The concept of the knowledge economy which has been widely used and is preferred nowadays by policy makers and international bodies was invented by Machlup in 1962 and later was embraced by most economists, researchers and firms. What interests this research, is four concepts that have been used interchangeably and widely in which the role and significance of knowledge as an input to economic process has fundamentally being described.

These concepts are: *knowledge economy, knowledge-based economy, new economy,* and *modern economy.* From these concepts, this research explicitly prefers *knowledge-based economy* or simply *knowledge economy,* as both mean and refer to the same definition. This is because of the presumed importance of knowledge as a driver of economic development, whereas new economy and modern economy concepts are more biased towards developed economies where the emphasis is more on the use of high technology and information technology that is still less visible in the economic development in less developed countries.

This variation among these concepts reflects the view that finding a universally accepted definition for the knowledge economy is not an easy task (Neef, 1998; Bontis, 2002: Wood, 2003). As a concept, it is very loosely used and embraces a number of quite different aspects of an economy. While opponents such as Godin (2006) see it as no more than a buzzword or a label used to attract policy makers' attention to invest more in science, the phrase has been enthusiastically described by some as the new positive effect of technology and communication in the workplace and the home (Neef 1998). Others look at it from another angle, as Reich (1991) and

Druker (1994) do, describing it as the declining role of the blue-collar workforce in the business community and the rise of a new type of knowledge management brought about by the new breed of knowledge workers where the shift is from 'brawn to brain'.

OECD (1996) and APEC (2003) see it as very much bound up with the high skills/high performance/high value added scenario, as a way for firms and countries to compete in a globalised economy. Another view, found principally in the scientific and technical community, tends to view knowledge economy narrowly as applying to knowledge intensive industries where knowledge itself is the core competence. The latter is typically found in software, internet companies and the health care sectors (Bankes and Builder, 1992).

A broader and more appealing view to developing countries in particular has emerged recently. Sheehan and Grewal (2000), OECD (2002), APEC (2003) and the World Bank (2004) have provided a more comprehensive and convincing definition when they noted that the term knowledge economy refers to an economy in which the use of knowledge, as manifested in technologies, better processes and workforce skills is applied to a broad range of traditional and new economic sectors, and is the main driver of productivity improvements and growth across all industries. This view of the knowledge economy seems to attract a wider range of supporters from academia, international bodies and government policy makers. This view also reflects the researcher's preferred definition as it opens an opportunity and hope for the developing countries regardless of their demographic and geographic sizes, availability of natural resources and level of industrialisation or economic development level to pursue knowledge economy strategies.

3.4 Theoretical Views on Knowledge Economy

The assertion of the knowledge economy can be traced to four views that try to theorise and explain the changing significance of knowledge in today's world economy. First, there are those who believe that knowledge is quantitatively and in some sense qualitatively more important than before, as an input. Drucker (1998), for example, suggests that knowledge is now becoming the one factor of production,

sidelining both capital and labour. Along the same lines, the OECD (1996) has suggested that the role of knowledge (as compared with natural resources, physical capital and low-skill labour) has taken on greater importance. This is due to the fact that all OECD economies are moving towards a knowledge-based economy although the pace among them may vary. This view claims that knowledge accumulation can be separated from capital accumulation. While this idea is central to neoclassical production theory, it is somewhat questionable as knowledge cannot be incorporated into production except through investment, and the function of investment is often to implement new knowledge in technology production (Grossman and Helpman, 1992).

Critics of this view see no real separation between knowledge and other important factors of production, as it cannot be supported by empirical data (Metcalfe and Ramlogan, 2005). They argue that the OECD has produced a series of data comparing investment in physical capital and investment in knowledge in terms of public spending on education, R&D and ICT infrastructure. For the OECD as a whole, physical investment is about two and a half times greater than knowledge investment as a percentage of GDP. In terms of growth rates, knowledge investment is growing faster than physical investment in the US, the Nordic countries and France (OECD, 1997; Saisana, 2005). Although, physical capital investment is growing faster than knowledge investment in other developed countries such as Italy, Japan, Australia, Belgium, Germany, Austria, the Netherlands and the UK, this growth difference is minimal as it stands at less than 25 per cent on average. The data does not therefore support any generalised claim that knowledge is increasing in importance in aggregate investment.

Second, there is the idea that knowledge is in some way more important as a product than it has been before and that we are seeing the rise of new forms of activities based on the trading of knowledge products (Kanter, 1995). This assertion depends on claims of the growing significance of knowledge intensive business services in areas like finance, insurance, consultancy, education and health care. Despite some statistical issues in defining these services, and in determining whether some services are an independent source of growth or primarily an effect of vertical disintegration in manufacturing, the evidence is strong that these sectors are growing and playing an important role in inter-industry diffusion of knowledge. In fact, there has been strong

growth in Europe and the US in the share of business services. Statistics show that 78 per cent of activities in OECD countries and in some fast growing economies are service or knowledge based, which indicates an area of real change (OECD, 1999). Rapid growth of knowledge based services has been a major feature of India's economic development in recent years. The importance of this phenomenon lies not in such services as an autonomous source of growth, but as a connecting process within the innovation system. This should direct attention to the economy-wide aspects of the use of knowledge, rather than to the knowledge products as an independent activity.

Third, there is the view that sees codified knowledge (as opposed to tacit, person incorporated skills) in some ways more significant as a component of economically-relevant knowledge. Thus, Abramowitz and David (1996) argue that perhaps the single most salient characteristic of recent economic growth has been the secularly rising reliance on codified knowledge as a basis for the economic activities. According to Sveiby (1996), OECD (2001) and Rodrigues (2002), the use of codified knowledge and codified results of science are rising. They indicate that in general the only employment categories that are rising across OECD economies are those for people with higher education. In terms of codified science, perhaps the clearest indicator is the sharp growth in the number of patents in recent years. World Intellectual Property Organization (WIPO) figures show that while it took 18 years from 1978 to reach quarter of a million total patent applications, it took only four years to double that figure to half a million, and another four years to double it again to one million (WIPO, 2006).

Finally, there are those who theorise that the knowledge economy rests on technological advancement, since innovation in computing and communications changes both the physical constraints and costs in the collection and dissemination of information and hence in the overall production circle. For new growth theorists like Romer (1994) and Solow (1994), the rise of information and communication technology (ICT) in particular, and its associated industries were and still are essential to move to the knowledge economy. These technologies have added a new dimension to economic development by enabling codifying, assembling and transmitting of new knowledge on a global basis with no physical barriers much more quickly and cheaply.

Nevertheless, Lundvall and Foray (1996) argue that the ICT revolution should not be taken as synonymous with the advent of the knowledge economy, although both phenomena are strongly interrelated. To them, technologies in general and ICT in particular do not produce knowledge alone but they do give the knowledge economy a new and different technological boost which radically changes the conditions for the production and distribution of knowledge as well as for its coupling with the whole production system.

Although some authors try to avoid taking sides on the assessment of these arguments, it is clear that every argument tries to show the significance of new knowledge from different angles. The unifying thread among these arguments tends to be the importance of knowledge in modern economic development. Thus, it is important to recognise that all economic activities rest on some form of knowledge, not only in the developed societies but in all forms of human activities and societies (Al-Rahbi et al., 2008). In addition, these theories and arguments are assuming indirectly that recent enhancement of education, technologies in general, and research and development in particular, are playing a major role in the current economic growth, especially in those countries that have very limited natural resources.

3.5 Drivers of the Knowledge Economy

As indicated earlier the measurement of the knowledge economy is not a straightforward matter, as it involves changes across many aspects of the economy. Thus, the World Bank Institute has introduced several indicators that together provide guidance on this, although measurement remains a matter of judgment for each individual economy. As the real purpose of measurement of the knowledge economy is to assess the progress in a particular economy (over time) or a region (over space), these indicators serve as a useful benchmarks for comparison rather than absolute measures (Bontis, 2004; World Bank, 2004). In Oman's context, such comparative measurements should play an important role in convincing the policy makers to consider the pursuit of the knowledge economy as a potential alternative for diversifying the local economy.

It is widely acknowledged that in the case of the knowledge economy, empirical studies undoubtedly provide a more solid base for policy making than theoretical concepts (Bontis et al., 2000; Malhotra, 2000). To this end, the OECD has also developed a framework based on four key knowledge pillars that has been adopted by the World Bank's researchers, academics and other think tanks around the globe. Although it is not an optimal framework, it represents a good start and possible method to tackle knowledge economy issues at the macro level. This framework seems to have worked well so far in terms of convincing policy makers in developed countries (i.e. OECD member countries) and also some of the major developing countries. Building on that, and boosted by empirical studies in the OECD and the high growth Asian economies, the OECD and the World Bank have initiated several research and technical programs aimed at assisting the policy makers in the less developed countries who wish to join the knowledge economy club as a possible and an affordable economic development strategy. As a result, a series of case studies at country and regional levels have been conducted by the OECD and the World Bank. However, Oman has remained as one of the least evaluated countries in this respect, as it has been mentioned in some of these studies only in the context of the Middle East and North Africa (MENA) region. In undertaking a study of the readiness of Oman for the knowledge economy, the purpose of this thesis has been to close this gap.

The OECD and the World Bank Institute inspired knowledge economy framework is based on the following key pillars

- effective government institutions and economic incentives that facilitate and encourage efficient creation, acquisition, dissemination and use of knowledge;
- an education and training system that produces a productive and innovative labour force;
- an information and communication technologies (ICT) infrastructure to disseminate effectively the creation, adoption and use of knowledge; and
- research and development (R&D) that creates dynamic interaction between local science and technology, and the local private sector to tap them into the growing stock of global knowledge.

The choice of these four factors or drivers is essentially based on their vital role in the creation, dissemination, storage and use of knowledge (OECD, 1996; Sheehan and Grewal, 2000; World Bank, 2004). Studies by the OECD (2000), the World Bank (2002) and APEC (2003) maintain that a holistic development approach towards these four drivers is necessary to obtain the desired results. This is reflected in the variation of economic development among OECD nations, where countries such as Finland, Ireland and Norway that have maintained a strong holistic approach toward the knowledge economy pillars, have achieved higher rates of economic growth than the other OECD member countries. The advantages of this framework are also related to the fact that these pillars complement each other and enable a country to create and exploit knowledge in a circular process propelled by positive feedback from each pillar. The main characteristics of each of these pillars are briefly discussed below.

3.5.1 Effective government institutions and economic incentives

This pillar refers to the effectiveness of government institutions in promoting and executing policies that nurture a productive, innovative and competitive business culture. In addition, it refers to the economic incentives that usually associated with government institutions which entice domestic businesses to grow naturally and independently (OECD, 2002; World Bank, 2004).

The World Bank (2004) indicates that government institutional reform in developing countries and in the Middle East and North Africa (MENA) region in particular is essential as the current weak economic incentives and ineffective institutional regimes have contributed to these countries' poor economic performance, despite their abundance of natural resources. Furthermore, several recent empirical studies show that, on the one hand, the failure to reform government institutions and economic regimes has contributed greatly to the slow economic development in Russia and the transition economies (Hearn and Rooney, 2002; Grimes and Collins, 2003). On the other hand, the rapid rates of growth in Finland, Ireland, Singapore, Taiwan and South Korea have resulted from government-initiated knowledge economy policies in these countries (Pack and Westphal, 1986; Rodrick, 1995; Sweeney, 1998; Rodrigues, 2002). These studies suggest that effective and transparent public governance, comprehensive and dynamic regulatory regimes, and effective structure of economic

incentives not only facilitate and enhance local market development, but also work as a magnet for foreign investments and joint ventures, which are essential for the acquisition and dissemination of new knowledge and technologies (Eres, 1981; OECD, 1999; Hunaidi, 2002).

According to Malhotra (2000), promotion of the knowledge economy requires governance definitely not through the old top-down and bureaucratic type, but one that nurtures the development of new capabilities of local businesses and encourages them to find creative solutions to business problems. More importantly, governments of the developing world need to develop new systems of governance that are best suited to local socio-economic peculiarities. Importing foreign best practices from other jurisdictions is not an option, because transplanting an imported model of governance would simply not work in local conditions (OECD, 2001). Indeed, the World Bank (2004) emphasises that local initiatives based on innovative approaches particularly in creating credible government institutions, business friendly laws, and effective and fiscally responsible incentives for investors, have all contributed to the remarkable success of the OECD nations. As most developing countries have not made sufficient progress in these areas, recent studies on policymaking appear to favour selective government interventions (Goh, 2003; Klein, 2004). This is because markets in these countries are not optimally efficient and there is still an important role for governments to play (Padmanabhan, 1993; Grewal et al., 2002; Melody, 2006). This perception presents no exception to Oman's economic policies, where a free market approach has been characterised by selective government interventions to correct market failures that may arise due to local or external factors.

Moreover, the role of the government is particularly important in those countries in which small and medium-sized enterprises (SMEs) dominate the business sector and employ the bulk of the workforce. This approach of selective government intervention has been highly effective in several developing countries including Malaysia (Jomo and Felker, 1999), Singapore (Chiu et al., 1997), China (Grewal et al., 2002), India Katrak, 2002) and Thailand (Kamaruding, 1999). The same inspiration and results were recorded in Latin America (Cimoli and Katz, 2003; Costa et al., 2002), Africa (Edwards, 2001) and Eastern Europe (Matlay, 2006). Thus, more private sector friendly policies could enable the private sector in the Middle East and North Africa

region to achieve similar outcomes and become independent springboards in the global market.

An equally important factor in enhancing local economies in the developing countries, especially at this stage of the knowledge economy development, is to reform the legal system to make it more compatible with the new economic realities (Bennett, 2003; World Bank, 2004). In addition to the lack of effective and dynamic regulatory regimes that are responsive to local and international market needs, the weakness of the private sector, suffering from pressures of a persistent government bureaucracy, overregulation and control of information, is often cited as a factor contributing to the low level of economic performance of most developing countries, particularly in the Arab World (Yousef, 2004; World Bank, 2004). This is undoubtedly true, given that the laws in these countries were formulated to deal with conventional economic activities and are unsuitable for a dynamic and flexible market economy based on knowledge acquisition, utilisation and dissemination. Laws that deal with new realities of the knowledge economy, such as the protection of intellectual property rights, and promotion of foreign direct investment and innovation have yet to be legislated or implemented in most of these countries. Therefore, emphasis on the need for reform of the legal systems in developing countries is mounting as such reform is considered a prerequisite for attracting new knowledge through foreign investment joint ventures, innovation and technological transfer.

In the past, the notion among the developing countries was to compete for a good share of foreign direct investment. The obvious reasons were merely to generate employment, transfer technologies and obtain foreign currencies. This approach may have succeeded in the past in big developing countries such as China (Grewal et al., 2002), Brazil and Chile (World Bank, 1998). However, it has been proven to be ineffective for small developing countries as most of them only provide a low skill labour force and low scale uncompetitive and unattractive local markets (Eres, 1981; Moll, 1983).

It is true that Oman together with most of the Arab Gulf states in the Middle East, has realised its disadvantage in this regard and has adopted a different approach which targets and attracts foreign direct investment (FDI) into mature industries in which

technologies and know how are reasonably well established – as for example – in the petrochemical, oil, gas and communication industries (MNE, 2005). Nonetheless, this FDI attraction approach in Oman has also proven to be of minimal effect in attracting useful knowledge, as the private sector (the supposed acquirer of new knowledge) is incapable and ineffective in taking advantage of such ventures due to its small size, lack of management expertise and excessive dependency on government support (World Bank, 1994; Bennett, 2003). In such a situation, lessons could be learnt from the experience of a country such as Singapore. APEC (2003) studies on Singapore suggest that new knowledge acquisition and creation in a dynamic and innovative knowledge economy environment requires a different approach that rests more on building local business capabilities, legal system modernization, research institutions, higher education and ICT infrastructure. In the words of Mintzberg (1994), these policies create the pull of the innovation strategy.

The role of government in the quest for the knowledge economy may seem at odds with the views of those who believe that the progress of the knowledge economy inherently leads to a dramatically reduced role for government. The reality is that in many ways the role of government is now even more important, particularly in developing countries, for facilitating and investing in knowledge economy enhancement. The fundamental point that should be emphasized here is that the knowledge economy requires a new way of governing, that should steer the economy according to a clear and effective strategic vision in order to avoid being marginalized in the rapidly globalising world economy. This implies governance definitely not through the conventional old top-down, bureaucratic ways of governing, but in a way that challenges and enhances the potential of local businesses, augments the skill base of its workforce, and applies creative solutions for overcoming local and regional economic hurdles.

3.5.2 Education and training

As indicated in Section 3.2 on knowledge accumulation, education in the early days came about through work participation, and preparation for work happened by interaction with other people in the community not through any formal education as most young people took on the tasks of their parents (Neef, 1998). The fundamental

change in the modes of education has come about as a result of the fundamental changes in the modes of production. As population density increased, division of labour became beneficial. Rather than inheriting skills, it became more valuable to specialize and learn a particular job or trade. Such skills could only be learned from the masters of that trade, who were not always the parents (Thurow, 1996).

In today's information era, this process of education accumulation has even wider implications, because it gives educated people greater power, provided policies and opportunities for continuous learning and specialisation are in place for arming them with competitive advantages in today's competitive markets (Stern, 1996). According to Neef (1998), those who enter education today will stay in the labour force until 2060 and need to be prepared for future developments in knowledge and technology. They therefore have to undertake retraining. People have to refresh and increase their learning power to sustain their earning power. This is because knowledge is believed to double every seven years and what has been taught in the colleges and training institutions in the first year is almost obsolete by the time of graduation (Thurow, 1999). The World Bank (1998) and OECD (2001) also emphasise this notion of continuing education and retraining by pointing out that people need knowledge that is not only relevant today but also durable for tomorrow. Thus, they require not only skills that are immediately applicable to work, but also a knowledge base that will enable them to adapt as products and production methods advance (Marginson, 2006). From this perspective, education and training have become inseparable elements in today's economic strategy formulation (Smith, 1995; Bontis, 2002; Shaw, 2005).

For the sake of avoiding any definitional complexities, this research will use the UNESCO definition of education as it encompasses the basic elements that will be used as indicators in the subsequent chapters. According to UNESCO (2005a), education is the organized teaching and training of students which contains theoretical, applied research and teaching that leads to a learning process. This learning comprises both essential learning tools and content required by human beings to be able to survive and develop their full capacities through continuous learning to become productive members in their communities. In fact, it is this fundamental learning which was recognised as one of the basic human rights in the Universal

Declaration of Human Rights adopted in 1984 by the United Nations which should be promoted and achieved by all nations by 2012 (UNESCO, 2005a).

On the other hand, training is defined as an educational way of preparing learners for careers that are based on manual or practical activities, traditionally non-academic and totally related to a specific trade or occupation (UNESCO, 2005a). Vocational or technical training, sometimes referred to as vocational education or just simply training, is used interchangeably in the education literature in developed countries but is still rarely considered a form of higher education, although vocational training reformists are calling for the abolishing of this distinction (Reich, 1998). However in Oman, as is also the case in most developing countries, technical training requires a higher level of education such as post-secondary levels, as it deals with advanced technologies and manuals where the learner develops expertise in a particular group of techniques or technologies, whereas vocational training requires below secondary education levels as it deals with traditional crafts (Ministry of Manpower, 2006).

The assumption is that in developing such qualifications, young people can accommodate the ever changing and improving work tasks to enable them to catch up with technological and knowledge developments. This is because there is a growing concern that current school systems, as well as public institutions can no longer keep up with developments generated by economic and technological change. Thus, ways must be found for continuous learning, that allow innovative ideas to float in a flexible and complementary manner (OECD, 1996; World Bank, 2002; APEC, 2003).

The importance of modern education and training within economic development in developed countries is well documented. For example, education has been identified as a critical factor in preventing future high levels of long-term unemployment, and there is evidence of a strong positive relationship between educational attainment and income over a lifetime (OECD, 1996; Sweeney, 1998; OECD, 2001; World Bank, 2004; UN, 2005b). Similarly training in general, and in the workplace in particular, has been highlighted as an essential element in maintaining and upgrading the learning capacity of an innovative workforce. Indeed, training is now seen as a key part of the human resource management process where workers are viewed as a source of wealth creation, rather than a cost to firms (Brown et al. 1993; Dewatripont

and Roland, 1996). OECD (2001) and Fokkema et al. (2005) note that knowledge and skills, as developed through education and continuous training, are new areas where a country can engineer a competitive advantage. They add that the education and training system is one of the few factors advantageous to the economy that is controllable and adjustable by governments.

Furthermore, new studies in OECD countries emphasise the virtues of an educated workforce as being a magnet for foreign direct investment (FDI) (OECD, 2002). This creates an opportune circle, leading to an increase in productivity, making the country even more attractive to further FDI. This finding is important to small developing countries like Oman, which lag behind many developing countries in receiving less than an 0.5 per cent share of total FDI flow to developing nations. In addition, acquisition of new knowledge in the private sector in particular seems to rest on the capabilities of the local workforce to absorb and utilize such knowledge. Without an educated and skilful labour force, developing countries risk further marginalisation and entrapment at the bottom of the knowledge economy ladder (UNCTAD, 2002; Wilkins, 2002; World Bank, 2004). Moreover, the International Labour Organization (ILO) points out in its *Report on Labour 1998/1999* that an addition of just one year to average schooling years would result in 5 per cent to 15 per cent increase in labour force productivity. Sluis et al. (2005) have reached a similar conclusion at the firm level, that an extra year of schooling raises enterprise income in developing countries by an average of 5.5 per cent.

The literature on education in general asserts that a country at any level of development can become a knowledge economy in some way. However, in no case can investment in cognitive fundamentals be bypassed; reading, writing and calculating capabilities, as basic literacy are essential in the knowledge economy development (Stern, 1998; UN, 2005a). The literacy rate, secondary enrolment rate and tertiary enrolment rate are considered to be fundamental indicators that have been introduced recently by the OECD and the World Bank to gauge development in education and training. This does not mean that other important indicators such as total expenditure on education as percentage of GDP, ratio of number of teachers to students and tertiary education spending, are not relevant in this context. The important point is, however, that the first three education indicators represent

continuous building blocks in the education ladder, and have been well recognized, empirically tested, and are available in the databases of most countries. More importantly these indicators also suit the level of education of developing countries, the assessment which is of special interest to this research.

It is in this context that the World Bank (2004) and UNESCO (2005a) have urged developing countries to seriously tackle their education deficiencies through concentrating on building up effectively the foundation of their education systems through the enhancement of these three most fundamental blocks in the learning process. It is believed as evidenced by many studies of both developed and high growth developing countries, that education and training enhancements could be the first step toward eradicating economic stagnation, political instability and environmental degradation (OECD, 2001; World Bank, 2002; APEC, 2003). This is because developing human capital has been positively related to higher income, better public health, political and community participation, and social cohesion. It also complements new technologies all of which are essential to the development of the knowledge economy (Lee et al., 2002).

Generally, the literature on education reform in developing countries is rich as the UN, World Bank, UNESCO and other countries' collective and individual efforts in this regard have produced an enormous number of studies to enhance understanding in this vital socio-economic factor. Diagnosis of education and training deficiencies in developing countries range from: lack of resources (UN, 2005b); gender inequality (World Bank, 2004); non-existence of reliable assessment systems (Stern, 1998; UNESCO, 2005b; Sluis et al., 2005); lack of proper school management, teachers' insufficient expertise and qualifications (Al-Saeed et al., 2000; Cairney, 2000); importation of foreign experiences (Wilkins, 2002); to the unjustifiable separation between education and training strategies which has resulted in incoherent and ineffective strategies (Smith, 1995; Wilkins, 2002).

The high growing developing countries in Southeast Asia such as Singapore, Taiwan and South Korea have successfully closed the gap with OECD average levels in education spending, gender equality, education and training assessments, and teacher expertise (APEC, 2003). Similarly, Oman has tried to tackle some of these

deficiencies in the areas of spending, which was increased to about the international average of 4 per cent of GDP and equalised the gender ratio rate to about the world average of 102 as of 2005 (Rassekh, 2004; MNE, 2006).

In their assessment of MENA's education development, the World Bank (2004), Fergani (2002) and Hunaidi (2002), have raised concerns that tertiary education in particular is far below the world average level. Should such deficiency remain, it could represent a major hurdle towards true economic development reforms. This deficiency is evident in Oman's low tertiary enrolment which stands at 12.9 per cent, which is far below the regional and international levels of 25.19 per cent and 30.53 per cent respectively. As a result, Oman still depends heavily on foreign manufacturing and technological imports which represent about 65 per cent of its total import, and expatriate workers that represent 68 per cent of the total labour force (MNE, 2006). In addition, its low level of workers' productivity growth rate of about 0.8 per worker per year is far behind the World and OECD annual averages of about 2 and 4 per cent respectively which has made its private sector uncompetitive and risks engulfment by international competition by 2010 when Oman's WTO preference grace period comes to an end.

An equally important symptom not diagnosed thoroughly, but which seems to persist and impose limitations on the education and training enhancement efforts in the developing countries, is the offer of vocational training for students who are considered to possess relatively low academic abilities. Most developed countries realized this problem about three decades ago and acted seriously to remedy this situation to enable the majority of their students to participate more fully in the education system and consequently become more productive in their economic development (Smith, 1995; Sluis et al., 2005).

It is not suggested here that the dichotomy between vocational and academic spheres should be abolished immediately, since the traditional disciplines have existed for decades. Rather, what is suggested here is that gradual reform is required in this regard. The reforms in the developed countries have included the strengthening of the academic content of vocational teaching, making it easier for vocational graduates to pursue further studies at university and higher education levels. Consequently more

intellectually talented students have been attracted into vocational training giving them theoretical and practical training that prepares them for continual problem solving purposes. Reforms such as these have achieved successful results and have been recorded in countries like the United States, United Kingdom, Germany, Finland, Sweden and Japan (Smith, 1995; Neef, 1998; Stern, 1998). Recent implementation of such strategies in the high performing developing countries such as Singapore, Taiwan, Korea and to some extent Malaysia have also shown similar results, although some modifications have to be made in the latter set of countries to accommodate particular social, political and economic needs and circumstances (Goh, 2005).

There is no doubt that countries educate their citizens for the ultimate goal of making them productive in their socio-economic systems, particularly in this stage of global economic development and competition. To achieve this, individuals should be prepared for hard work that demands curiosity and continual learning. It requires an education system that promotes thinking for all students, not only for the elite as is the case with the current education systems in many developing countries. Evidence that has been produced so far indicates that there is a positive relationship between education and training achievements, and economic growth (World Bank, 2004; UNESCO, 2005a).

3.5.3 Information and communication technologies (ICTs)

A modern information infrastructure that facilitates effective communication, dissemination and processing of information is an essential tool to develop a knowledge economy strategy. Information and communication technology (ICT) infrastructure in an economy refers to the accessibility, reliability and efficiency of computers, phones and telecommunication networks that link knowledge creation, dissemination and usage together. The World Bank defines ICT as consisting of the hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information in the form of voice, data, text and images (World Bank, 2004).

As mentioned earlier, new knowledge can only be generated by cognitive, mental processes. For knowledge to be available to the public and to be transformed into useful information and have wider impact, it must be encoded, transmitted to others and they must be capable of decoding this information flow and incorporating it with their own knowledge (Loasby, 1999). This is the role that modern ICT plays nowadays. Understanding grows through widening the process that involves all stakeholders and physical technologies which is reflected in the growing number of individuals and institutions who benefit from this process to create new or innovative knowledge (Hundey, 2003). This distribution of personal knowledge and socially contingent understandings feed off one another to generate a system necessary for their mutual development. Based on that, some authors (e.g., Lundvall and Foray, 1999) have suggested the concept of the knowledge worker as a 'symbolic analyst', a worker who manipulates symbols rather than machines. The concept of symbolic analysts includes professions such as scientists, engineers, architects, financial managers, bankers, fashion designers, pharmaceutical researchers, teachers, policy analysts, etc.

It is in this sense that ICTs have made major changes to our ability to handle and translate information into useful knowledge. It is important to emphasise here that data moved or analysed by ICT methods do not by themselves constitute knowledge, and that ICT do not necessarily create knowledge or even extend knowledge (Thurow, 1999). Consensus has been built around the fact that ICTs are primarily an essential information management and distribution resource that play a vital role in knowledge production and distribution as re-organisation of the technical and financial terms on which a resource such as information is available (Lee et al., 2002; APEC, 2003).

Over the past decade, evidence has been mounting to back up the claims of proponents of ICT, who had been asserting that ICTs are responsible for significant increase in productivity and output growth. For example, the OECD economies having accepted the crucial contribution of ICTs to higher economic growth, had invested on average 7 per cent of their GDP in ICTs as of 1997 (OECD, 2001; Rodrigues, 2002). The experience of OECD countries shows that investment in technological advancement in ICT producing sectors has resulted in large gains in total factor productivity at all levels of OECD economies. Furthermore, investments

in ICT have also resulted in capital deepening and in consequential increases in labour productivity in the non-ICT producing sectors. Substantial productivity gains are reported by the OECD (1999) and the World Bank (2002) suggesting that ICT usage has resulted in overcoming geographical distance and boundaries for sharing information, reducing uncertainty, reducing transactions costs and increasing competitiveness across borders, all of which have given a competitive edge to industries in these economies.

Moreover, the European Commission Information Society reveals that ICTs are powerful drivers for growth and employment, with 25 percent of EU GDP growth and 40 percent of productivity growth related to ICT. More recent industry level studies in the United States and Canada also show that ICTs play an important role in raising labour productivity and in generating R&D spillovers across industries (Branscomb, 1992). Indeed, ICT services and skills are a growing part of the rapidly emerging knowledge based economy that has contributed to lowering unemployment rates. It is estimated that over 60 per cent of production in these countries is created by knowledge workers who utilize ICT as their main input (Rodrigues, 2002; Lim, 2002). This trend has been also supported by another study in the United States which shows that the ICT sector has a more powerful multiplier effect in the overall economy compared with manufacturing. A 1995 study of the effect of software producer Microsoft on the local economy revealed that each job at Microsoft created additional 6.7 new jobs in Washington State, whereas a job at Boeing created only 3.8 additional jobs (Mandel, 1997). Furthermore, the OECD (2001) estimates that 8 out of every 10 new jobs created in OECD countries were for knowledge workers. Thus, wealth generation is becoming more closely tied to a country's capacity to add value by using ICT products and services.

The omnipresence of ICTs leads us to argue that ICT is an essential enabler of change in economic development which cannot be underestimated, as it contributes greatly to the essential transformations in any modern society. ICTs are best regarded as the facilitators of knowledge creation in innovative societies. Indeed, the literature on the knowledge economy views ICT not as the driver of change, but an essential tool for releasing the creative potential and the knowledge embodied in people. Studies at the OECD (2002) and the World Bank (2004) seem to suggest that the importation and

acquisition of ICTs should not be regarded as a goal in itself. Rather it should be a means to achieving higher productivity and economic growth. Studies at the firm level also reveal that introduction of ICT does not bear fruitful results unless structural reform in respect of human resources development, organisation management restructuring and legislative reforms also accompanies the introduction of ICT (Milgrom and Roberts, 1990; Black and Lynch, 2000; Black and Lynch, 2001)

In recent years, most developing countries have come to realize the economic importance of the ICT sector. Many developing countries such as Singapore, South Korea, Malaysia and the Arab Gulf States have increased their ICT investments significantly in 2005, which is about the same rate as that of the OECD. Nonetheless, while high growth Asian States have consolidated their ICT infrastructure across their economic activities, the Arab Gulf States including Oman are yet to reach that stage.

The World Bank (2004) and Al-Shihi (2006), attribute poor ICT performance in the MENA countries mainly to ineffective public sector governance, lack of competition among communication companies which are mostly run by the governments, cultural and religious barriers which treat ICT products as a Western phenomenon, and the lack of strategic vision for utilizing ICT more effectively. These shortcomings in turn have resulted in poor management, poor services and high costs, creating more impediments to further development of ICT services. These weaknesses of the ICT sector are clearly visible in Oman where the penetration of ICT products and services is still very low. For example, for every 1000 inhabitants in Oman, there are only 76 internet users, 56 units of computers, 265 fixed telephone connections and 253 mobile connections. The usage of the first two of these services in Oman is far below the corresponding international levels of 201 internet users and 194 computers for every 1000 persons. Oman's usage of telephony is higher than international standards of 227 fixed telephone connections and 215 mobile telephones per 1000 persons.

Despite these weaknesses in its ICT services, it is hoped that Oman's keen desire for formulating the digital Oman strategy in 2002 (which aims at the extensive adoption and integration of ICT at home, work, education and recreation) could be regarded as the point of positive turn around in this regard. Thus, it is expected that the above rates of ICT penetration in Oman would double by 2010 due to the liberalization of

mobile phone and internet services in the country which started in 2004 (Gartner, 2002).

The upshot of the literature reviewed in this section is that the economic importance of the ICT products and services in today's economic development should not be underestimated. Indeed, it is becoming increasingly evident that no country in today's world can afford to be left out of the information technology revolution. To do so would mean returning to the old world of underdevelopment. This revolution will affect humanity in a way no other revolution has done before. It is in this context the literature urges the developing countries to make a choice between ignoring ICTs and facing an uncertain future, or marching with the rest of the world into the information age by embracing effective ICT policies that recognise the real needs of their economies and societies.

3.5.4 R&D and innovation

Research and development (R&D) and innovation refer to the creative work undertaken on a systematic basis in order to increase the stock of knowledge which could be applied to improve products, processes, applications or technologies (OECD, 1997). The R&D system refers to the network of institutions, rules and procedures that influence the ways by which a country acquires, creates, disseminates and uses knowledge. It comprises private enterprises, universities, public research institutes, and the people within them. In short, such a system provides the environment for nurturing innovation, which results in new products, new processes and new knowledge, and is therefore, a source of a competitive edge for a country's products and industries in today's global market (OECD, 1996; Sheehan, 1999; World Bank, 2002).

Modern innovation theory sees knowledge creation inseparable from the R&D process, as knowledge creation rests not only on discovery but also on continuous learning and research. Learning need not necessarily imply discovery of new technical or scientific principles, but could be based on activities which recombine or adapt existing forms of knowledge. The basic stages of an R&D and innovation policy require investment in higher education, support to universities and other institutes that

conduct research, mechanisms and facilities for training scientists and engineers, support to the private sector to invest in R&D, acquire and generate new knowledge, and implementation of government policies that promote enhancement of such knowledge-oriented activities. Innovation requires close and continuing collaboration between the research community and the entrepreneurs, who are willing to apply the results of R&D for producing new products and services.

The positive relationship between R&D and innovation on the one hand and economic performance on the other hand is confirmed in the literature. A number of recent OECD studies confirm that R&D and innovation tend to be intensive in the high income and high productivity countries (OECD, 1996). Similarly, Porter (1998a) finds that economies that have been more innovative have also tended to achieve higher levels of GDP per capita. This finding was evident not only in the OECD countries but also in some of the high performing developing economies like Singapore and South Korea which have doubled their GDP in less than twenty years (APEC, 2003). Moreover, a number of empirical studies carried out by Cameron (1998) and Temple (1999) on the impact of innovation on total factor productivity (TFP) confirm the positive impact of innovation on TFP and a significant impact on output at all levels, i.e., at the level of the firm, the industry and the national economy. Indeed, one of these studies finds that a 1 per cent increase in the stock of R&D leads to an increase in general output of between 0.05 and 0.15 per cent (Grossman and Helpman, 1991).

More importantly, Cameron (1998) indicates that the effect of knowledge spillovers from R&D and innovation throughout the domestic and world economy on the social rates of return to R&D, are generally higher, often in the range between 20 to 50 per cent due to patents, scientific literature, technology and process improvement that enhance overall productivity and economic growth. It is believed that R&D investments have multiple economic development effects as they attract foreign technological investments, value added to production, and competition among local businesses for innovation and discoveries. According to Fagerberg (1994), this has a wider implication that there is a possibility that the less developed countries could catch up with the developed countries, but only if such countries manage more effectively their human resources and investments in R&D and education. Studies have shown that there is a significant convergence among OECD countries as the

poorest 25 per cent growing on average 2.4 percentage points faster than the richest 25 per cent between 1950 and 1992 (OECD, 2001).

Mintzberg (1994) views innovation as a direct result of R&D by defining innovation as the means to break away from established patterns. The OECD (1997) defines innovation as the creative process through which additional economic value is extracted from knowledge and transformed into new products, processes and services regardless of technological advancement. The last part of this definition seems to suggest that innovation can occur even in the developing countries, which may be able to leapfrog the developed nations as appears to be the case in Singapore, South Korea and Taiwan (Goh, 2002). Furthermore, some empirical studies on the convergence of developing countries toward higher income countries also suggest that education and R&D have played a major role in this convergence (Fagerberg, 1994). Innovation surveys also suggest a link between R&D and innovation on the one hand and the rates of firm survival and employment generation in the European countries on the other hand (OECD, 1999; Gera and Weir., 2001).

Some of the literature provides hope for developing countries by pointing out that SMEs too can be innovative. For example, Acs and Auddretsch (1991) find that SMEs in the United States contributed some 2.4 times more innovation per employee than the larger firms. These findings are also in line with earlier findings by Rothwell (1989) who had found that the relative strengths of the larger firms are predominantly material oriented while small firms have greater strength in terms of their dynamic and flexible behaviour towards market conditions, which give them greater ability to be competitive and successful.

As a starting point, Drucker (1998) seems to provide some guidance for decision makers in developing countries to pursue effective R&D and innovation strategies. He states that government policies should influence the incentives and opportunities for innovative activities in a wide variety of ways that benefit the country's interest in terms of new knowledge acquisition, transfer and diffusion of technology. He believes that countries that have business friendly institutions and incentives through good and effective governance, legal protection of intellectual property rights and efficient financial systems, tend to produce fruitful innovation results. Most developed

economies seem to benefit from such institutions and incentives. According to OECD (1998) and the World Bank (2004), such a positive R&D and innovation environment is a precondition for promoting productive local innovation and attracting foreign collaboration with international R&D institutions.

The economic contributions of R&D and innovation are supported empirically by the experience of many countries. For example, Bassanini et al. (2000) have found that at the macro level, total factor productivity (TFP) which measures the synergy and efficient use of capital and human resources through their proper utilization in the production process, was linked directly to R&D spending in countries like Finland, Ireland and Singapore. Reasons why these countries showed improvements in their R&D to TFP are attributed to several channels. For example, R&D often leads, through innovation, to production of new products, generating market growth, and consumer satisfaction. Improvements also occur in the existing products and process that contribute to cost effectiveness and value adding. The spillovers of these improvements enhance the competitiveness of local businesses in general because of the competition among producers and manufacturers, and in this way benefits of R&D accrue to the entire economy (APEC, 2003). Furthermore, studies at the micro level find that higher R&D expenditure by local firms in France, Japan and the United Kingdom has been positively associated with higher productivity levels and survival rates (Griliches, 1986; Hall and Mairesse, 1995).

In the light of this discussion, studies indicate that generous R&D investment is essential in the quest for better R&D development which results in quality researchers and research outcome (OECD,1996). As noted above, many empirical studies in both the developed and the developing countries relate investments in R&D and innovation directly to higher improvements in productivity and economic development. This also suggests that special attention must be given to the role of governments – particularly in developing countries – for implementing an innovation-driven strategy that gives priority to R&D and innovation.

Oman in particular needs to increase significantly its R&D and innovation spending for stimulating economic growth. This requires in turn that many institutional, organisational and societal rigidities that stifle national innovation systems be

eradicated, and obstacles that prevent co-operation and networking among R&D stakeholders removed, while collaboration and partnerships should be promoted. Based on the gross expenditures on R&D and innovation as a percentage of GDP, Oman is still trailing far behind most of the world's technologically advanced and high performing Asian nations. In fact, Oman spends less than 0.10 per cent of its GDP on such activities, compared to 2.2 per cent and 1.8 per cent of GDP in OECD and world averages respectively. This seems to have direct impact on Oman's low productivity level of about 0.8 per worker per year and its constant low ranking as one of the least competitive economies in the world according to the Swiss-based World Economic Forum (WEF) and the International Institute of Management Development (IIMD, 2006). Barriers such as low literacy rates, low rates of enrolment in higher education, weak R&D infrastructure, underdevelopment of the private sector firms, and inadequate legal protection of intellectual property rights all need to be removed (World Bank, 2002).

It is encouraging to see that in recent years, some positive developments have taken place in this context in Oman. Thus, for example, the government has established in 2005 its first Scientific Research Council (SRC), which is aimed at creating a scientific research foundation for conducting, promoting and coordinating research activities across the nation. In due course, this will undoubtedly enhance the capabilities of local researchers and research institutions for engaging with leading global R&D communities.

3.6 Social Impacts of the Knowledge Economy

As indicated earlier, knowledge-based development leads to not only rapid economic growth but also to rapid social change. For example, the Industrial Revolution was the start of a major shift in populations from rural to urban areas, with the consequent growth of large cities and with sustained changes in income distribution and employment patterns. Similarly the current information and communication revolution is already beginning to have social ramifications of comparable proportions. Specifically, the impact of worldwide flows of information and knowledge, and changes to the labour market present significant social issues for policy makers to address. While earlier episodes of change have occurred in particular

products or industrial sectors, knowledge now impacts on every element of the economy and society (Neef, 1998; Lee et al., 2002).

The speed at which new knowledge and technologies are being developed and introduced onto the market and the increasing sophistication of these new elements is changing the way people interact and do business. The potential for these new elements to enable greater efficiency and flexibility in business, public services and life styles cannot be underestimated; however, these effects must be widely communicated to ensure that all segments of society are fairly included among the beneficiaries of new growth (UN, 2005a). Key concerns about today's knowledge revolution are that it would lead to greater income inequalities and that it would benefit largely the urban population, leaving behind those who rely on agriculture or other rural industries (Al-Rahbi et al., 2008).

While it is widely accepted that education and training, and ICT can be used to empower disadvantaged societies, technology itself could cause further disadvantage to some sections of the population. The terms 'knowledge divide' and 'digital divide' are used to refer to the emerging gap between those people who have access to the new opportunities for benefiting from new technologies and acquiring skills and those who for one reason or another miss out on these opportunities.

From an equity perspective, people without access to education and ICTs are likely to become increasingly marginalised as these two elements become a fundamental form of social and economic participation (OECD, 2001; UNESCO, 2005b; World Bank, 2004).

The significance of these divides is threefold:

- there is a risk that those without access to knowledge and ICTs will lag further behind as knowledge evolves and technology progresses, with whole groups of society becoming less and less capable of participating in the economic development;

- this adds pressures towards wider income inequality, potentially eroding support for growth-enhancing policies and driving up costs of social programs; and
- moreover, one of the main advantages of knowledge and ICTs lies in their network effects, so that the more people obtain and use them, the greater the economic benefits; and given the importance of human capital to growth, closing these divides should by definition improve human capital and medium-term growth as well.

The literature indicates that inequalities in income, employment, skills, education, and access to information and modern communications are a part of every country's experience, although their impact varies across countries and within countries (OECD, 2001; World Bank, 2002; IMF, 2007). There is evidence that such inequalities have grown during the past two decades and that this is attributable to economic globalisation and the knowledge economy. Evidence of an increasing gap between highly skilled and unskilled workers is supported by the argument that technological change has increased the demand for high skilled workers economy-wide as new technologies are biased towards this group of workers (IMF, 2007). As a result, technological changes over time would benefit the employment and wage prospects of high skilled workers relative to their lower skilled counterparts.

To illustrate, wages of knowledge workers in the USA has risen much faster than wages for other occupational groups. Between 1985 and 1998, real earnings of knowledge-intensive workers grew by almost 17 per cent cumulatively, compared with 5.25 per cent for the average US employee. Similar income increases have also been recorded in Canada and the EU. As a result, across the OECD the gulf between 'work-rich' and 'work-poor' households is widening and the number of workers below the 'poverty line' in many OECD countries is growing. Similarly, the families in the USA that are below the poverty line level of US$13,000 dollars have risen by 50 per cent between 1979 and 1992 (Thurow, 1999; UN, 2005b).

This pattern is consistent with OECD analysis which suggests that as firms hire more skilled labour, the incentive to invest in technology rises. This leads to a

complementary technological advance that further increases the demand for skilled labor. The OECD also found that up-skilling is not only a consequence of technological change but also of the general increase in educational attainment levels. For example, over the last 30 years, employment in Australia's manufacturing industries has declined from 45 per cent of total employment to 29 per cent, while employment of knowledge workers and professionals has increased from 25 per cent to 40 per cent. This suggest that people with low educational attainment face the consequences of structural changes in labor markets, via the increased risk of unemployment (Lee et al., 2002). Furthermore, Burniaux et al. (1998) studied 13 OECD countries and found that inequality (measured in disposable income) has risen in most of these countries between the mid 1970s and the mid 1990s which they relate to the economic globalisation and technological change.

Worldwide, the analysis of the World Income Inequality Database (WIID) for a sample of 73 countries shows that cross country income inequality rose in 48 countries – approximately two thirds – between the 1950s and the 1990s (UN, 2005b). The International Labor Organization (ILO) reveals similar results between 1993 and 2003, while 1.4 billion or half of the world's workers still earn less than US$2 per day which is the poverty line, and 20 per cent of them actually earn less than US$1 per day (ILO, 2006).

In a recent paper, Al-Rahbi et al. (2008) have argued that the likelihood of increasing inequalities can be reduced by including the right type of economic reforms as a part of the overall strategy for a knowledge economy. They cite the example of the rapidly growing Asian countries, which have experienced high rates of growth during the past decades without rising income inequalities. The important point made by these authors is that a county should not turn its back on the knowledge economy, because of the risk of rising inequalities. Rather appropriate economic reforms should be implemented to ensure that the benefits of the knowledge economy are shared, as they can be, by all sections of the population. Progress towards the knowledge economy provides enormous opportunities to developing countries to raise the level of incomes of all inhabitants, provided that their development strategies are shaped properly with emphasis on social cohesion and equity.

3.7 Summary of the Chapter

This chapter has presented a critical review of the literature that addresses the concept of the knowledge economy. The review has highlighted the role and the importance of the various elements that together make up the knowledge economy.

The term knowledge economy refers to an economy in which the use of knowledge – as manifested in new technologies, better processes and higher workforce skills – is applied to a broad range of traditional and new industries, in which economic growth of all sectors of the economy is driven by these applications.

The apparent promise of the knowledge economy (for Oman and for the other developing countries) is not only that the economic contribution of physical resources can be greatly augmented through knowledge accumulation and utilisation, but it also represents real and achievable new opportunities for rapid and sustainable economic development. The literature shows a strong positive relationship between rapid economic growth and investment in the main pillars of the knowledge economy.

It has also been noted that Oman in particular is yet to benefit fully from this promise of the knowledge economy. This is indeed the core problem that is addressed in this thesis. The next chapter will explain the framework chosen to address this problem.

Chapter 4. Knowledge Economy Framework

4.1 Introduction

The objective of this chapter is to propose a practical knowledge economy framework that suits a small developing country like Oman in which the main pillars of the knowledge economy are yet to be established. Indeed, there is not yet a full recognition of the developmental potential of some of these pillars in Oman. For example, government institutions and economic incentives, research and development (R&D) and innovation, and ICT are not yet widely recognised as potential drivers for sustainable economic development in Oman. It is necessary, therefore, to develop a framework that is fully sensitive to social, economic, cultural and religious specificities of the Omani society.

This chapter is organised as follows. Section 4.2 summarizes the various ways of measuring the extent and progress of the knowledge economy. Major existing frameworks for the knowledge economy are discussed in Section 4.3 with a view to assessing their degree of relevance to this study. Section 4.4 discusses the rationale for the operationalisation of the selected variables and indicators that are adopted in this research, taking account of Oman's social and economic specificities. Some of the limitations of the selected framework are discussed in Section 4.5, and Section 4.6 offers a summary of this chapter.

4.2 Development of Knowledge Economy Measures

The promotion of the knowledge economy in developing countries is becoming a major occupation for policy makers and academic professionals. The growing interest in the subject stems from a recognition that it is necessary to consider the various economic strategies that have been implemented and tried with different degrees of success in other developing countries. For example, the experience with policies of privatization of government-owned companies and utilities, liberalization of local economies from strict government intervention and opening of domestic sectors and industries to foreign investment has been mixed, with some successes and some

failures. Similarly, policies for modernization by heavy investments in infrastructure have not always yielded the expected outcomes, especially in some of the GCC countries.

Despite this increasing attention being paid to the promotion of the knowledge economy, there is no solid conceptual framework from which an appropriate framework can be developed to guide policy makers. While there is considerable experience accumulated in relation to developed economies, much of this experience is not directly applicable to developing countries. According to Aubert (2005), for example, developing countries face genuine obstacles in developing the knowledge economy and this is precisely why they remain underdeveloped. These obstacles originate from inappropriate business and governance climates and inadequate education systems. Thus, there is a need to develop alternative frameworks for the knowledge economy that can be adapted to the needs and capabilities of developing countries.

Guidelines provided by the OECD (1996), ABS (2002) and World Bank (2004) for developing a knowledge economy framework are useful in identifying suitable knowledge economy factors and indicators that could be included in a similar framework for Oman. A factor is defined in this context as a key variable or element that is chosen to represent a key characteristic. An indicator on the other hand, is a single figure or a small data set that provides a quantitative measure of a factor or variable. Both factors and indicators are used for economic analysis because they represent or summarise at a glance how an economic system is performing. The most commonly used economic indicators include gross domestic product, consumer price index, total factor productivity, current account balance and fiscal deficit.

Ideally, every knowledge economy factor or indicator that is included in the knowledge economy framework should have the following essential attributes:

- it should be of relevance to the characteristic it is intended to describe;
- it should be supported by reliable and timely data;
- it should be sensitive to the underlying phenomenon which it purports to measure;

- it should be easily interpreted;
- it should preferably be available for several time periods including recent periods; and
- for the purposes of international comparison, it should preferably also be available for other countries.

Most studies in knowledge economy development suggest that new knowledge creation and acquisition, effective dissemination and proper utilization are the key elements of economic growth. Dahlman (1999, cited in APEC 2000) describes four phases of the knowledge flow: acquisition, creation, dissemination and use of knowledge. Others, including Neef (1998), Sheehan (1999) and Grewal et al., (2002) have referred to the production, distribution and use of knowledge as the key elements. Howitt (1998) considers the production and exchange of knowledge together with the depreciation and obsolescence of knowledge in the context of its use as the key elements. More recent studies by Lee et al. (2002) and Grewal and Kumnick (2006) have added the importance of incorporating local social and cultural values in the knowledge economy frameworks to guard them against the emergence of knowledge and digital divides.

The upshot of this discussion is that generally, the knowledge economy frameworks emphasise the elements of knowledge creation, acquisition, dissemination and utilization. In the case of a developing country, it is important to also consider any specific peculiarities and capabilities that may impinge upon the development of the knowledge economy in that particular country.

4.3 Major Knowledge Economy Frameworks

The aim of this section is to offer an overview of major knowledge economy frameworks that could provide a basis for developing countries in general, and for Oman in particular, to develop an appropriate knowledge framework that is suitable for local conditions. Although a list of about seventeen existing frameworks is provided in Table 4.1 below, only three frameworks are discussed in some detail, because these represent greater relevance to a developing country's capabilities and characteristics. These are the frameworks developed by the OECD, APEC and the

World Bank. Each of these three frameworks have been developed from the experience of many countries, in contrast to several other frameworks that have been developed at the single country level, as is the case in Australia (DISR, 1999, 2000, 2002), Ireland (*Knowledge is in Our Natuer,* IDA, 2003) and Finland (*The Finish Experience,* Dahlman et al., 2005). More recently, similar frameworks have also been developed in the rapidly growing Asian economies, such as Singapore's *Vision of an Intelligent Island* (Ramcharan, 2006), South Korea's *Knowledge for Action: Transforming Korea into a Knowledge-driven Economy* (World Bank, 2000) and Malaysia's *Malaysia Knowledge Economy Master Plan* (Department of Statistics Malaysia, 2002).

Table 4.1 Main knowledge economy frameworks

Number	*Framework*	*Country/Organisation*	*Year*	*Aims of framework*
1	The New Economy Index	USA, Progressive Policy Institute	1989-2007	Examining and measuring US states' competitiveness, their degree of how knowledge based they are internally and globally.
2	Index of the Massachusetts Innovation Economy	USA, Massachusetts Technology Collaborative	1997-2006	Measures the states economic growth in key knowledge intensive areas such as financial services, technology and science.
3	Measuring the Knowledge-Based Economy	Australia, Department of Industry, Science and Resources	1999-2005	How does Australia compare to global competitors in areas like science and technology.
4	Porter's index of innovative capacity	USA, Porter	1999	Identify key factors that determine a nation's capacity for innovation.
5	Our Competitive Future	UK, Department of Trade and Industry	1999	Monitor the UK progress as a knowledge driven economy in areas like competitiveness and productivity in its private sector to close the gap with main competitors.
6	The Knowledge-Based Economy: A Set of Facts and Figures	OECD	1999	Indicators that measure science and technology development in OECD states.
7	European Innovation Scoreboard	Europe, European Commission	2000-2006	Evaluates and compares the innovation performance of the 25 EU member states.
8	Towards a European Research Area: Science, Technology and Innovation: Key Figures	Europe, Eurostat	2000	Evaluating the performance of research in Europe as a step toward knowledge and

	2000			information based economy.
9	Knowledge-Based Activities: Selected Indicators	Australia, Department of Industry, Science and Resources	2000	Assessment of the degree to which Australia is a knowledge-based economy and society's through use of relevant output statistics.
10	Towards Knowledge-based Economies in APEC	APEC Economic Committee	2000	To provide the analytical basis to promote the effective creation, dissemination and use of knowledge among APEC economies.
11	The New Economy and APEC	APEC Economic Committee	2001	Identify potential rewards and challenges that face APEC countries in their quest for knowledge economy.
12	UK Competitiveness Indicators: Second Edition	UK, Department of Trade and Industry	2001	To extend the analysis and add new indicators to the first edition of 1999 based on feedbacks from main stakeholders (businesses and policy makers).
13	On the Road to the Finnish Information Society, II, III	Finland, Statistics Finland	1997, 1999, 2001	To develop a statistical system for describing the information society in Finland its potentials and challenges.
14	Knowledge Assessment Scorecard	World Bank Institute	2002, 2007	A knowledge assessment methodology (KAM) which consists of a set of 83 structural and qualitative variables that benchmark how an economy compares with countries.
15	Science, Technology and Industry Scoreboard: Towards a Knowledge-based Economy	OECD	2001	To bring together latest internationally comparable output data on innovation, science, and technology in OECD member states.
16	The 2002 State New Economy Index	USA, Progressive Policy Institute	2002	Extended version of framework number (1) that added more indicators to its evaluation of innovation, science and technology among US states.
17	Australia as a Modern Economy: Some Statistical Indicators 2002	Australia, Department of Industry, Tourism and Resources	2002	examines theoretical and empirical work relating to the role of knowledge in the economy and society .

Source: Adapted from ABS (2002).

4.3.1 The OECD framework

The OECD framework was among the pioneers in trying to map the development of the knowledge economy as part of its attempt to understand the drivers of economic growth of its member countries. In 1996, the OECD published the *Knowledge-based Economy* (OECD, 1996), an early attempt to incorporate statistical indicators on the measurement of the knowledge economy. Another compilation was published in 1999 (OECD, 1999) before the OECD started in 2000 releasing the results of a two-year research project. The aim of this project was to pinpoint the causes underlying the differing rates of economic growth of the member nations during the 1990s. As a result, these publications made a significant contribution to research on the knowledge economy. The final report of the growth project, *The New Economy: Beyond the Hype* (OECD 2001b), was released in mid 2001 and emphasised the role of the following key factors in economic growth in OECD:

- a stable and open macroeconomic environment with effectively functioning markets that stimulate the private sector in general and the creation of new firms creation in particular; such business friendly environment was credited with stimulating business and job growth in the USA, Canada, Japan and the European countries;
- diffusion of information and communication technologies (ICTs) as an effective means to store, disseminate and link knowledge creators and users.
- innovation development in terms of funding and investing in R&D, coordinating R&D and entrepreneurial activities, and protecting the intellectual property rights of new inventors; and
- investing in human capital which has been regarded as the backbone of the knowledge economy for enhancing education and training at all levels, and for all age groups.

4.3.2 The APEC framework

This framework was part of a project commissioned by the APEC Economic Committee in mid 1999. The title of the project was 'Towards Knowledge-based Economies in APEC' and the project was developed by a specially created Knowledge Economy Task Force, members of which included Australia, Canada and

Korea (APEC Economic Committee, 2000). The project report listed the following factors that the member countries should strive for:

- innovation and technological change as focal points of productivity and competitiveness that should be supported by an effective national innovation system;
- pervasive human resource development, including a high standard of education and training throughout a person's working life;
- an efficient ICT infrastructure that allows citizens and businesses to readily and affordably access pertinent information from around the world; and
- a business environment that is enticing and supportive of enterprise and an innovation development imperative.

4.3.3 The World Bank framework

The World Bank Institute (WBI) program on Knowledge for Development uses a knowledge economy framework which incorporates the essence of APEC and OECD frameworks. The distinguishing feature of the World Bank framework, however, is in its basic building blocks of the knowledge economy – the knowledge economy pillars – which are mutually supportive in sustaining the overall framework. This framework consists of the following knowledge pillars:

- effective government institutions and economic incentives that encourage efficient creation, acquisition, dissemination and use of knowledge; as well as the efficient use of the existing and new knowledge and the flourishing of the private sector in general;
- education and training that produce a productive and innovative labour force and creates a lifelong learning culture that enhances new knowledge absorption and development;
- information and communication technologies (ICTs) infrastructure to transfer foreign knowledge and disseminate effectively the creation and use of knowledge; and
- research and development, and innovation (R&D and innovation) system that creates a dynamic interaction between local science and technology

institutions, consultants, universities and the local private sector, to tap them into the growing stock of global knowledge.

The World Bank Institute's knowledge economy framework seems to provide the basic unifying thread among the three frameworks considered above. This is because its focus on the gradual input process in building upon resources and capabilities available in any country, and in taking due account of different countries' specificities, including their conditions of governance, provides a safer track for the development of the knowledge economy in a developing country. Rather than imposing a single, unique model for judging and promoting growth capabilities, this approach tends to understand and prioritize the minimal changes which can help generate progress and growth. Implicit in this framework is also the recognition that the development of a knowledge economy is indeed a longer-term process, involving the formation and diffusion of new socio-economic values that make the dynamic change possible through promoting productivity, innovation and lifelong learning. This framework has been mainly developed on the basis of more than 83 input and output indicators (World Bank, 2007). When it comes to constructing knowledge economy frameworks in developing countries, they are not expected to make use of all the 83 indicators, but should be able to select only those indicators that suit their own specific peculiarities and capabilities.

4.4 The Rationale Behind Choosing the Knowledge Economy Pillars and Indicators

Empirical studies stress that knowledge flows around the whole economic system, i.e. within and between individuals, business firms, and academic and professional research organisations. In fact, these non-linear knowledge flows are a crucial condition for the generation of new products, processes and technologies. For such knowledge flows to occur, individuals, firms and government institutions need to be involved in a circular interaction that creates, disseminates and utilizes knowledge in an innovative system. This knowledge interaction should flow within the whole system, rather than in one direction only from the non-commercial sector to the commercial sector, as is often the case with most of the less developed countries.

It is because of this vital interaction that the role of government in the development of the knowledge economy becomes very important in facilitating and enhancing the creation of a suitable economic environment for nurturing knowledge economy fundamentals. The positive contribution of governments is acknowledged in the OECD countries and the rapidly growing Asian economies (OECD, 1998; World Bank, 2002; APEC, 2003). This conclusion is related to the fact that competition among firms creates conflicting interests and only governments can help in avoiding these conflicts and promote trust by strengthening the rule of law and the neutral regulatory institutions (APEC, 2000)

According to Hofstede and Hofstede (2005), trust plays an important role as it lowers transaction costs and increases certainty. In organisations, trust facilitates teamwork, productivity, innovation, and reduces the need for expensive monitoring. Correspondingly high levels of trust between players will reduce the need for complicated regulatory effort and the imposition of sanctions, and thus productive cooperation and beneficial change will be enhanced. Studies indicate that such productive interaction between all knowledge economy players in developed and high growth economies was aided by effective governance, an efficient and up to date legal system, economic incentives that protect and nurture innovation, and a competitive environment that supports the private sector in general (APEC, 2003).

Based on these observations, it becomes particularly crucial that institutions of governance are strengthened in developing countries, including the MENA countries to stimulate trust among the knowledge economy stakeholders. This is because governments in these countries are still the principal drivers and main actors in their economic development and the private sectors are still in the early stages of development and are for the time being largely dependent on government support (World Bank, 2004; Yousef, 2004). As a result, reforms in government institutions appear to represent the starting focal point in fostering a knowledge economy framework in these countries.

Based on the criteria of identifying useful knowledge economy indicators, the World Bank Institute has identified several indicators that could be used to gauge the first knowledge economy driver (factor). Only three of these indicators will be used in this

study to gauge the first factor of the knowledge economy framework in Oman. The inclusion of the rest of the indicators will be problematic due to the lack of reliable statistics that can be used to make comparisons across countries (World Bank, 2004; Aubert, 2005). Furthermore, some of the indicators may also be irrelevant or unrepresentative of Oman's economy and society.

It is noteworthy that a reasonable consensus was established during the course of this study among Omani academics and policy makers in the area of the knowledge economy, who were surveyed or interviewed by the author about the main factors that are the most important for evaluation in such a study. Indeed, such a consensus is in line with the experience of many other similar evaluations of a country's readiness for the knowledge economy (OECD, 1999; ABS, 2002; Aubert, 2005; European Innovation Commission, 2005).

The following sub-sections identify the factors and indicators believed to be the most important building blocks in creating effective governance and enhancing effective interactions between knowledge economy players in a developing country such as Oman.

4.4.1 Government institutions and economic incentives

The indicators chosen to gauge this factor have been extracted from the World Bank's database as of 2006 and are relevant and useful to the developing countries and Oman's case in particular (World Bank, 2006). These indicators are:

- Government effectiveness: This indicator measures the quality of public service provision, the quality of bureaucracy, the competence of civil servants, and the credibility of the government commitment to dynamic policies. This indicator is measured according to the series *Doing Business* (World bank, 2006) which is widely used as a reliable evaluation tool by the World Bank and other international think tanks.
- Regulatory quality: This indicator measures the incidence of policies that are unfriendly towards the knowledge economy, such as the lack of a legal system necessary for promoting innovation and protecting local businesses, as well as perceptions of the burdens imposed by excessive regulation in areas such as

business development. This indicator is also evaluated according to the *Doing Business* series (World Bank, 2006).

- Economic incentives: This indicator measures the economic incentives that the government provides for the development and enhancement of the private sector's role in terms of promoting a fair competitive environment, the existence of intellectual property law, and government taxes, fees, expenditure and other kinds of support. This indicator is measured according to the World Bank Institute (2007) database which relies on the *Global Competitiveness Report*.

According to the World Bank database, the measurement and evaluation of these indicators are based on surveys that are drawn from about 31 sources and 25 different think tanks, institutions, organizations, individuals and domestic firms with first-hand knowledge of the governance situation in the country under investigation. Other data sources are from non-government organisations (NGOs), as well as reputable international commercial risk rating agencies, which base their assessments on a global network of correspondents typically familiar with the country they are rating.

The influence of effective governance conditions on economic performance is clearly demonstrated in the successful experiences of the developed countries, as per capita incomes and the quality of governance are strongly positively correlated across countries (Hearn and Rooney, 2002; Kaufmann and Kraay, 2002). However, there is a need to approach this reform with some caution. McBrierty (1999) and Aubert (2005) caution that the quality of governance should be seen from the perspective of countries themselves with their own values and cultural specificities. A lack of financial transparency, for example, may not necessarily be a problem in a number of cultures including the Arabic culture which is known for its secrecy. On the other hand, a bureaucratic climate which forces an entrepreneur to obtain tens of authorizations before establishing a business is certainly a problem, whatever the culture in question.

On the choice of the regularity quality indicator, the World Bank (2004) and the IMF (2005) indicate that many of the major obstacles to knowledge economy development in developing countries are related to the improper legal environment. Generally,

empirical evidence shows that investors are primarily concerned about the overall regulatory framework of a country, more than the incentives (e.g. fiscal or financial) it offers, and they prefer to locate investments, especially large, long-term ones, in countries with predictable policy regimes (UNCTAD, 2002). Furthermore, a regulatory regime with strong intellectual property law has been associated positively with innovation development (Aubert, 2005). This is related to the fact that protection for the invention of individuals and companies enables them to appropriate reasonable returns on their R&D investment. More importantly for developing countries, the absence of such laws provides no incentives to develop indigenous knowledge potentials.

Economic incentives in the form of generous tax laws, financial incentives and flexible intellectual property regulations that encourage a competitive and innovative business environment are important to induce individuals and firms to create and acquire necessary knowledge for their survival. According to Dahlman (2002, p. 43):

> Under a regime without much competition, there will not be much pressure for firms or individuals to exert the effort to find those more efficient ways of producing, or to find or develop new and better goods and services.

4.4.2 Education and training

This second driver of the knowledge economy is of major importance to developing countries, as they have been struggling to deliver effective and productive education systems that can successfully respond to their economic needs. The importance of human capital underlies the demand for increased skills, including teamwork and cognitive skills, and lifelong learning in order to adapt to the continuous business change of business requirements (OECD, 1997). Moreover, the impact of knowledge accumulation on productivity underscores the importance of appropriate education systems, which also generate positive spillover effects in a society. According to the World Bank (2002) and APEC (2003), education and training represent the sequential and logical build-up towards creating an effective innovation culture, which is a critical component in the success of modern economies. This is related to the increased importance of fluidity of knowledge flow between individuals, firms and organisations. Empirical studies have found that successful knowledge creation

reduces the cost of R&D and speeds up the innovation process through collaboration in the discovery, application and diffusion of knowledge and technologies (Neef, 1998; OECD, 1999).

The relevant education and training indicators for this study have been obtained from UNESCO as of 2006. These indicators include:

- Adult literacy rate: Measures the percentage of literate population who has had formal education above the age of fifteen years.
- Secondary enrolment rate: Measures the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of secondary education.
- Tertiary enrolment rate: Measures the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of tertiary education.

These indicators have been put in a sequential order as natural and essential building blocks that prepare individuals for knowledge attainment and development. Although these indicators may not represent training directly, it is anticipated that training is considered a part of the continuous learning cycle and an inseparable element of the education process. According to UNESCO (2005a) this is because of the conviction that a successful transition to a knowledge economy should be also accompanied by a gradual transition to a lifelong learning society.

The adult literacy rate indicator gives a very broad stock measure of the educated population who can read and write in their everyday life. Empirical studies indicate that human capital is almost always identified as an essential ingredient for achieving growth. For example, Barro (1991), using cross-section data for 98 countries, found that higher literacy rates and school enrolment rates had statistically significant positive effects on growth of GDP per capita. Similarly, Cohen and Soto (2001), using cross-country time-series data on educational attainment or average years of schooling, found statistically significant positive effects of education on economic growth in general.

On the secondary enrolment front, the International Labour Organization (ILO) indicates in its *Report on Labour 1998/1999* that an addition of just one year to average schooling years will result in a 5 per cent to 15 per cent increase in labour force productivity. Sluis et al. (2005) have reached a similar conclusion, that an extra year of schooling raises enterprise income in developing countries by an average of 5.5 per cent. Thus, the importance of secondary education is not only limited to its role in the improvement of labour quality, productivity and employment longevity, but also as a source of fulfilment that people need to function in their communities in a beneficial and cohesive manner (UNESCO, 2005a). More importantly for Oman and the GCC countries, secondary education is needed at this stage as their graduates also present a possible opportunity for replacement of migrant workers where the vast majority of whom (more than 80 per cent in Oman) have an educational attainment below secondary level (MNE, 2006).

Tertiary education in the form of higher education, and technical and vocational training is even more important at the advanced stages of knowledge economy development which depend heavily on skilled and semi-skilled workforces. The OECD (2000) estimates that over 60 per cent of production in OECD countries is created by knowledge workers. Furthermore, empirical studies show that there is positive relationship between a skilful and educated workforce and economic growth (Neef, 1998; UNESCO, 2005a). According to OECD (2007), university graduates in most OECD countries earn more income and find jobs more easily than people who have not had a university education, and these advantages have been reflected positively in overall economic growth. Thus, fears of a crowding-out effect whereby more tertiary graduates would increase unemployment, as some policy makers argue, appear to be groundless.

This view is also supported by the fact that higher education enrolments continue to grow in most OECD economies, with more than 50 per cent of high school graduates – and in some countries more than 75 per cent - going on to higher education (OECD, 2007). In addition, these countries are collectively spending more than ever before on education, with expenditure increasing in real terms by more than 40 per cent since 1995. Although results show that education output from such investment is not at its

optimal level, studies estimates that learning outcomes could be increased by 22 per cent.

More importantly for the developing countries, particularly the small ones, such higher education development has proven to be a magnet for FDI, innovation development, and technology and know-how transfers, which are all critical to knowledge economy growth. Finland, Ireland, India and Singapore are all clear cases in this regard in which effective human resources development has contributed to their competitive and innovative edge (UNCTAD, 2002). Thus, tertiary education development at all levels represents an opportunity that must be exploited in Oman as well.

4.4.3 Information and communication technologies (ICTs)

As noted earlier, the knowledge economy literature stresses that ICT is another driving factor that has contributed to economic growth in the developed economies. However, full potential of up to date ICT infrastructure cannot be realised with an uneducated labour force, conventional management practices and a traditional legal system. This is because ICTs of themselves do not generate knowledge but they facilitate individuals and firms to access, store, utilise and transfer knowledge efficiently, promptly, and in a timely and cost effective manner (OECD, 2002). Empirical evidence confirms that effective adoption of ICTs in the USA and other major OECD economies was accompanied by a significant shift towards more skilled workers (OECD, 2000). The European Commission Information Society (ECIS) reveals that ICTs contribute to 25 per cent of EU GDP growth and 40 per cent of productivity growth. In terms of job generation, which is crucial to developing countries which suffer from high unemployment, ICTs tend to create a powerful multiplier effect. A study in Washington state (USA) shows that each job at Microsoft created an additional 6.7 new jobs, while a job at Boeing created only 3.8 additional jobs (Mandel, 1997). Recent studies by the World Bank in the high growing Asian economies also support such tendencies (Dahlman, 2002).

As a result, ICTs are considered to be a vital element in the knowledge economy build up. The indicators that have been chosen to measure ICT development are obtained

from the Ministry of National Economy in Oman and the World Bank database as of 2006. These indicators include:

- Telephones per 1,000 persons: Refers to the sum of telephone mainlines and mobile phones connecting a customer's equipment to the public switched telephone network.
- Computers per 1,000 persons: Refers to the number of personal computers and laptops that are owned by a customer as an indicator of personal computer penetration.
- Internet users per 1,000 persons: This indicator relies on nationally reported data. In some cases, this is based on national surveys (they differ across countries in the age and frequency of use they cover), in Oman it is derived from reported internet service providers and subscriber counts.

These indicators have been widely used in the developed economies at the early stages of knowledge economy development, and are considered to be equally useful for developing economies (ITU, 2006). Although developed economies have been shifting away from the infrastructure development stage to effective services and applications, most developing countries are still lagging behind in this regard, where quality, speed and access in terms of affordability are among the barriers that impede these countries' ICT penetration (World Bank, 2002; Al-Shihi, 2006). Indeed teledensity rates in most of the MENA countries for telephones, computers and the internet stand at 163, 137 and 132 per 1000 inhabitants respectively, which is below the world average of 226, 201 and 193 respectively. This handicaps their efforts in providing effective knowledge creation, dissemination and use amongst main stakeholders (World Bank, 2004).

4.4.4 R&D and innovation

R&D and innovation is the final driving factor of the knowledge economy framework used in this study. Aubert (2005) emphasises that a successful innovation culture in the developing countries depends on intervention from the government which is the principal promoter of the whole innovation cycle among government institutions, the private sector firms, local think tanks and individuals who hold indigenous knowledge. This is because R&D activities are costly and take a long time to generate

positive income streams and the private sector in developing countries is often too weak to carry the burden during the long gestation period of investment in R&D.

Three indicators were used here as proxies for the extent to which an economy taps into the growing stock of global knowledge: R&D spending as percentage of GDP, the number of researchers in R&D and the number of articles published in scientific journals. The importance of these indicators of R&D and innovation as a major source of a competitive edge in today's world markets has been well documented (OECD, 1999; Bontis 2004). The following R&D indicators, obtained from the UNESCO database as of 2006 have been chosen to reflect the relevance of R&D and innovation to Oman, and to the other developing countries in the region:

- total public expenditure for R&D as percentage of GDP: reflects the total government expenditure on fundamental and applied research and experimental development work leading to new discoveries, products and processes; it includes scientists' and researchers' salaries, as well as spending on the purchase of laboratory equipment and accessories;
- researchers in R&D per 1,000,000 people: refers to the number of researchers engaged in full time R&D per one million people; and
- scientific and technical journal articles produced per 1,000,000 people: this refers to the number of scientific and engineering articles published per one million people in a year in scientific and engineering journals.

A number of recent OECD studies indicate that high innovation performance tends to be intensive in the high income and high productivity countries (OECD, 1996). Similarly, Porter (1998a) has shown that economies that have been more innovative tend to achieve a higher level of GDP per capita. It is estimated that a 1 per cent increase in the stock of R&D leads to a rise in GDP output between 0.05 and 0.15 per cent. Ireland, Finland, Singapore and South Korea are clear examples of positive and sustainable economic achievements due to their effective research management and generous R&D spending.

According to Grossman and Helpman (1991), well-funded and well-managed R&D systems produce quality researchers who in turn produce valuable scientific research

and technical publications. The OECD (2000) and World Bank (2002) acknowledge this result when they stress that new knowledge is largely created where R&D spending is the highest. A study of the comparative performance of the world's major science producing countries found that researchers in eight countries – led by the USA, UK, Germany and Japan – produce almost 85 per cent of the world's most cited publications, while another 163 countries, mostly developing countries, account for less than 2.5 per cent of total publications. In the light of these facts and figures, Mcbrierty and Al Zubair (2004) have pointed out that the late Oman's R&D development, its low spending on R&D (0.10 per cent of GDP), only 231 R&D investigators and staff, and about 500 overall publications together present a real challenge for the government. Accordingly, focusing on gradual development of R&D capabilities through correcting the major weaknesses in Oman's R&D indicators should be the key to success in this regard.

In addition to the above four knowledge economy drivers noted above, more recent studies emphasise the importance of adding a social dimension to this process. Thus, for example, Neef (1998), Grewal et al. (2002), Lee et al. (2002) and Al-Rahbi et al. (2008) have argued that ignoring the social side-effects of the knowledge economy could result in undesirable consequences. Indeed, they warn that unless appropriate social reforms accompany the development of the knowledge economy, its benefits could be largely captured by the skilled workers, urban areas and the developed countries, creating what is commonly known as the knowledge and the digital divides.

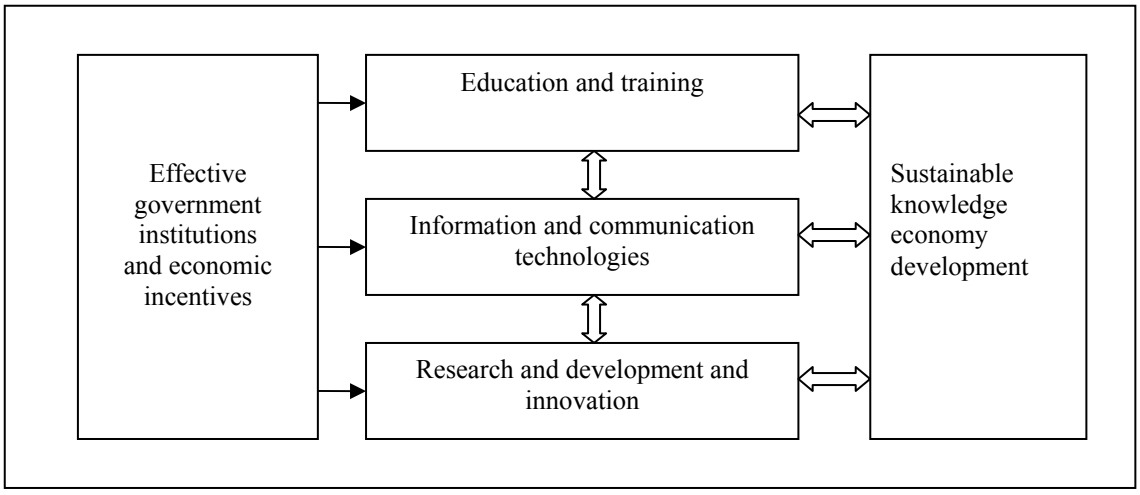
These warnings are indeed based on empirical evidence, such as the fact that five major developed economies produce 80 per cent of the world GDP. In addition, while wealth accumulation of knowledge workers and ICT literates and specialists is growing rapidly, the wages of unskilled workers and rural income have been on a decline since the 1970s (UN, 2005b). Similarly, the social gap between urban and rural dwellers has been rising in several countries, including China and India, where ICT services have tended to be concentrated in major urban centres, leaving rural populations in a vulnerable position (Lee et al. 2002; UNESCO, 2005b).

Another social dimension worth consideration by knowledge economy planners in developing countries is the need for addressing gender inequality. This need is

particularly high in the MENA region where women empowerment is ranked next to last among the world regions (Fergani, 2002; Yousef, 2004). Although gender inequality is a global phenomenon, the World Bank, (2004) argues that harnessing female potential for socio-economic development is essential for any sustainable economic development. Al-Lamki (2007) finds that in Oman too, gender inequality still has along way from being totally eradicated, in spite of several improvements in the status of women in the Omani labor market as well as in government sector employment. It is true that these improvements reflect a departure from the old religious deviation of housekeeping and family related activities, although social forces perpetuating male supremacy are still far too strong. Figures from MNE (2006) show that total female participation in the labor force is still 18 per cent and their unemployment is estimated at 40 per cent compared to 15 per cent for men.

A diagrammatic representation of the structure of the framework proposed in this study is shown in Figure 4.1. As noted above, most knowledge economy frameworks tend to be country-specific as they must address each country-specific socio-economic development level (Aubert, 2005). Nonetheless, effective governance, an education system responsive to the needs of the business community, effective ICT infrastructure and services, and institutions that nurture research and development and innovation, are preconditions for developing a strategy for the knowledge economy particularly in the developing countries.

Figure 4.1 Conceptual framework for the development of the knowledge economy in Oman



A distinguishing feature of the framework depicted in Figure 4.1 is the key role assigned to government institutions and incentives. The reason for this, which has already been eluded to in the discussion above, is that unlike the situation in a developed country, the private sector in Oman is not yet developed enough to take the main responsibility of creating viable R&D and innovation systems in the country. The size of private sector enterprises is typically too small to be able to undertake serious research and development internally. The market for their products is also typically small, making it difficult for them to recoup the sunk costs that would be necessary for a viable R&D and innovation activity. An additional factor in Oman is the need to achieve the social objectives of fairness and equity in the distribution of the benefits of the knowledge economy, an outcome that only the government can deliver. It is necessary, therefore, in the initial stages at least, that the government lead the process of Oman's transition towards the knowledge economy.

As indicated earlier, the relationship between knowledge economy drivers is non-linear; rather it is one of a series of overlapping relationships. For a developing country like Oman, Figure 4.1 shows the overlapping of only three core drivers that are depicted in the middle panel. The role of government institutions and economic incentives is shown separately from the overlapping relationship among the three drivers simply to depict the need for more government commitment to promote the other three factors. Thus, this separation represents the vital role of the government as the key driver and facilitator of the other three drivers, as well as being the key promoter of the private sector in Oman during the early stages of the development of the knowledge economy.

Claiming to have chosen the latest and the best indicators to gauge Oman's knowledge economy readiness would be misleading. However, as pointed out earlier, the choice of these factors and indicators is not only because they are derived from the guidelines of the experiences of other countries, but because the selected factors and indicators are also based on Oman's economic and social realities. This explains the exclusion of some other commonly applied more advanced indicators, such as the number of patent applied and granted as an indicator of innovation because of its non-existence in today's Omani economy. Similarly, the exclusion of foreign direct investment (FDI) as an indicator of economic incentives for foreign investment and

technology is based on the fact that this factor is currently insignificant in Oman. Oman's low FDI inflow is related to demographic smallness, regional conflicts and instabilities, lack of sufficient natural resources, and unskilled labour force. Another important indicator that has been excluded from this study is the liberalisation of tariff and non-tariff barriers, which are directly related to economic globalisation that is already underway in Oman as a consequence of Oman's obligation as a signatory to the WTO membership.

4.5 Limitations of the Framework

There is a consensus among knowledge economists and researchers that there is no ideal knowledge economy framework that fits all situations. Indeed, even in some of the developed countries, different frameworks have been developed to suit their specific peculiarities (OECD, 1996, 1998; ABS, 2002; World Bank, 2002). As a result, the framework presented in this study does not attempt to cover all knowledge elements in Oman's economy. Not only would such a task be overly ambitious but it would be misleading to pretend that all knowledge factors are measurable (ABS, 2002). In particular, the proposed framework does not offer *a comprehensive* treatment of a knowledge economy although *it does address and prioritize key factors* which are considered to potentially affect the ability of knowledge economy development to achieve economic transformation in Oman.

The number of indicators in the framework has been left deliberately small due to the lack of sufficient and reliable information on Oman. For instance, Oman is yet to formulate an R&D strategy and thus R&D output indicators, such as patent applications do not currently exist. In this situation, the basic building blocks of R&D indicators were chosen to set a basis for further studies, should the government proceed with its knowledge economy initiative, and should more information and empirically relevant data become available.

Furthermore, the characteristics of many indicators in this framework tend to be dynamic and change over time. For example, access to phones, internet and computers that are currently of interest as indicators of ICT penetration, are increasing fairly rapidly and can change within a relatively short time. Similarly, education and

training as well as R&D and innovation indicators are likely to change but at a slower pace.

4.6 Summary of the Chapter

The proposed framework in this study draws on the work done by a number of organisations namely the OECD, Australian Bureau of Statistics (ABS), Australian Department of Industry Science and Resources (DISR), APEC and the World Bank Institute. This study proposes a framework with four dimensions, all of which are based on Oman's current achievement in respect of the main driver of the knowledge economy. Thus, this framework stresses the importance of a strong commitment and dynamic government leadership in terms of investment, regulation and coordination of the four dimensions of the knowledge economy. Holistically, these four dimensions encompass an institutional regime with economic incentives that promote education and training, information and communication technologies, and research and development for sustained creation, acquisition, dissemination and utilization of knowledge in domestic economic development. Success along these dimensions would result in a more innovative, competitive, productive private sector that would lead to more sustainable economic growth.

Given the limitations of the development of a knowledge economy framework, the selection of basic knowledge economy drivers and indicators has been based on the socio-economic development levels in Oman.

Chapter 5. Research Methodology

5.1 Introduction

This chapter describes the methodology used in this research for identifying the factors that would assist the government of Oman to pursue a knowledge economy strategy in an attempt to diversify and consolidate its economy.

The chapter is organized as follows. Section 5.2 outlines an overall paradigm that rationalises the research process, research approaches and research strategy that identifies data collection techniques and analysis. In Section 5.3, a benchmarking process is used to examine Oman's knowledge economy readiness by benchmarking Oman's four knowledge economy drivers against the world, the region, the GCC countries, Finland and Malaysia. This benchmarking process utilizes the knowledge assessment methodology (KAM) that consists of the basic scorecard and the knowledge economy index, both of which have been developed by the World Bank Institute and used widely by knowledge economy researchers and international bodies.

Section 5.4 details the second data collection phase with the choice of a qualitative data gathering strategy in the form of an interview approach, where the definition, techniques, justification and limitations of this approach are discussed. The third data collection technique is described in Section 5.5 where the choice of the quantitative data collection technique is explained, together with the techniques and limitations of a questionnaire survey. Ethical issues related to this research project, along with the procedure and precautions followed to ensure the cooperation of the participants and compliance with this university's ethical procedures, are detailed in Section 5.6.

Reliability and validity of the questionnaire survey are detailed in Section 5.7 where robustness and usefulness of the data collection are scrutinized. Section 5.8 outlines the procedures followed in data processing in the form of checking completeness, coding, computer entry and other data manipulation procedures that are necessary before conducting any such analysis. In Section 5.9 the data analysis technique used

in this research is described, which includes the use of factor analysis.. A summary of the main conclusions is presented in Section 5.10.

5.2 The Research Process

In its simplest form, research can be seen as a process of discovery of new information or relationships amongst the variables considered to expand existing knowledge for some specified purpose or to solve problems which may be theoretical or practical in nature (Cavana et al., 2001; Creswell, 2003). According to Blaikie (2003) research can also be seen as a process to explore, describe, understand, explain, predict, change, evaluate and assess aspects of certain phenomena. It starts with a research problem or a practical problem which requires answering three types of questions that take a sequential order of: 'what', 'why' and 'how', which form the first layer in the research process or what is sometimes referred to as the research paradigm (Saunders et al., 2000). In fact, it is the platform that determines how knowledge or answers to the research problem are going to be obtained.

There are two major fields of research processes namely, positivist (scientific) and interpretive (social) research (Zikmund, 2000). Scientific research is conducted within the rules and conventions of science. It utilizes deductive reasoning through guidance of a specific theory towards achieving concrete empirically verifiable results of investigation (Saunders et al., 2000). Interpretive research is based on logic, reasoning and systematic examination of evidence. Ideally, this type of research should be capable of replication by the same or different researchers with similar results obtained (Zikmund, 2000). This research utilised the interpretive approach as an appropriate research method to tackle this research problem.

5.2.1 Selecting research design techniques

Zikmund (2000) and Blaikie (2003) state that explanatory research could take a quantitative approach; that is, gathering numerical data to ensure objective and accurate results. However, a qualitative approach, or data in words, is potentially useful to obtain more information. A common consensus has been established recently that mixed qualitative and quantitative research studies provide more robust and useful findings (Cavana et al., 2001; Creswell, 2003; Hair et al., 2006). Saunders

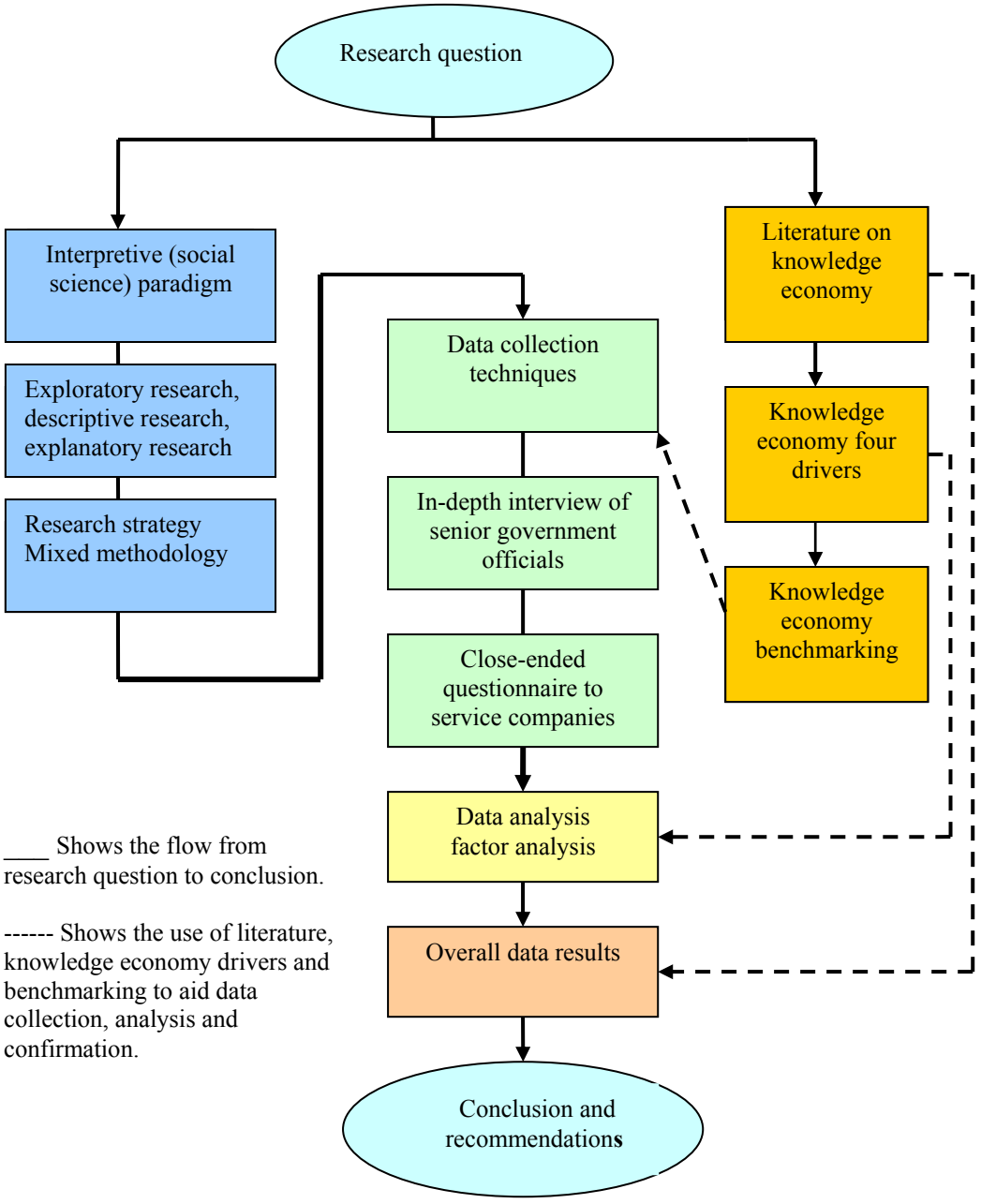
(2000) and Zikmund (2000) suggest that qualitative and quantitative methods could complement one another if applied efficiently, to enrich the data gathering particularly in new research areas, as is the case with this study.

For this study, which is essentially concerned with the future pattern of Oman's sustainable economic development through the adoption of a strategy for developing a knowledge-based economy, the first step involved gathering information by holding meetings with various senior government officials, executives of leading private sector companies and relevant academics at Sultan Qaboos University. All of the above emphasized the importance of including all the relevant data and involving the main stakeholders in this process.

In addition, the knowledge economy literature also emphasises the importance of incorporating a benchmarking process through a tool known as the knowledge assessment methodology (KAM). This has been developed by the World Bank Institute to gauge a country's readiness for a knowledge economy compared with other regions and countries (World Bank Institute, 2002; World Bank, 2004). Thus, a benchmarking process, a qualitative approach (in the form of interviews) and a quantitative approach (in the form of a questionnaire survey) were applied in the data gathering approaches with a view to producing practical and useful results. This multi-method research strategy tests the validity of measurements by means of triangulated cross-method comparisons.

Triangulation requires multiple sets of data tackling the same research question from different viewpoints (Cavana et al., 2001; Cresswell, 2003). Testing of variables by different methodologies may have important ramifications for the research problem as long as these methods are employed independently of one another, but are focused as tightly as possible upon the question being researched. Brewer and Hunter (2006) indicate that an advantage of multi-method studies is that when multiple tests are designed and performed by the same investigator in a short period of time, the same level of knowledge and skill are more likely to inform and consolidate each test. The research design of this project is summarized in Figure 5.1.

Figure 5.1: Different phases of the research methodology



Source: Adapted from Koo (2004, p. 68), modified to suit this research project.

Exploratory research was undertaken at the initial stage to crystallize problems that lead to identifying the information required for this research. In this process, the researcher consulted with academic colleagues at Victoria University in Melbourne and Sultan Qaboos University in Oman, government officials, and executives and managing directors of some grade excellent service companies in Oman, to explore issues related to this study. A thorough review of the knowledge economy literature was conducted to explore its evolvement, development and application in different

countries. A benchmarking process followed the previous two steps as recommended by the knowledge economy literature as an essential and powerful tool to unveil Oman's knowledge economy readiness in the four main drivers relative to international, regional and some relevant countries' levels.

A qualitative approach was also used as a subsequent step to gain insights on the issue from senior government officials whose positions qualified them to provide useful information on Oman's economic development plans in general, and knowledge economy main drivers in particular: education and training, information and communication technologies, research and development, and government institutions that support such factors. Finally a quantitative approach was conducted to gain valuable information from targeted grade excellent service companies that could provide useful feedback and information on this new issue as main end users of knowledge economy development in Oman. This approach was part of the descriptive and explanatory approaches which try to explain, relate and find the appropriate factors or variables that would contribute to knowledge economy development.

These companies were selected according to their registration at the Oman Chamber of Commerce and Industry as of 2006. The choice was based on the anticipated valuable information they could provide in initiating knowledge economy policies in Oman. The importance of the service sector in Oman stems from the fact that it contributes more than 78 per cent of non-oil GDP and almost 60.5 per cent of overall GDP (MNE, 2006). More importantly this sector employs semi-skilled and skilled labor. For instant, about 84 per cent of the local labor force employed in commercial banks hold secondary certificates or above (Al-Lamki, 2005). Similar labor and education characteristics, but to a lesser extent, are also present in other major service sectors such as insurance, education and health care institutions (MNE, 2006). Thus, this sector has been viewed as the potential driving force of any knowledge economy quest as is the case in developed and fast growing developing countries.

A mail survey was used as a means to collect data for analysis. Statistical measures of the factorability and correlations between variables are analysed in Chapter 6 to identify factors, ranking and their relationship strength. The quantitative research approach played a major role in this research since it was used to answer questions

requiring numerical data to solve the problem. In quantitative studies, the data are transformed from words into numbers, are then subjected to different statistical manipulation, and are subsequently reported in both numbers and words (Cavana et al., 2001).

This research used factor analysis to analyse the data collected via the survey questionnaire to answer the questions proposed, to find appropriate and significantly related factors that assist in formulating a knowledge economy policy that takes into consideration all stakeholders' ideas and concerns. As is the case with some knowledge economy data collection surveys, where some regression analyses were used such as Shapira et al. (2006) in Malaysia, this research concentrated on factor analysis. This proved to be more useful in answering the research question as Oman is yet to initiate a knowledge economy strategy. According to Chen and Gawande (2007) factor analysis is a useful tool for data reduction and provides a clearer picture of which factors act together according to their underlying dimensions. Other possible analysis techniques such as discriminate analysis and hierarchical regression analysis which were tried in this research fell short of providing useful findings due to the low and negligible correlations among the variables as demonstrated in Chapter 6.

5.3 The Benchmarking Process

For this research project, the benchmarking process depended on secondary data from the World Bank and various ministries' databases, along with primary data from in-depth interviews, and a mail survey questionnaire where data were generated from field survey methods in Oman, that were intended to complement each other. According to the World Bank Institute (2002), the benchmarking process is a powerful and a reliable technique that provides practical learning through comparing indicators and outcomes. It is particularly useful for developing countries to get an idea of their current knowledge economy standing compared to their neighbors, competitors, region and world averages. In this research, Oman has been benchmarked against the average performance of the world, the region, the GCC countries, Malaysia and Finland. The World Bank, the United Nations and other international think-tanks and bodies use such comparisons as a quick overall measurement to obtain the knowledge economy development levels of countries. In

fact, such a benchmarking process is the only suitable comparison procedure that could be utilized to generate a reasonable understanding of Oman's current knowledge economy readiness (World Bank, 2004). The choice of these regions and countries is based on the following reasons.

- The world's overall knowledge economy average provides a good indicator of a country's specific status. In fact, most international organizations use such benchmarking as an indicator of a country's level of knowledge economy development readiness from which an overall picture can be generated. According to the World Bank (2004), such a comparison provides an enticing opportunity for politicians and policy makers.
- The regional knowledge economy readiness average is also a useful measure that provides a closer picture with regional partners and competitors. Its usefulness stems from the fact the Middle East and North Africa (MENA) region is considered among the least fortunate in knowledge economy development as it comes second last in the world knowledge economy ladder just before the African Sub-Saharan region (World Bank, 2004). Thus, such a comparison offers an escape window for Oman to improve its knowledge economy position to avoid being trapped in the same situation.
- Inclusion of the GCC countries is based on Oman's membership of this organization. Although these states vary in their knowledge economy readiness, their economic integration since the formation of this counsel in 1989 is considered a pivotal step towards a more competitive and globalised world economy. Thus, not only is a knowledge economy readiness benchmarking process between these countries necessary to pinpoint their strengths and weaknesses in relation to knowledge economy main drivers, but it is also important to coordinate their knowledge economy policies collectively to create a knowledge economy cluster that would assist in consolidating and harmonizing their policies toward better socio-economic integration.
- The choice of Finland provides an interesting and lucrative experience of a small well-developed knowledge economy nation that shared similar economic characteristics with Oman during the 1970s before its implementation of knowledge economy strategies. In fact, as recently as the

1970s Finland relied mainly on forestry as a main resource-intensive industry, where as now it is one of the most knowledge intensive economies in the world particularly in information and communication technologies (ICT). In fact, Finland was ranked 3rd in the world's knowledge economy index in 2006 despite a major economic recession during the 1980s (Dahlman et al., 2006), and is exemplified as successfully pursuing a knowledge economy.

- Malaysia is another good example that has been cited often by politicians in the Arab and Islamic worlds (and the World Bank). As an Islamic country, Malaysia also shares religious and cultural backgrounds with Oman, and has pursued to some extent successful knowledge economy initiatives since the mid 1990s and leapfrogged many Middle Eastern oil rich nations in this regard. Malaysia is ranked 46th in 2006 in the worldwide knowledge economy development index out of 132 countries despite its late entrance to the knowledge economy world and in spite of a major financial crisis in 1997. In fact, along with other nations such as Singapore, South Korea and Chile, it represents an inspiring experience for the developing world (APEC, 2003; World Bank, 2005).

Despite there being many other good knowledge economy implementation examples worldwide such as Ireland, Israel, Taiwan, and more recently China and India, the choice of the above countries was based on social, cultural and economic relevance in the case of the GCC countries, and economic relevance in the case of Finland and Malaysia. In fact, the last two economies used to rely heavily on one natural resource as Oman does now on oil, where forestry was Finland's main economic activity during 1970s and 1980s and agriculture in Malaysia during the 1980s and 1990s.

This benchmarking process according to the World Bank (2007) is useful to gauge Oman's knowledge economy readiness as a first and essential step towards gaining an insight and understanding of its current knowledge economy abilities. In fact, such a process has been proven to be particularly useful for the interview preparation stage as it has assisted in formulating proper interview questions and enriched the discussions with the interviewees.

As mentioned before, this benchmarking will be based on the World Bank Institute framework which incorporates four knowledge economy drivers recommended by the literature as part of the knowledge assessment methodology (KAM) to measure and compare countries' knowledge economy readiness. According to the World Bank Institute (2006), the unique application and strength of the KAM lies in its cross-sectoral approach that allows a holistic view of factors relevant to knowledge economy development.

This process aims to reveal Oman's knowledge capabilities and readiness against the abovementioned groups and countries. It includes 14 standard indicators: two economic performance indicators namely GDP growth rate and GDP per capita growth rate that have been discussed in the background Chapter 2 and 12 knowledge economy indicators, with 3 indicators representing each one of the 4 drivers of the knowledge economy (Table 5.1). As indicated in the literature, there may be more robust data describing a country's preparedness for knowledge economy development, however the 12 indicators selected for this study have been empirically scrutinized, are available for a longer time series for Oman specifically, and are regularly updated for the rest of the groups and countries that are included in this benchmarking process.

Table 5.1 Knowledge economy main drivers (variables) and their indicators

Variables (drivers)	*Indicators*	*Source of data & information as of 2006*
Economic performance	- GDP growth - GDP per capita growth	World Bank & Ministry of National Economy
Government institutions & economic incentives	- Government effectiveness - Regulatory quality - Economic incentives	UN & World Bank
Education & training	- Adult literacy rate - Secondary enrolment rate - Tertiary enrolment rate	World Bank & UNESCO
Information & communication technologies	- Telephones per 1000 people - Computers per 1000 people - Internet users per 1000 people	UN & International Telecommunication Union
Research & development	- Total expenditure for R&D as % of GDP - Researchers in R&D per 1,000,000 inhabitants - Scientific and technical journal articles produced per 1,000,000 inhabitants	World Bank & UNESCO

Source: World Bank (2007).

As discussed in the conceptual framework (Chapter 4), knowledge economy measurements largely depend on representative elements or indicators which are subject to debates among knowledge economists over their robustness in gauging properly a country's knowledge economy readiness. However, the European Innovation Commission (2005) asserts that well-guided indicators could form the basis for a scientific benchmarking analysis. According to Saisana et al. (2005), such indicators seem to be inevitable at this stage. ABS (2002) identifies the following four steps that are useful in undertaking the benchmarking process:

- gathering information about the issue under investigation from reliable official sources, international organizations, relevant countries databases, and international think-tanks;
- understanding the data to generate coherent and quantifiable indicators;
- analyzing the indicators in order to start the benchmarking process; and
- critically reviewing the benchmarking results to make them more defensible and practically useful.

Oman is a developing country where output indicators such as number of patents, productivity level and number of scientists are still too low to be useful in comparisons. Chen and Dahlman (2005) suggest that input indicators such as education levels, ICT development level, and research and development expenditure could be used at an early stage of knowledge economy development. Similarly, the World Bank (2007) in its developing countries assessment seems to favor such an approach where most developing countries' knowledge economy assessment is based on input indicators which are evaluated according to two assessment tools. These two tools are detailed in the following sub-sections.

5.3.1 Basic Scorecard

The basic scorecard is a tool of the World Bank Institute's knowledge economy assessment methodology (KAM). According to Chen and Dahlman (2005), it is a useful tool for providing an insight into problems that a country may face and opportunities that it may need to seize, and where it needs to focus policy attention with regard to making the transition to a knowledge economy. Comparisons in the KAM are made on the basis of 83 structural and qualitative indicators that serve as

proxies for the four knowledge economy drivers. Although the World Bank Institute has developed this large number of indicators to cover the full range of the four knowledge economy dimensions, this study will utilize only twelve of these indicators as proxies of Oman's basic scorecard.

There are various ways of presenting the analytical value of such a scorecard and according to the World Bank Institute (2002), most charts are useful. However, in visual illustrations of the knowledge economy basic scorecard tool, a small number of proxies could be more convincing in spider and bar charts as they demonstrate clearly the knowledge economy's four drivers and their selected indicators facilitating comparisons among the chosen regions and countries.

Chen and Dahlman (2005) suggest using the procedure detailed in Box 5.1 to normalize the values of each indicator according to each country's specific data available to reach a reliable benchmarking outcome. This procedure has been used in this study.

Box 5.1 Normalization procedures of knowledge economy indicators

- The raw data (u) is collected from the World Bank database, international organisations, or the country's database for every indicator under investigation.
- Ranks are allocated to countries based on the absolute values (raw data) that describe each and every indicator (rank u). For instance, the rank equals 1 for a country that performs the best among the chosen countries in this study's benchmarking sample on a particular indicator (that is, it has the highest score), the rank equals to 2 for a country that performs second best, and so on.
- For each specific country, the number of countries that ranks lower or below it (Nw) is calculated.
- The following formula is used in order to normalize the scores for every country on every variable according to its ranking and in relation to the total number of countries in the sample (Nc) with available data:

  Normalized (u) = 10 (Nw/Nc).
- The above formula allocates a normalized score from 0-10 for each country with available data on required indicators. Ten represents the top score for the top performers and 0 the worst. The top 10% of performers gets a normalized score between 9 and 10; the second best 10% gets allocated normalized scores between 8 and 9 and so on. The 0-10 scale describes the performance of each country on each variable, relative to the performance of the rest of the country sample.

Source: World Bank Institute (2002).

5.3.2 Knowledge economy index (KEI)

The knowledge economy index is an aggregate index that represents the overall level of development of a country or region in respect of the knowledge economy. It summarizes performance over the four drivers and is constructed as the simple average of the normalized values of the 12 knowledge indicators of the basic scorecard. The basic scorecard can thus be seen as a disaggregated representation of the knowledge economy index (Chen and Dahlman, 2005). Values for each pillar are constructed as the simple average of the normalized values of the respective pillars in the basic scorecard.

The World Bank Institute favours using both the basic scorecard and the knowledge economy index, as they can together pinpoint at a glance the strengths and weaknesses of the status of the knowledge economy in a country. Furthermore, these two tools provide the possibility of choosing certain indicators that may be more relevant for some countries, but less relevant for others. This option significantly increases the versatility of these tools by allowing the use of indicators that are the most relevant for the country being analysed.

However, the benchmarking process has been criticized by some for its over-simplification as it does not provide in-depth information and is limited in providing a pragmatic diagnosis for knowledge economy development, particularly in the developing countries. To overcome this limitation Aubert (2005), Saisana (2005) and Shapira et al. (2006) suggest that additional data collection should be undertaken to generate deeper information on knowledge economy inputs and outputs. Both the European Innovation Commission and the Malaysia Department of Statistics have followed this approach and collected additional information from potential stakeholders segments.

5.4 The Qualitative Approach

As indicated before, the qualitative approach involves gathering in-depth information presented in non-numerical format, which can be used to support a subsequent quantitative approach. The aim of this stage was to collect information from

knowledgeable informants who were in a position to provide directions, insights and useful information on the problem under investigation (Creswell, 2003).

In-depth interviews

In-depth interviews are a good information gathering method for small samples (O'leary 2004). They are beneficial as they allow participants to propose solutions or provide insights, and have the flexibility to answer questions under investigation (Zukmund, 1997; Neuman, 1994). According to Yin (1994), interviews are essential sources of gathering survey evidence because they are about human affairs. The additional data for this research were generated from in-depth interviews. Yin (1994) defines in-depth interviews as those that are open-ended and conversational in nature but follow a definite set of questions derived from the relevant literature. Understandably, due to their verbal nature, interviews are open to certain shortcomings due to interpretation bias, poor recall, and poor or inaccurate articulation (Yin, 1994). In order to overcome these limitations, Yin (1994) suggests that the interviews be substantiated with other sources of data. In this study, the researcher, who also has past experience of being a senior Omani government official, was able to do so by utilising information provided in government publications and policy documents.

Interview sampling

According to Creswell (2003), a targeted survey is a non-probability purposeful sampling where people are chosen because they know the most about the subject under investigation. In-depth interviews were conducted in Oman with nine targeted senior officials, of which seven were working in government ministries, one in a partially government-owned company, and one in a government-owned ICT Park. The selection of these senior officials was based on the fact that they are directly involved in planning and supervision of the economy, human resources and ICT-related strategies. Names and contact numbers of these officials were obtained from the Protocol Directorate at the Diwan of the Royal Court in Oman according to Table 5.2.

Table 5.2 Profiles of the in-depth interviewees

Position	*Government agency*	*General responsibilities*
Undersecretary for Higher Education	Ministry of Higher Education	Planning, supervision and execution of higher education policies.
Undersecretary for Commerce	Ministry of Commerce and Industry	Planning, supervision and execution of business policies.
Undersecretary for Educational Planning and Human Resources Development	Ministry of Education	Planning, supervision and execution of general education.
Undersecretary for Development	Ministry of National Economy	Planning, supervision and execution of economic development strategies.
Undersecretary for Vocational Training and Technical Education	Ministry of Manpower and Vocational Training	Planning, supervision and execution of vocational training and technical education.
Chairman of Oman Chamber of Commerce and Industry	Oman Chamber of Commerce and Industry	Participate in the planning, supervision, promotion and coordination of local business policies.
Secretary General of the Scientific Research Council	National Research Council	Planning, supervision and execution of research development.
Chief Executive of Oman Telecommunication Company	Oman Telecommunication Company	Participate in the planning, supervision and delivery of ICT infrastructure and services.
Director General of Knowledge Oasis – Muscat	Knowledge Oasis Muscat	Participate in the planning, supervision and coordination of ICT and new knowledge-based policies and activities.

As indicated before, the interviewees were selected on the basis of their knowledge of the issue under study. The process for their selection and interview was the following:

1) Identify the key undersecretaries who have direct involvement in planning and supervision of government economic development or related strategies and who fulfil the criteria explained in the interview section above.
2) As all of these informants work in Oman, the researcher could only access them on one of his annual holiday trips to Oman to control and limit his expenses as the researcher is an Omani resident. The interviews had to coincide with these visits.
3) Find out availability of the informants by sending invitation letters outlining the research objectives and asking for permission to conduct the interview (Appendix 1).
4) Conduct face-to-face interviews according to the procedure outlined in (Appendix 2).
5) All interviews had notes taken (with the permission of the informant) as eight of them preferred such method. Although note taking is a tedious job and

requires a lot of concentration given the time limit and seniority positions of these government officials, the researcher was able to achieve very good and useful feedback. This was related to the extensive pilot tests, practices, corrections and feedback from the Victoria University Ethics Committee, fellow PhD students, supervisor and co-supervisor on the original versions of the interview questions.

6) All participants were dealt with, approached and treated equally as they are all senior government officials.

Interview questions

The interview questions were formulated on the basis of the review of the knowledge economy literature and the benchmarking process, and were representative of the four main knowledge economy drivers. Each interview was divided into two parts. The first part was used to obtain factual information about the informant. Apart from their factual content, these questions served as a 'warm-up' towards establishing rapport with the informant. The second part of the interview was related to questions about the role, plans and knowledge of the participants on Oman's knowledge economy. Due to the intangible and evolving nature of the knowledge economy terminologies, which were often difficult to explain to the interviewees, the researcher avoided using specific terminology on the knowledge economy. Instead, the questions were described in layman's terms.

Coding

Eight out of the nine interviewees preferred note taking instead of tape recording and the researcher had to comply with the majority's request in accordance with Victoria University Ethics Guidelines. The coding procedure consisted of note taking of the interviews and then rewriting the notes in a clearer manner to enable the researcher to get a sense of the whole picture and note down any important ideas and phrases that may arise. The next step in this coding process involved filtering the interview notes looking for common themes that could be useful for the analysis stage. In addition, this stage also involved writing down quotations and suggestions that had special meaning to the informants.

Local integration

After all the material had been coded, local integration involved summarising all of the material and asking the following questions. Does the summary of each interview make sense? What about the variant? Do the results concur with existing literature? Do I need to conduct further interviews or follow-ups on certain issues?

Inclusive integration

Inclusive integration ties together all the findings and then leads to a conclusion. This involved writing up the results of the analysis into a framework. Due to the small number of informants involved in this data collection stage, no software was used, although the software NVivo could have been used to record, save, link, trace, access and compare patterns within and across documents, particularly for a large number of interviews (Richards, 1999).

Validity and reliability

Yin (1994) states that the quality of a qualitative research design can be tested by four logical tests: construct validity, internal validity, external validity and reliability. These tests are discussed below.

Construct validity

Construct validity pertains to 'establishing correct operational measures for the concepts being studied' (Yin, 1994, p. 33). Yin also suggests three methods to achieve such validity. These are: (1) using multiple sources of evidence; (2) establishing a chain of evidence; and (3) having reviews done by key informants. This research employed multiple sources of evidence starting from the investigative model of the knowledge economy literature review, to the benchmarking process, to the interviews of key informants, thus fulfilling the construct validity requirements.

Internal validity

Internal validity deals with cause and effect relationships (Yin, 1994). In order to test a claim for internal validity, the researcher needs to be able to measure and establish a link between the phenomenon and its effect. Internal validity is only a concern for causal or explanatory studies (Yin, 1994). This is the case in this research where the aim is to develop a sustainable knowledge economy in Oman and the factors that may

affect the pursuance of such development. Thus, the problem of internal validity is a concern in this study which was dealt with through answering the research questions.

External validity

External validity pertains to the generalisation of the results of the study outside the immediate study (Yin, 1994). For example, are the results of this study applicable to other countries in the region? In some studies exact outcomes cannot be generalized due to the specific characteristics of every country and society; but there is still something that other countries in the region can learn from the outcome of this study as they share some similarities. In order for a study to be generalisable, it must be tested through replication of the findings in a second or even a third study (Creswell, 2003). The goal of this study is to generate results that can be used in further research pertaining to knowledge economy development in Oman. Indeed, there are many ideas and concepts that can be derived from this research and some can be used immediately while others can be used in further research.

Reliability

The objective of reliability is that:

> … if a later investigator followed exactly the same procedures as described by an earlier investigator and conducted the same research study all over again, the later investigator should arrive at the same findings and conclusions. (Yin, 1994, p. 36)

The goal of reliability is to minimise errors and biases in a study (Cavana et al., 2001). Accordingly, this study's interview notes and transcripts, which were considered as being the raw materials, had important implications for the reliability of the research. From these interviews, notes and transcripts were analysed and coded to identify emerging patterns and themes. Codes were developed for assigning meaning to words, phrases and paragraphs for clustering related segments to draw conclusions within the context of the research questions underlying the study.

In addition, key points were listed on analysis worksheets that were separated by answers to each of the key questions and the four sub-questions. These questions were compared, analysed and described by using the cross-case analysis framework in order to identify common views, opinions and patterns (Neuman, 1994).

5.5 The Quantitative Approach

The quantitative approach involves data analysis to test the objectivity and accuracy of numerical evidence (Zikmund, 2000). To perform analysis and derive representative inferences, it is imperative that we have a truly representative sample of the population for data collection. In this regard, a population represents a group of potential participants relevant to the research project, and a sampling frame or a working population is the list of population elements that can be worked with (Cavan et al., 2001; Creswell, 2003).

5.5.1 Sampling: Design and size

This section discusses the processes and reasons behind choosing a sample of major service companies in Oman. This research followed studies with similar research approaches in selecting the design and size of sample to study. In selecting a valid sample for the study, it was important to consider how well the sample represented the characteristics of the population under study. It also considered the representativeness of the source of data and carefully chose the sampling design in which the sample elements being selected represent the potential population in initiating knowledge economy policies. The two issues that indicate the representativeness of samples are the sampling design and the sample size (Zikmund, 2000; Cavana et al., 2001). Thus, if the sampling design and sample size are right, the researcher can ensure that the sample subjects are not chosen from the extremes, but are truly representative of the characteristics of the population (Creswell, 2003). The sampling design and sample size are discussed below.

As most social science studies warn, taking a large number of participants into a survey can be expensive and time consuming. In selecting a valid and efficient sample for this study, a seven-staged sampling procedure, outlined by Zikmund (2000), was modified and used for this study. The sampling design decisions are important issues for any research and involve both the sampling plan to be used and the sample size that will be needed. The seven stages of the selection of the sample are depicted in Table 5.3 and discussed in detail below.

Table 5.3 Stages in selection of research sample

Stage	*Process*	*Selection for this research*
1	Define target population	Private sector in Oman
2	Select a population frame	2151 of grade excellent companies in the private sector in Oman
3	Determine sampling design	Purposive (targeted) sampling
4	Plan for select sampling units	Plan for sample size selection, accuracy, time, resources, and right analysis
5	Determine sample size	310 of grade excellent of the service sector
6	Select sampling units	Survey of 310 companies
7	Conduct fieldwork	Mail survey questionnaire to survey subjects

Source: Adapted from Zikmund (2000, p. 342).

Stage 1: The sampling process begins with the identification of the population that the researcher wishes to investigate (Creswell, 2003). The target population is the specific, complete group relevant to the research project. According to Zikmund (2000), in such a process there is a need to correctly identify and carefully define the target population since it is the source from which the researcher is to collect data. The population for this research was defined as the private sector in Oman as potential creators, adaptors and utilisers of knowledge economy elements. Such an approach is inline with that adopted by the Malaysia Department of Statistics (Knowledge Content Survey 2002) and the European Innovation Commission (2005).

As of 2005, there are 119,281 small, medium and large companies registered in the Oman Chamber of Commerce and Industry (OCCI). Generally, there are two ways of classifying the size of private companies, either based on the number of employees or the value of capital. In Oman, the latter classification is in place according to OCCI, which works as an umbrella organisation for the private sector's legal registration and representation. Table 5.4 represents an overall picture of the private sector in Oman according to OCCI registration as of 2005.

Table 5.4 Classification of private sector companies, Oman, 2005

Company category	*Capital (Omani rials)*	*Number of companies*	*% of total number*
International	-	298	0.3
Consultancy	-	205	0.2
Grade 'excellent'	**250,000 +**	**2151**	**2.0**
Grade 'first'	100,000–250,000	5959	5.0
Grade 'second'	50,000–100,000	7723	6.5
Grade 'third'	5,000–50,000	7239	6.0
Grade 'fourth'	5000 or less	95707	80.0
Total	-	119,281	100%

Source: OCCI (2006).

Stage 2: After identification of the target population, a population frame was created. A population frame, according to Cavana et al. (2001), is the list of elements in the population from which a sample of study may be drawn. Since choosing a correct population frame that provides useful information is important if the research results are to be valuable to policy makers, service companies graded 'excellent' in the service sector in Oman were considered as potential creators, adaptors and utilisers of knowledge economy elements. Only these service companies can afford to implement such new policies particularly at the starting phase of knowledge economy strategy pursuance. More importantly, it has been widely acknowledged among knowledge economists, international think-tanks and knowledge economy researchers, that the level of development of the service sector, particularly the knowledge-intensive segments, has become a key determinant of national competitiveness for many economies (Malhotra, 2000; Sheehan and Grewal, 2000; World Bank, 2004) .

Stage 3: Determining the sampling design or sampling method is the next stage after selection of the sampling frame. Sampling design is the approach used to select the units of analysis for study. There are two basic sampling designs that could be used: non-probability sampling and probability sampling (Zikmund 2000; Creswell, 2003). Probability sampling is used in large populations and when the representativeness of the sample is crucial and very important to the study. This research used the non-probability sampling method where the selection of sampling units is based on judgments such as availability/convenience or desire of a researcher that believes they will lead to more reliable results (Zikmund 2000; Cavana et al., 2001). In this case, the sampling is confined to the companies with the grade 'excellent', which have the desire and capability to provide the desired information. This selected group of companies with the grade 'excellent' form the purposive sample for this study as supported by Zikmund (2000) and Cavana et al. (2001) who suggest that a purposive survey study is most appropriate when:

- the boundary between the phenomenon being studied and the context is not clear;
- a limited number or category of people have the information that is sought;
- multiple sources of evidence are used to triangulate on the final result; and

- existing literature can be used as a guide to the data collection and analysis.

Stage 4: After determining the sampling method, procedures for selecting sampling units are planned. The sampling plan specifies the operational procedures and methods to obtain the desired sample, and guides the researcher in determining the sample size and the level of accuracy, time and resources (Zikmund, 2000). In this research, a group of grade 'excellent' service companies were selected, forming the purposive sample based on size, readiness and availability to provide information and the advice inputs from the OCCI.

This research used a questionnaire survey in collecting data, within a two-month collection period. The data received were checked to make sure they were ready for coding and transfer to data storage. The purpose of this step was to ensure the completeness, accuracy and reliability of data before analysis.

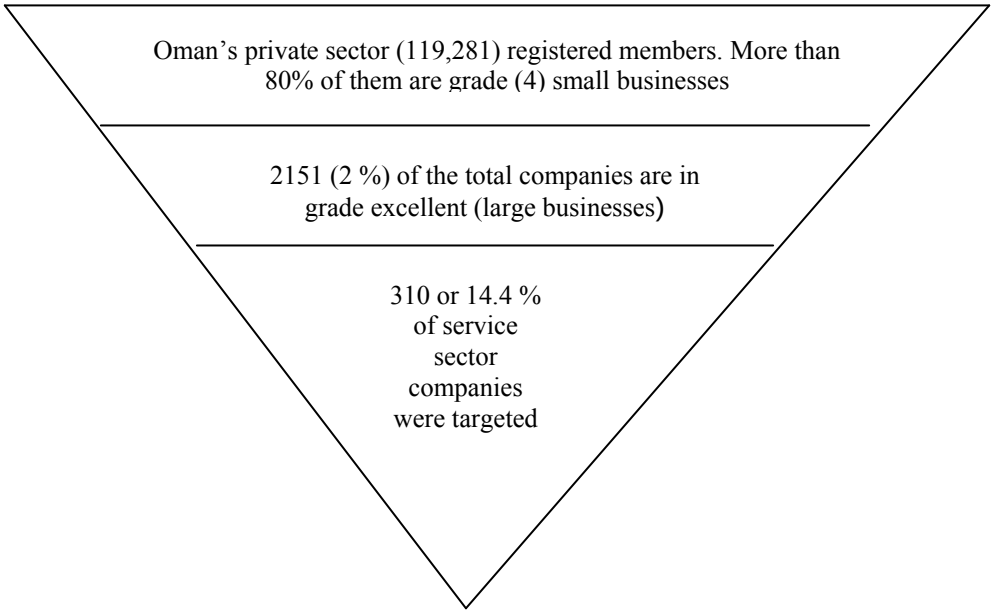
Stage 5: When the sampling plan is in place, the sample size is determined. Sample size is the selected number of people or objects to be chosen to represent the population (Zikmund, 2000). As the sample size is important to statistical analysis, the researcher took into consideration different views in this regard. Roscoe (1975) proposed a rule of thumb for determining an appropriate sample size, this should be larger than 30 and less than 500 as suitable for most social research. Cavana et al. (2001) suggest that for multivariate analysis including factor analysis, the sample size should preferably be 10 times or more larger than the number of variables in the study.

This research took into account both suggestions, along with the fact that implementation of knowledge economy initiatives on well established, well managed and financially capable companies could also give the government valuable feedback on the necessary steps and policies needed to initiate knowledge economy policies. Having considered these, a sample size of 310 is more than 30 and less than 500, and fifty times as large as the number of variables (4 independent variables representing the knowledge economy drivers and 2 dependent variables representing the knowledge economy outcome as discussed in Chapter 6). Thus, the choice of 310 companies fits into the abovementioned ranges. The total number in the sample size

selected for this research was approximately 14.4 per cent of the sampling frame of service companies. The sample size of 310 companies was considered to be manageable in size, cost and time (Cavana et al., 2001; Pallant, 2006).

Stage 6: Once the sample size is finalised, a researcher selects the sampling units, which are the working units that the researcher will study before proceeding to conduct the fieldwork (Zikmund, 2000). Since this research applies the purposive sampling technique, meaning that all companies classified under grade excellent in the service sector were considered, and after reviewing their details (names and addresses of the companies and their OCCI registrations), a total of 310 grade excellent service companies were selected purposefully to represent the sample units of this research. Figure (5.2) depicts the choice of the questionnaire sample.

Figure 5.2 Filtration of the questionnaire sample size



Stage 7: On the completion of stage six, the researcher was ready to proceed with data collection and conducting the fieldwork.

5.5.2 Development of questionnaire

Since a questionnaire is a communication medium for data collection that consists of a set of written questions for the respondents to answer, the design of the questionnaire is therefore one of the critical stages in the survey process (Zikmund, 2000).
A good questionnaire design should focus on three areas: use of simple and clear language and wording, the question sequence and the appearance should be designed to generate interest and keep respondents involved, and the formulation of each question should be carefully phrased, so that respondents can respond to the questions with responses made easier to code, tabulate and interpret (Cavana et al., 2001).

Incorporating the above guidelines, the language used in this questionnaire was kept simple and the questions were provided in English and Arabic to suit respondents' language preferences.

5.5.3 Questionnaire design

The questionnaire was designed to appear on 8 pages, with a total of forty questions separated into 6 parts. The question sequence in this questionnaire began with easy-to-answer questions to involve respondents' cooperation. Definitions and instructions were used and kept simple and understandable to assist respondents to complete all questions. Part 1 of the questionnaire was devoted to general questions that dealt with the company, its specific service activity, legal status, its formation, branches, and internal and external challenges facing the organization. The purpose of these questions was to gain some information on the organisation's specific activities, business requirements and challenges that may impede its business growth. Although some authors recommend putting this demographic part towards the end of the questionnaire survey, the researcher decided to put it in the first part, as recommended by the pre-test group due to its ease of use and the fact that contained no personal information which could threaten or embarrass respondents such as age, marital status or salaries.

Part 2 concentrated on the first driver of knowledge economy development, namely governance quality and economic incentives. Part 3 was devoted to the second driver of knowledge economy development, education and training. The questions regarding

information and communication technologies, the third important knowledge economy development driver, were incorporated in Part 4 of this survey. Part 5 dealt with research and development (R&D) elements that make up the fourth driver of knowledge economy development. Finally, Part 6 dealt with knowledge economy outcomes that could be generated from the current status of knowledge in these organisations.

The construction of the type of questions and measurement scales used in the questionnaire are crucial in determining how the researcher wants each question to be answered. While open-ended questions allow respondents to answer them in any way they choose, closed-ended questions ask respondents to make choices among a set of alternatives provided by the researcher (Zikmund, 2000).

The questions asked in this research all consisted of closed-ended questions in which the respondents were asked to choose the answer closest to his/her own opinion. This research chose closed-ended questions not only to ensure that the alternatives are mutually exclusive and to code the information easily for subsequent analysis, but also to lead respondents with some sort of guidance that better benefited the data collection process as knowledge economy development in Oman is yet to be recognized. A tick box was provided in front of every question that could be marked easily by respondents. It is very important in this context that the researcher decide the best way to measure what is to be investigated by determining the measurement scale used in quantifying the value which affects the form of statistical analysis to be used after receipt of the responses (Zikmund, 2000; Creswell, 2003; Pallant, 2006).

Generally, there are three types of measurement scales that have been recognized by the literature; nominal, ordinal and interval scales (Zikmund, 2000; Cavana et al., 2001). A nominal scale, sometimes called a categorical scale, is the simplest type but has no intrinsic ordering. That is, it offers basic categorical information on the variable of interest such as male or female gender grouping. An ordinal scale is similar to a nominal scale, but the earlier differs in it has a clear ordering of scales. Even though the order can be classified, however, it is hard to determine whether the space between each level is equal. An example could be ranking from lowest to highest or best to worst. An interval scale is similar to an ordinal scale, except that the

intervals between each level are equally spaced. This is the scale mainly used in this research. An example of the interval scale used in this research questionnaire is:

How much do you invest on your staff training from your annual budget?

□ None □ Between 1-3% □ 4-6% □ 7-9% □ More (please specify)

Besides these three types of scales, there are attitude measurement such as the Likert scale, itemised rating scale, and graphic rating scale, all of which are also important in social research since they offer a number of choices when dealing with attitude scales. The Likert scale is the most common among these scales and is designed to examine how subjects rate statements on a five or seven point scale (Cavana et al., 2001; Creswell, 2003). The researcher should consider several questions and consider the advantages and disadvantages of each attitude scale by comparing it with the research problem. An example of the Likert scale used in this research questionnaire is:

How do you evaluate the overall telecommunication services in Oman?

(1) Very good (2) Good (3) Neutral (4) Bad (5) Very bad

It is very important that questions in the questionnaire be linked to the research problem and research question that relates to the field of study. The linking of research questions to the appropriate questionnaire questions is indicated in Table 5.5. Demographic factors, even though not included as part of the variables in this research theoretical framework, were also gathered since they can be used to describe the sample's characteristics in the report following the data analysis (Zikmund, 2000; Creswell, 2003). From the research problem, five research questions were identified according to the research model proposed in Chapter 4. These research questions were used quantitatively to find out what knowledge economy factors could assist Oman best in developing a knowledge economy.

Table 5.5 Quantitative research questions and their relationship to the questionnaire survey

Research questions	*Part number in the survey*	*Number of question items*	*Type of variable*
Q1. What are the potential factors (outcomes) of sustainable knowledge economy development in Oman?	6	18	Dependent variable
Q2. What is the role of quality government institutions and economic incentives in knowledge economy development?	2	27	Independent variable
Q3. Does education and training enhancement influence knowledge economy development?	3	25	I.V
Q4. Does information and communication technologies affect knowledge economy development?	4	18	I.V
Q5. What is the role of research and development and innovation in knowledge economy development?	5	14	I.V

5.5.4 Justification of questions in the questionnaire

Chapter 3 reviewed related literature about the variables that were used to build the research model. Table 5.5 above has shown the linkage between the research questions and the questions that appeared in the questionnaire. The justification for each research variable represented in the questionnaire is discussed in the next section.

Independent variables (IV)

In quantitative research, the central interest is the relationship between variables, rather than in just describing the variable (Zikmund, 2000). The most common conceptual framework for quantitative research is to look for the types of relationships among variables, where one could be the 'cause' and the other is the 'effect', as well as the strength of this relationship. The independent variable is the cause that influences the dependent variable, or the effect, in either a positive or negative way (Cavana et al., 2001). This research selected four independent variables, where all represented knowledge economy (pillars) factors that contribute to successful knowledge economy development pursuance in any country. As indicated previously, the objective of this research project is to identify factors that would assist the government in developing a knowledge economy in Oman. These four independent variables are listed below:

1) Governance quality and economic incentives

In this research questionnaire, respondents were asked to indicate the level of evaluation on four sub-sections on governance quality and economic incentives:

- quality and efficiency of eleven government bodies that provide direct services to the private sector in general in Oman;
- quality and efficiency of eleven business oriented laws that represent economic incentives to the business community in Oman;
- private sector involvement in business policies formulation; and
- government care when business policy concerns are raised by the private sector.

2) Education and training

In this second independent variable, nine questions were asked on nine sub-sections (items) to evaluate education and training in Oman according to the following:

- quality of the education and training system in Oman;
- quality of education graduates from local and foreign education institutions;
- the education system in Oman as a source of qualified labour force;
- effectiveness of training support that the private sector gets from the government;
- quality of vocational and technical education graduates;
- government coordination with the private sector in terms of its general education needs;
- government coordination with the private sector in terms of its training needs;
- government coordination with the private sector in terms of its technical education needs; and
- quality of local private university graduates.

3) Information and communication technologies (ICTs)

This third independent variable contained six sub-sections that asked respondents to evaluate ICT capabilities within their organisations and within Oman in general:

- evaluation of the overall ICT quality in Oman;
- evaluation of ICT specific components;
- valuation of ICT enablers;
- government investment to build new and up to date ICT infrastructure;
- local ICT companies efforts to invest in new ICT infrastructure; and
- evaluation of ICT status within the companies under investigation.

4) Research and development (R&D), and innovation.

In this fourth independent variable, one sub-section was used to ask respondents to evaluate fourteen item questions that were centred on the following points:

- organisation's need to be involved in R&D and innovation;
- existence of innovation culture in the company;
- investment in R&D;
- collaboration with the local academic community, international research centres and the government;
- government incentives, rules and regulations, and availability of local and expatriate researchers; and
- capabilities of local research bodies.

5.5.5 Dependent variable (DV)

The dependent or knowledge outcome variable, is the variable that is influenced or predicted by one or more independent variables. The dependent variable is the variable of primary interest to this study and is to be explained (Blaikie 2003; Creswell, 2003). A knowledge economy outcome was proposed as the dependent variable for this research project. Respondents were asked to rate or evaluate from their organizations' point of view a knowledge outcome in terms of better productivity, profitability, acquisition of new knowledge and introduction of new

services, products and processes. One sub-section was utilised to gauge this dependent variable which contained eighteen questions that were centred on the following:

- improvement in productivity;
- improvement in profitability;
- increase in sales, revenues, new jobs, gender equality, better support from vendors and the government, and new knowledge acquisition;
- improvement in R&D understanding, management and employee skills, and product quality, services and process; and
- acquisition of licenses to use intellectual property laws and filling patent applications.

In fact, the use of these indicators were consistent with surveys that were conducted in Europe and Malaysia (European Innovation Commission, 2002; Shapira et al., 2006)
The original questionnaire was prepared in English by the researcher, but was translated into Arabic by an accredited Arabic/English translator in Oman. Further, an Arabic/English lecturer from the Sultan Qaboos University, not the original translator, undertook back-translation (from Arabic to English). The purpose of this step was to assure that respondents had clearly understood the survey questions, the content of the covering letter, and that the questions being asked were used only for this research. The layout of the questionnaire was designed to appear as brief, neat, clean and easy to follow, so that respondents could easily page through and understand the survey as required. This, according to Zikmund (2000), could positively affect the response rate.

5.5.6 Pre-testing the questionnaire design

Zikmund (2000) and Cavana et al. (2001) define pre-testing or pilot testing as the administration of a questionnaire to a small group of respondents that allows the researcher to detect ambiguities or biases in the questions. Pre-testing serves as a trial run of the questionnaire to see if it needs further revision. Other objectives of pre-testing include:

- making sure that respondents understand the questions;
- determine whether the questions provided are appropriate and serve the intended purpose;
- familiarizing the researcher with the questionnaire administration procedures;

- rectifying any inadequacies in time, before the actual questionnaire is administered, thus reducing bias;
- obtaining a set of preliminary data for trying out the proposed data analysis technique; and
- assist in determining the reliability and the validity of the questionnaire (Zikmund, 2000; Creswell, 2003).

The pre-testing sample should be a group of respondents selected on a convenience basis and similar in makeup to the one that will be sampled (Zikmund, 2000). The pre-testing respondents should not be too divergent from the actual respondents, so that the results of the pre-test assist the researcher in determining whether the questionnaire meets the aims of the research.

In this research project, a pre-testing sample of 10 managing directors and general managers was chosen by the OCCI. The pre-test was carried out in the researcher's presence to observe filling out of the questionnaire, time taken in answering the questionnaire, and to ask for respondent's comments. This pre-test stage was also taken as an opportunity to check for the face validity, which refers to whether the question measures what it is intended to measure (Cavan et al., 2001). Several comments were made including adding some definitions on the first page and the questionnaire design which were then incorporated.

5.5.7 The mail survey questionnaire

The mail survey questionnaire method was chosen because of the following advantages:

- it is cost effective, especially when it involves a large sample size in a geographically dispersed population as is the case in this study where most of respondents are scattered all over the capital city area and other parts of Oman;
- it facilitates contact with normally inaccessible executives such as CEOs, managing directors and general managers;
- it provides respondents with enough time to think about their answers especially in new research areas and thus researcher bias could be reduced; and

- although there are some new means of data collection such as e-mail surveys which have become more popular recently, the follow-up process is more complicated than a mail survey and if the respondents can be identified, they may not feel comfortable in responding to an email questionnaire, thus causing a lower response rate.

The researcher was aware that a mail survey has some limitations and shortcomings, such as slow speed in collecting data and lower response rates compared to other survey methods. Further, there is no assurance that the 'right' informant fills out the questionnaire or all questions in the questionnaire (Zikmund, 2000). To overcome these limitations or disadvantages of using a mail survey, the researcher undertook the following measures:

- Respondents were able to choose to participate and had the option of not to completing the questionnaire or withdrawing at any time in compliance with Victoria University's ethics guideline.
- To achieve a high response rate, a covering letter from the researcher was sent, stating the purpose of study and encouraging the respondents to complete and return the questionnaire. In addition, the covering letter stated that the data received from the respondents would be kept anonymous and confidential. This was to assure that the respondents' identities and the companies' information would not be explicitly reported and they would be strictly accessible to the researcher, supervisor and co-supervisor only.
- A prepaid postage-stamped and self-addressed return envelope was used to increase the response rate.
- An attractive and professionally designed questionnaire booklet was prepared to simplify responses, and maximize the cooperation level of the respondents.
- A follow-up strategy such as sending a reminding letter to companies and telephone calls to the respondents' offices were also utilized to increase the response rate (Zikmund, 2000)

5.5.8 The survey administration

The research survey was conducted according to the following conditions:

- A draft questionnaire was submitted to Victoria University's Human Research Ethics Committee (HREC) for approval according to the University's code of research ethics. The research questionnaire was approved on February 2, 2007 (see Appendix 3).
- The final questionnaire was professionally designed in a printing house in Oman where 500 copies were produced (see Appendix 4). Three hundred and ten survey invitation letters and questionnaire booklets were delivered to target respondents in label-addressed envelopes and sent out on February 15, 2007 to the CEOs, managing directors and general managers of grade excellent service companies in Oman (see Appendix 5).
- The first response was received on February 26, 2007. On March 5, 2007 reminder letters to non-responding participants were sent to increase the response rate (see Appendix 6). On May 14, 2007 the data collection stage was concluded with a total of 202 questionnaires returned.
- Five returned questionnaires were excluded because most of their parts were incomplete, and thus only 197 returned questionnaires were used in this study.
- Data coding and tabulation data entry using SPSS was carried out by the researcher for further analysis.

5.6 Ethical Considerations

Ethical considerations are important in academic and professional research, as is the case in any other field of research (Creswell, 2003). Ethical considerations were addressed in this research by adhering to Victoria University's code of research ethics.

The researcher's ethical obligations for this research study include the following:

- complying with the research regulation;
- maintaining high standards of research to ensure accuracy of the data via objectivity and scientific investigation;
- avoiding misrepresentation of the statistical accuracy of the data, and refraining from overstating the significance of the results by altering the

findings; the researcher also has an obligation to analyse the data honestly and to report correctly the actual data collection methods;

- protecting the rights, confidentiality and information of the respondents; and
- avoiding any conclusions that are not in line with the research aim or obligations to report artificial findings.

5.7 Reliability and Validity

Reliability and validity are two essential characteristics of a good measurement tool of questionnaire items (Zikmund, 2000; Cavana et al., 2001; Cresswell, 2003). The importance of these assessment tools lies in their ability to test the hypothesis or the research questions reliably and validly; otherwise the researcher may act incorrectly in answering research questions or accepting or rejecting a research hypothesis (Creswell, 2003). The relationship between reliability and validity is straightforward. A test can be reliable but not valid, but a test cannot be valid without first being reliable. In other words, reliability is a necessary, but not sufficient condition of validity (Cavana et al., 2001). Therefore, the criteria of reliability and validity were carefully considered in this research, since reliability is a necessary condition for validity and only reliable and valid instruments yield accurate results.

5.7.1 Reliability

Zikmund (2000) defines reliability as a measure where similar results are obtained over time and across situations. Reliability tests the consistency and stability of a measurement instrument (Pallant, 2006); that is, the degree to which measures are free from error and therefore yield consistent results across time and across various items under investigation (Creswell, 2003). There are two dimensions that underlie the concept of reliability, repeatability and internal consistency with which the instrument measures the concept and helps to assess its goodness (Zikmund, 2000). In assessing repeatability, the test-retest method and parallel-form method can be used. This research applied the test-retest reliability method, which is widely used in social science. It refers to establishing the stability of the measuring instrument by

correlating the score obtained through its application to the same set of respondents at two different points in time (Cavana et al., 2001).

In measuring internal consistency, a split-half method and Cronbach's alpha method are commonly used. This research used the Cronbach alpha method to measure reliability. The Cronbach alpha is applied to examine the reliability coefficient, within a particular set of items, by correlating performance on each of the items in a test or a scale with overall performance on the test or scale across participants (Cavana et al., 2001; Creswell, 2003). Cronbach alpha is computed in terms of the average inter-correlations among the items measuring the concept (Zikmund, 2000). The closer Cronbach's alpha is to 1, the higher the internal consistency reliability (Pallant, 2006). Reliability estimates for the measures of variables were computed using the software package SPSS version 15.0. Data should be subjected to such testing before any further analysis to ensure that the data being analysed are reliable.

5.7.2 Validity

Zikmund (2000) defines validity as the ability of the measuring instrument to measure what it is intended to measure. Cavana et al. (2001) and Creswell (2003) refer to the validity of an instrument as the extent to which information collected in a research study truly reflects the phenomenon being studied. If the measuring instrument does not measure what it is intended to measure, then the researcher could face a problem. Thus, validity is an issue of concern as it determines the confidence a researcher has in the outcomes of the study.

A questionnaire is examined for validity by investigating whether the questions focus on the results of the study and whether the results are understood within the context of the research's purpose (Zikmund, 2000). Despite there being several validity tests, three are most commonly used.

1) Content/face validity: is a measure of how well the items or questions represent the concept (Zikmund (2000). In fact, it accurately reflects what it intended to measure. To establish the content/face validity for this research, previous studies were reviewed to identify possible items to be included in the scale, experts from the Centre for Strategic Economic Studies (CSES) at Victoria University were consulted to obtain their comments on the

measurement instrument, then the measurement instrument was pre-tested on a group of respondents similar to the sample being studied, to see whether revision was needed before modifying the measurement based on the feedback from the pre-test (Zikmund, 2000). With this pre-testing and modification, it is believed that a reasonable degree of confidence of the content validity was achieved.

2) Criterion validity: refers to the ability of a measure to correlate with other measures of the same construct (Zikmund, 2000; Creswell, 2003). In criterion validity the researcher tries to predict how the operationalization of the constructs will perform according to some previous studies or theory guidance (Cavana et al., 2001).
3) Construct validity: refers to the extent to which the results of a test are related to an underlying construct (Creswell, 2003). Construct validity examines whether the empirical evidence or a test score relates to some underlying theory or set of related variables. Zikmund (2000) defines construct validity as the ability of a measure to confirm a network of related questions or hypotheses generated from literature based on concepts. This type of validity occurs during the statistical analysis of the data.

5.8 Data Processing Procedures

As indicated before, the objective of applied business research is to solve social or practical problems, to identify whether the desired outcomes were achieved and to establish an understanding or explanation of these results (Cavana et al., 2001). In fact, the research design should specify the methods used to transfer such a research problem into an action that requires collection of raw data. Such raw data cannot be used to reach conclusions or make decisions until they are converted into information in a format suitable for decision-making (Zikmund, 2000). The procedures in converting raw data into information include editing, coding, data entry and data analysis. These procedures are discussed in the following sub-sections.

5.8.1 Editing

Editing involves a process of checking and adjusting the data, and making it ready for coding and transfer to data storage. The purpose of editing is to ensure completeness, consistency and reliability of data (Zikmund, 2000; Pallant, 2006). Editing can be of two types: field editing and in-house editing. Field editing is used with the interviewing methods, while the in-house editing investigates the results of data collected in the mail questionnaires. In this research, in-house editing was carried out to check for errors, incomplete answers and omissions in the returned questionnaires; then adjustments were made to make the data more complete, readable and consistent before coding.

5.8.2 Coding

According to Pallant (2006) coding is the process of identifying the data from the mail questionnaires using numerical scores or other character symbols, then transcribing these scores or symbols into electronic format. There are two procedures in the coding process: coding of pre-coded questions and coding of open-ended questions. The coding of pre-coded questions is numbered against the answer. Where the answer is already a number, there is no need to code the answer, because the computer program can handle the numerical answer. Generally, only one answer is possible for every question item, therefore only one code is recorded for an answer to the question. In the case of open-ended questions, a number of replies to a particular question must be established to construct categories for coding (Pallant, 2006).

The decisions about how many categories are acceptable depend on the purpose of the study, the limitations of the computer program, the plan for data entry and the required analysis (Pallant, 2006). In this research pre-coded questions were used. A numerical score was assigned to each answer. Since the questions were closed-ended, the respondents were asked to select only one answer that was closest to his/her opinion, where the code was assigned. After completing the editing procedures, the code for each answer was then transferred to data storage in SPSS for analysis.

5.8.3 Data entry

Zikmund (2000) refers to data entry as a process of transferring data from a research project into a computer program. Transferred data include answers from the mail survey questionnaire. There are several options for entering data into a computer program: optical scanning, direct entry of data at the moment they are collected and manually keyboarding the data in after they are collected (Zikmund, 2000). When entering data manually, the researcher must be aware that errors may occur. Zikmund (2000) also suggested that to ensure accuracy in transferring data, the process of verifying data should be applied by a second keyboard operator, who is different from the original keyboard operator. In this research, the first keyboard operator (the researcher) manually keyed in the data into a computer program, while a second PhD researcher verified the data entered to ensure accuracy before the data were ready for analysis. The software program SPSS for Windows (Version 15.0) was used in this process.

5.9 Data Analysis

Once the data was edited, coded and entered into SPSS, data analysis was undertaken. Analysis is the application of reasoning to understand and interpret the data that have been collected about the research project (Zikmund, 2000). Pallant (2006) identifies three basic objectives for data analysis:

- to check the preliminary ideas of frequencies, central tendency and dispersion;
- to test the goodness of data in term of reliability and validity; and
- to test whether the hypotheses substantiated or research questions are answered.

The analytical tools used were descriptive statistics and inferential statistics. Descriptive and inferential statistics are quite different from one another, but work hand in hand. Descriptive statistics are used to describe or summarize information about the characteristics of the sample (Zikmund 2000; Tabachnik and Fidell, 2001). In order to summarize such information, tabulation is used to show how one variable relates to another by arranging the information in a table or other summary format (Pallant, 2006).

After the descriptive analysis stage, a researcher generally applies inferential statistics. Inferential statistics are used to make inferences or judgments about a population on the basis of a sample (Zikmund, 2000). Inferential statistics also help to establish relationships among variables, in which the conclusions are drawn and to decide whether the collected data relates to the original research questions or hypotheses (Tabachnik and Fidell, 2001). The techniques used to analyse the data in this research are described in the section below.

5.9.1 Analytical techniques: Factor analysis

The analysis technique used in this research was factor analysis. Hair et al. (2006) indicate that factor analysis is a tool that is part of the multivariate statistical technique, which is useful to extract information from large databases and identify the interrelated data. Factor analysis assists in finding interesting relationships among variables that might not have been seen from the examination of the raw data alone or even a correlation matrix. The two primary uses for factor analysis are to summarize the data and data reduction (Tabachnik and Fidell, 2001; Hair et al., 2006).

In summarizing the data, factor analysis describes the data in a smaller number of concepts or groups than the original individual variables and items. It summarizes the characteristics of variables with a clearer picture of which variables may act together and how many variables might be expected to have impacts in the analysis. For data reduction, factor analysis assists in calculating the scores for each underlying dimension and substituting them for the original variables. It provides an empirical basis for evaluating the structure of the variables and the potential to create new composite variables as replacements for the original ones, or selecting a subset of representative variables for further analysis. In either case, the researcher must know how the variables are interrelated to better interpret the results (Hair et al., 2006).

In this research, factor analysis technique was used to group 102 survey items (total survey questions) into a meaningful order to identify key factors deemed to be successful in enhancing the knowledge economy in Oman. It was also used to prioritise the importance of these factors according to their loading values. This was in line with a similar study conducted by Chen and Gawande (2007). Two groups of

variables were formed. The first group of variables represented the four knowledge economy drivers or independent variables. The second group represented knowledge outcome or the dependent variable.

5.9.2 Identification of significant factors

According to Tabachnik and Fidell (2001) and Hair et al. (2006) there are five criteria that affect the choice of significant factors:

1) The factor loading: Refers to the means of interpreting the role each variable plays in defining each factor. Put differently, factor loadings are the correlation of each variable and the factor. The higher the loading value the more representative the variable to the factor. Although there is no specific rule for ensuring practical significance of factor loading, as a rule of thumb, 0.30 or greater in both negative and positive directions is considered to meet the minimal level; 0.40 or greater is considered important; 0.50 or greater is considered practically significant (Tabachnick and Fidell, 2001; Hair et al., 2006). This is because factor loading is the correlation between the item and the factor. That is the squared loading is the amount of the item's total variance accounted for by the factor. Thus, a 0.30 loading translates approximately to a 10 per cent explanation, and 0.4 translates to 16 per cent, and 0.5 translates to 25 per cent of variance accounted for by the factor. Thus 0.5 was considered appropriate for this research because of its higher representativeness.
2) The Bartlett test of sphericity: Is a statistical test for the presence of correlations among variables. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) is an indicator of factor analysis appropriateness which ranges from 0 to 1. According to Tabachnick and Fidell (2001) and Pallant (2006), factor analysis is acceptable if the value of KMO is greater than 0.5. As a result, this research applied such value in choosing the representative factors.
3) The eigenvalue: Reflects the latent root that represents the amount of variance accounted for by factor analysis (Hair et al., 2006). Although there is no specific percentage of variance that could be significantly relied on, in science it is 95 per cent significance. However, in social science where data is less

precise 50 per cent of total variance is satisfactory (Tabachnick and Fidell, 2001; Hair et al., 2006). The eigenvalue is used to assist in selecting the number of factors to be retained for interpretation. Only factors that have an eigenvalue greater than 1 are considered significant. Another way to assist in this regard is the scree plot test, which does the same job as the eigenvalue and produces similar results. This research applied both the eigenvalue and the scree plot test as the most common tests in retaining useful factors.

4) Number of items in each factor: Refers to the number of items extracted from the data reduction process that load significantly on each factor. While the single item factor is rarely recognised in social science, most researchers indicate that between 3 and 5 items are more practical to obtain key indicants that closely reflect the underlying factors being investigated (Hair et al., 2001; Cavana et al., 2001; Pallant, 2006). This, according to Hair et al. (2001), will aid in validating the derived factors and assessing the significance of the results.
5) Rotation of factors: Is an important tool in interpreting factors. It means the rotation of variables (items) until a certain position is reached, other than the original status. Items are rotated in a factor based on their importance. That is the first factor generated with almost every item is loading significantly where the largest amount of variance is accounted for. The second item and the subsequent ones are based on residual amount of variance as each account successively for smaller portions of variance. The role of rotation comes as a way of redistributing the variance from earlier factors to later ones that provide a simpler and meaningful factor pattern (Hair et al., 2001). Although there are many types of rotations such as VARIMAX, QUARTIMAX and EQUIMAX, there is no compelling analytical reason to favour one rotational method over another, thus choice should be based on the availability of any of these programs and a given research problem. According to Hair et al. (2001) and Cavana et al. (2001), if the ultimate goal of factor analysis is to obtain meaningful factors or constructs, a VARIMAX is appropriate. This is because it is good for data reduction, which suits further analysis. This research used VARIMAX due to its wide availability and appropriateness for data reduction.

All of the above criteria are summarised in Table 5.6 below.

Table 5.6 Procedures in selecting and evaluating factors

Factor analysis components	*Significant values*	*Reason*
KMO value	Greater than 0.5	More acceptable in social science.
Type of rotation	Varimax rotation	It is a much preferred method in factor rotation as it provides a clearer separation of the factors in a simpler fashion.
Factor loadings	0.5 and above	The higher the loading value the more representative the variable to the factor
Eigenvalue	Greater than 1.00	The most commonly used criteria in choosing factors.
Number of items	3 items	Minimum threshold for building up single useful factor.

5.9.3 Reliability of significantly extracted item

Upon the completion of applying the above criteria in selecting the significant items, a reliability test must be performed to test the goodness, appropriateness and consistency of measures being applied. According to Cavana et al. (2001) and Pallant (2006) reliability measures the goodness of measures and the extent that a measure is without a bias (error free) and hence offers consistent measurement across time and the various elements in the instrument. It is about stability and consistency in measurement. In almost all cases, Cronbach's alpha is considered a perfectly adequate index of the reliability, where above 0.8 is very good, 0.7 is good, below 0.6 is weak, and 0.5 and below is unacceptable (Hair et al., 2006). This research applied these measures in selecting appropriate and consistent factor items.

5.9.4Transformation of selected items

It refers to the process of combining all selected items in one factor to form a new factor or variable for further analysis. When a satisfactory reliability has been derived, the researcher usually attempts to assign some meaning to it. All significant factor loadings are used in the interpretation process, but variables with higher loadings influence to a greater extent the name of the variable or the factor. As indicated earlier, the cut-off point for interpretation is (+/-)0.5 or above. This is a conservatively high cut-off point making interpretation quite straightforward. This, according to Hair et al. (2006), will aid in validating the derived factors and assessing the significance of results.

According to the above five criterion selected for applying factor analysis to this research, the factor analysis solution extracted 6 factors according to their importance

as factor 1 contained (12) items, factor 2 (8) items, factor 3 (6) items, factor 4 (6) items, factor 5 (6) items, and factor 6 (5) items. More importantly, all extracted items were loaded significantly and heavily on these six factors that ranked in order of the strongest factor loading. Since there are more than one item in each factor, Hair et al. (2001) and Pallant (2006) suggest the use of surrogate factors that truly represent the items included in the formation of these new factors. This number of factors is in line with a similar factor analysis study that produced 6 factors by Chen and Gawande (2007).

5.9.5 Correlation matrix (Pearson correlation)

Once the factor analysis is completed, further analysis of variables relationships is carried out using Pearson correlation to provide an indication of the type of the relationship between two continuous variables or factors. Tabachinik and Fidell (2001) and Pallant (2006) categorise the correlation values as follows: from 0.70 or higher very strong correlation, from 0.50 to 0.69 strong correlation, from 0.30 to 0.49 moderate correlation, from 0.10 to 0.29 low correlation, and from 0.01 to 0.09 negligible correlation.

In this study, the correlation matrix indicated insignificant correlations with all of the coefficients below 0.29 as discussed in the next chapter. In such a situation, according to Hair et al. (2001), Tabachinik and Fidell (2001) and Pallant (2006), any subsequent analysis will not produce useful empirical results. This result suggests that knowledge economy readiness in Oman, as is the case in the MENA region, is weak, which is in line with the literature indicating low preparedness in knowledge economy in developing countries in general. This also confirms the benchmarking result which showed low readiness in knowledge economy readiness in Oman.

5.10 Summary of the Chapter

Most economists argue that the knowledge economy has become a key factor in enabling developing countries to achieve sustainable economic development. However, no such study has yet been undertaken on the relevance of the knowledge economy for Oman. Thus, this study is among the first systematic studies of knowledge economy development in Oman. The researcher's unique position of being

a senior Omani government official and at the same time an insider-researcher has enabled him to conduct this study.

This chapter described in detail the research methodology adopted for this study. The research process which included research design and appropriate data collection methods were described together with the sample selection procedure and the measurement process. A benchmarking process that utilised the World Bank Institute's knowledge economy assessment methodology (KAM) was applied through its basic scorecard and knowledge economy index to gauge Oman's knowledge economy readiness against world, regional, GCC countries, Finland and Malaysia. Despite this benchmarking process's robustness in providing an insight of the country's knowledge economy current status, it is unable to provide a holistic view that could be utilised to initiate knowledge economy strategies.

In such a situation, interviews with relevant senior government officials were conducted as the literature suggests that the government's role cannot be ignored or underestimated as the key promoter and driver of the knowledge economy in a developing country. Nine government senior officials were targeted for this purpose and they provided valuable feedback that enhanced the quality of the data collection.

The next phase of data collection necessitated undertaking a questionnaire survey that took into account generating vital feedback from a potential creator, disseminator, and utiliser of the knowledge economy. The CEOs, Managing Directors and Director Generals of 310 grade excellent service companies in Oman were targeted via a mail questionnaire survey based on their involvement, relevance and capability to provide feedback on the issues under investigation. Thus, a triangulation in the data collection was achieved.

Upon completion of the data collection process, data was edited and entered into a computer program. Several analytical tools were explored and factor analysis seemed to be the most appropriate to identify significant and highly predictive value of factors that could be targeted for useful analysis. The statistical software package SPSS for windows (Version 15.0) was used to analyse the data. In the next chapter (6), the

collected data will be analysed and interpreted according to the research protocol established in this chapter.

Chapter 6. Key Drivers of the Knowledge Economy in Oman: Data Analysis and Discussion

6.1 Introduction

As indicated in Chapter 5, three different methods were utilised for data collection for this thesis. This chapter presents the data collected and provides a detailed analysis of this data using benchmarking, qualitative and quantitative tools. The chapter is organized as follows. As the first phase of this analysis Section 6.2 discusses Oman's readiness in undertaking the knowledge economy by comparing it with the regions and countries identified in Chapter 5. Section 6.3 describes the qualitative approach used in this study for evaluating the responses obtained from the interviews with nine senior government officials in Oman. The quantitative analysis of the data is discussed in Section 6.4, where data collected from the mail survey of 197 respondents is analysed through factor analysis and Pearson correlation. This section also examines the strength of the relationship among variables representing the knowledge economy and the variables representing knowledge outcomes. A summary of the main conclusions of this chapter is provided in Section 6.5.

6.2 The Benchmarking Process

This section will try to provide an answer to the following research question:
What is the current readiness of Oman's knowledge economy drivers (pillars) in terms of the quality and effectiveness of:

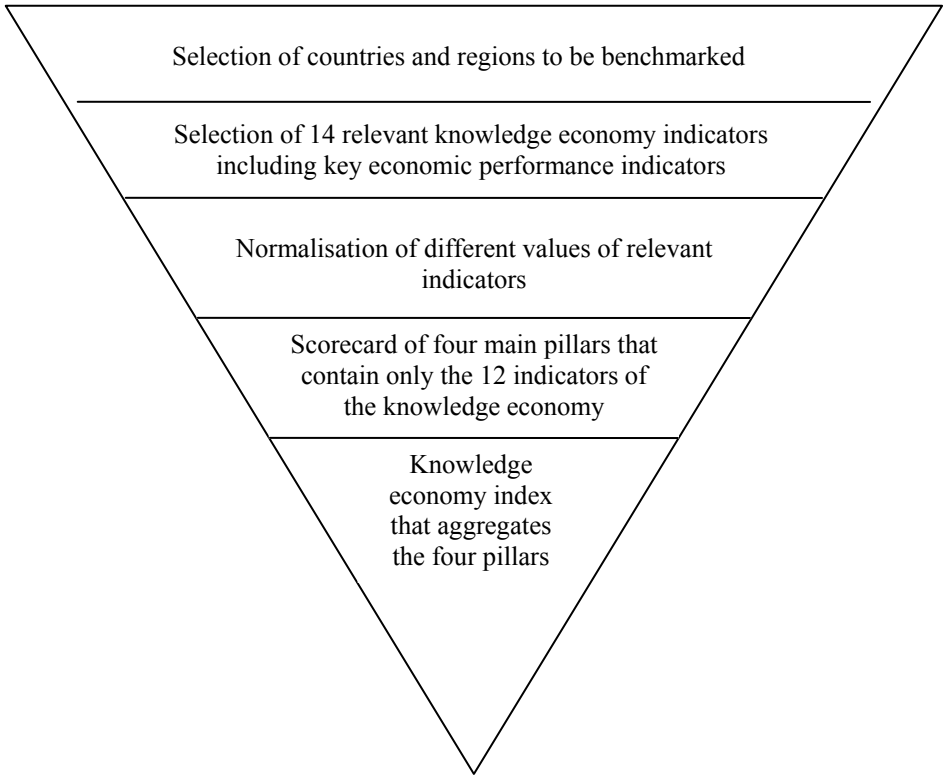
- *government institutions and economic incentives;*
- *education and training;*
- *information and communication technologies (ICTs); and*
- *research and development and innovation (R&D and innovation).*

As indicated in Chapter 5 on methodology, the knowledge assessment methodology (KAM) was utilised as the main tool for getting a snapshot assessment of Oman's knowledge economy readiness. According to Chen and Dahlman (2006) KAM is

designed to provide a basic evaluation of a country's progress in knowledge economy readiness to guide researchers and policy makers. In fact, KAM identifies the problems and opportunities, but does not provide a diagnostic analysis of the problems or how the opportunities should be enhanced. KAM utilizes indicators, scorecards and indexes that represent the knowledge economy readiness and compares a given country with its neighbours, regions, competitors or even with selected leading countries. In this thesis KAM was applied to compare Oman's knowledge economy readiness with the relevant benchmarking group and countries.

In conducting this benchmarking process, five sequential steps were followed. The first step necessitated identifying the benchmarking group which could consist of countries, regions or both and the rationale behind choosing such a group. The second step required identifying relevant indicators that are available for the whole benchmarking group and the rationale for choosing these specific indicators. The third step in this benchmarking process required performing a normalisation procedure where values of all indicators are normalised to a common base or scale as explained in the methodology in Chapter 5. The justification behind this step is that these indicators are measured in different scales and need to be expressed on a common base for comparison. The fourth step of this process utilised the knowledge economy scorecard, which combines the chosen indicators to form the knowledge economy pillars so that every country or region can be compared on every individual pillar. The fifth and final step used the knowledge economy indexes where knowledge economy pillars were aggregated to form these indexes for easy and quick benchmarking procedures. Figure 6.1 summarises this benchmarking process.

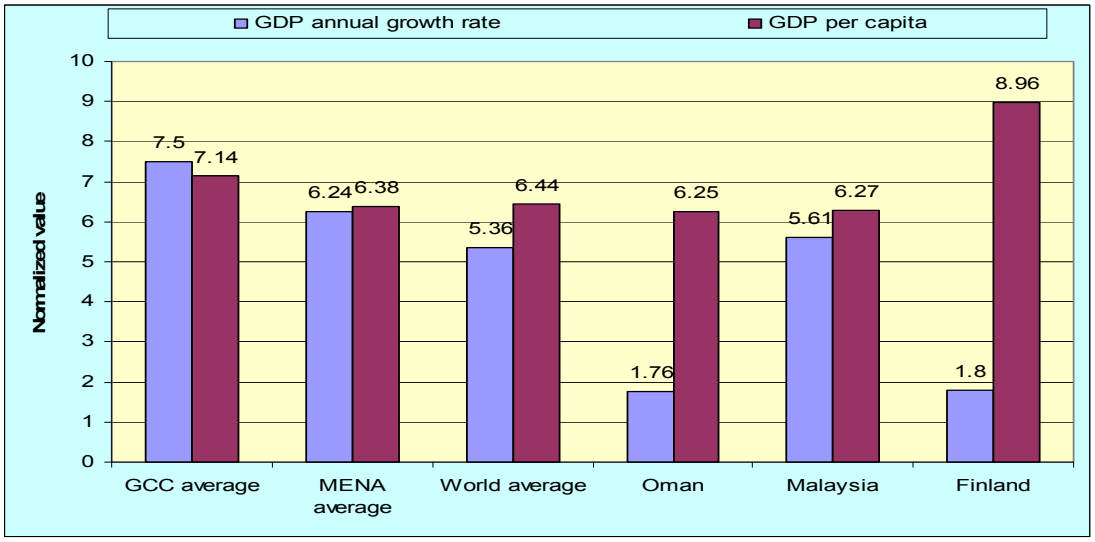
Figure 6.1 Formation of knowledge indicators, pillars and indexes



6.2.1 Main economic performance indicators

Figure 6.2 depicts the average growth rates of GDP and GDP per capita in the benchmarking groups and countries during the period 2001-2005. It is clear that Oman's overall economic performance seems strong in terms of these growth rates. Although Oman's strong economic performance was helped by the sharp increase in oil prices during this period, the non-oil sector also grew at an average annual rate of 8.3 per cent during the same period.

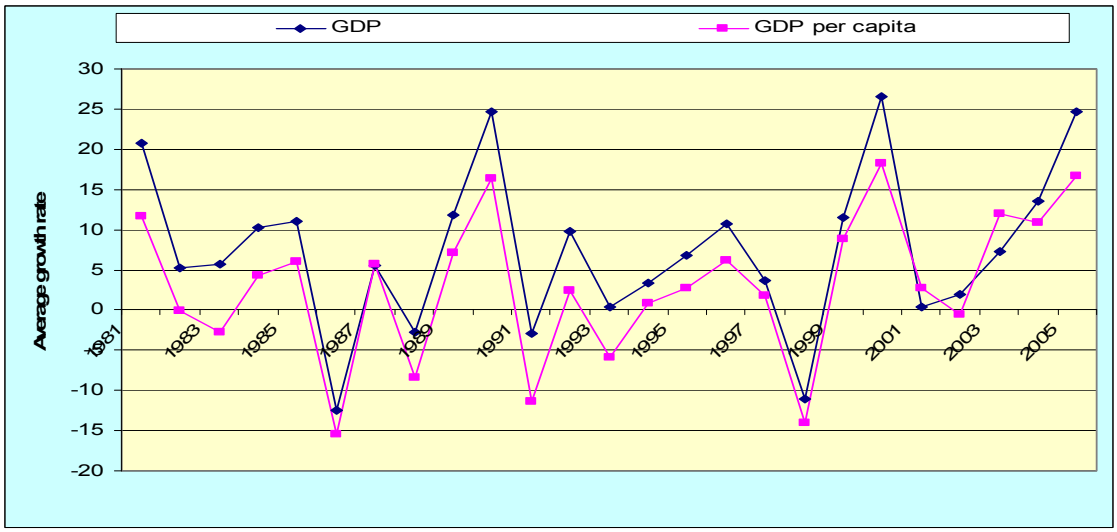
Figure 6.2 Overall economic performance of the benchmarking group, 2001-2005



Source: World Bank (2006).

However, a closer look at Oman's economic performance, depicted clearly in Figure 6.3, reveals the absence of stability of growth rates and the vulnerability of Oman's economic growth to annual fluctuations. This is related to the fact that Oman's economic performance depends heavily on oil revenues which represent about 79 per cent of its budgetary earnings.

Figure 6.3 GDP and GDP per capita growth in Oman, 1980-2006

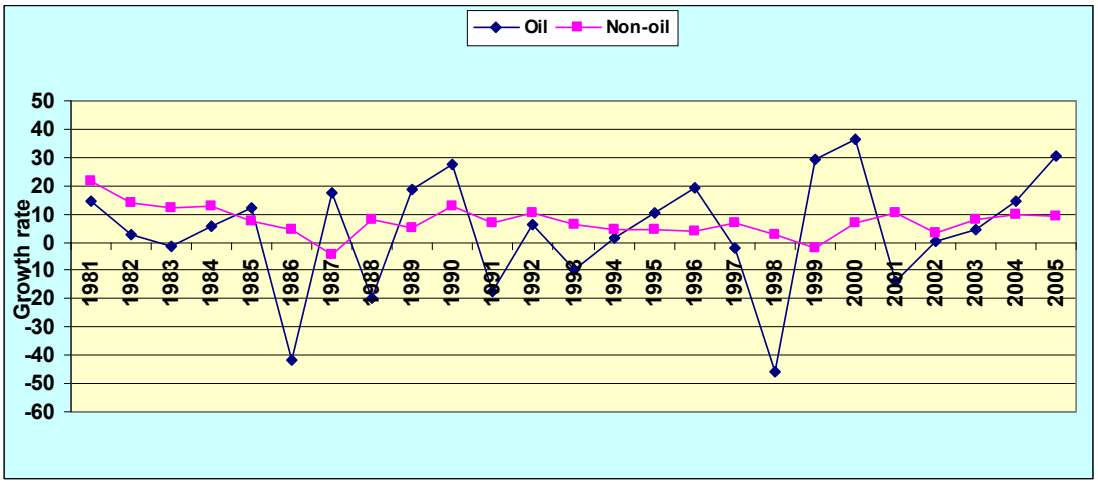


Source: MNE (2006).

More importantly, the pattern of non-oil sector's growth has been closely dependent on the performance of the oil sector in the last twenty-five years. Positive or negative growth in the oil sector was usually mirrored in the growth outcomes of other

economic activities, indicating that government expenditure was the main driving engine of all economic activities in Oman. The close relationship and the fluctuating growth pattern of the oil and non-oil sectors is depicted in Figure 6.4.

Figure 6.4 Growth of oil and non-oil sectors in Oman 1981-2005



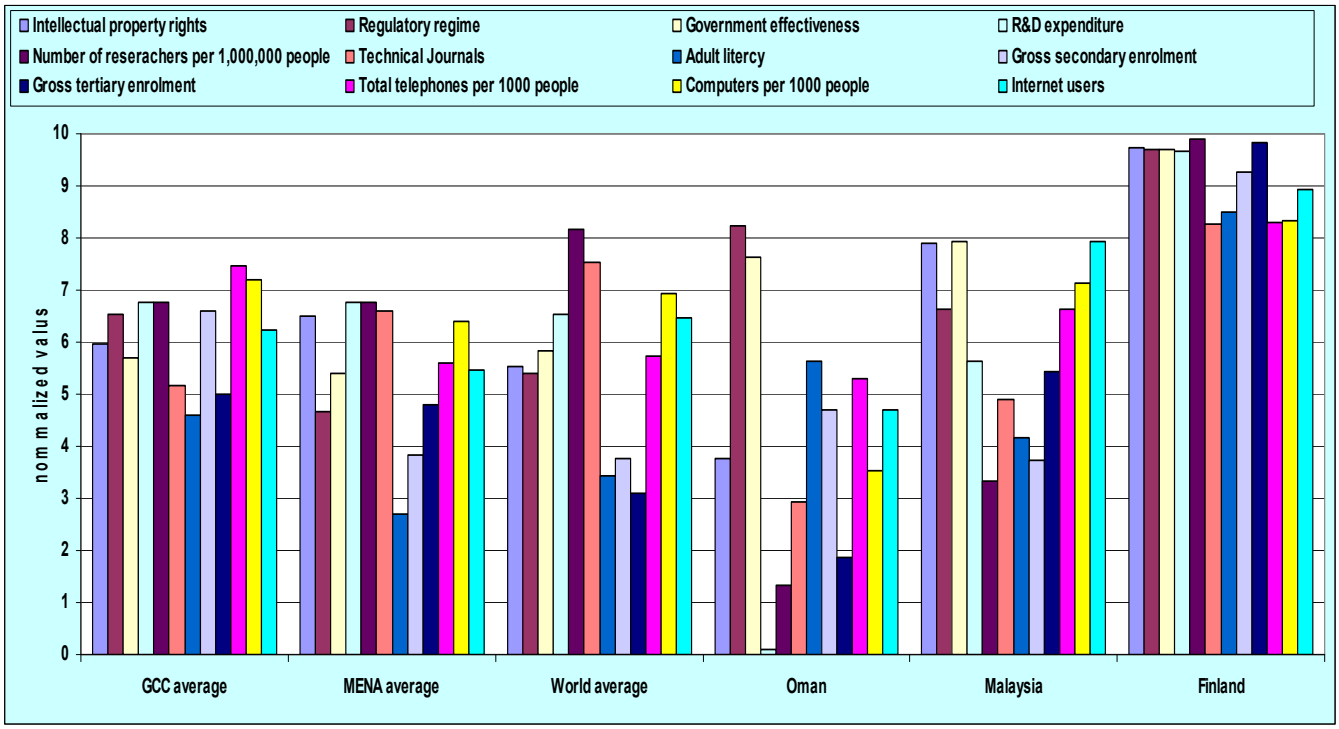
Source: MNE (2006).

This over-dependence of Oman's economy on oil revenues has been the main catalyst for the government's recent determination to diversify the country's economy and concentrate on developing new options that are capable of responding effectively to the new economic challenges.

6.2.2 Knowledge economy indicators

In identifying Oman's readiness for knowledge economy pursuance, this research followed a sequential build up that started with analysing and discussing the chosen indicators that make up Oman's knowledge economy scorecard. This scorecard was rationalised in the second phase of this build up to establish a knowledge economy index that can be used to evaluate Oman's overall knowledge economy readiness.

Figure 6.5 Twelve indictors of the four knowledge economy pillars



Source: World Bank (2006).

Examination of Oman's twelve knowledge economy indicators that make up the knowledge economy pillars revealed varying degrees of achievements. As Figure 6.5 indicates, Oman did well in only four of these indicators, namely regulatory regime, government effectiveness, adult literacy rate and the number of telephone lines per 1000 people, and fell below the 50th percentile in the remaining eight of the twelve indicators of the knowledge economy. These rankings are discussed in greater detail below.

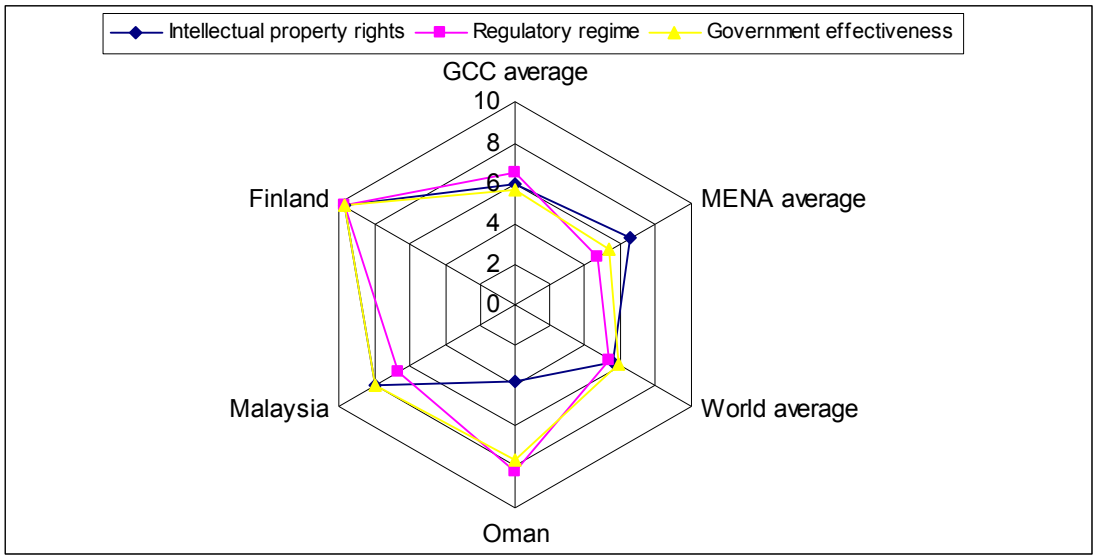
Governance and economic incentives

Oman seems to be strong in regulatory regime and governance effectiveness, both of which belong to the effective governance and economic incentives pillar, with normalised values of 8.24 and 7.65 respectively. These values indicated that Oman stands at the 80th and upper 70th percentile in these two indicators representing a positive achievement. (World Bank, 2006). In fact, Oman was found to be the second best among this group in regulatory regime, after Finland and third best in the effectiveness of governance after Finland and Malaysia. The government's commitment to the WTO obligations and the increasing role of the private sector in general has contributed to this positive performance in these two indicators in Oman.

Despite this positive achievement, the country's overall performance in this pillar was not as competitive as that of the other members of the benchmarking group. Some observers have attributed Oman's lacklustre performance in this pillar to the private sector's perception of the government's bureaucracy and the lack of effective e-governance that hinders competitiveness (Al-Shihi, 2006).

In addition, one indicator of this pillar, namely protection of intellectual property rights is the weakest indicator of this pillar among the benchmarking group. This indicator is currently scoring below the rest of the benchmarking group levels with values in the upper 30th percentile. Although the Oman's intellectual property law has been in place since 1996 when Oman joined the World Intellectual Property Organization, its weakness has been attributed to the absence of an innovation culture that protects and promotes innovators (World Bank, 2004). According to one of the interviewees, the absence of an innovation culture represents a disadvantage because innovation flourishes in a protective environment that rewards those who invest in new knowledge. This uncompetitive environment has also been reported by the 2007 *Doing Business Report* which ranks Oman at 49 out of 189 countries. Figure 6.6 depicts the overall benchmarking of governance and economic incentives pillar.

Figure 6.6 Effectiveness of governance and economic incentives indicators

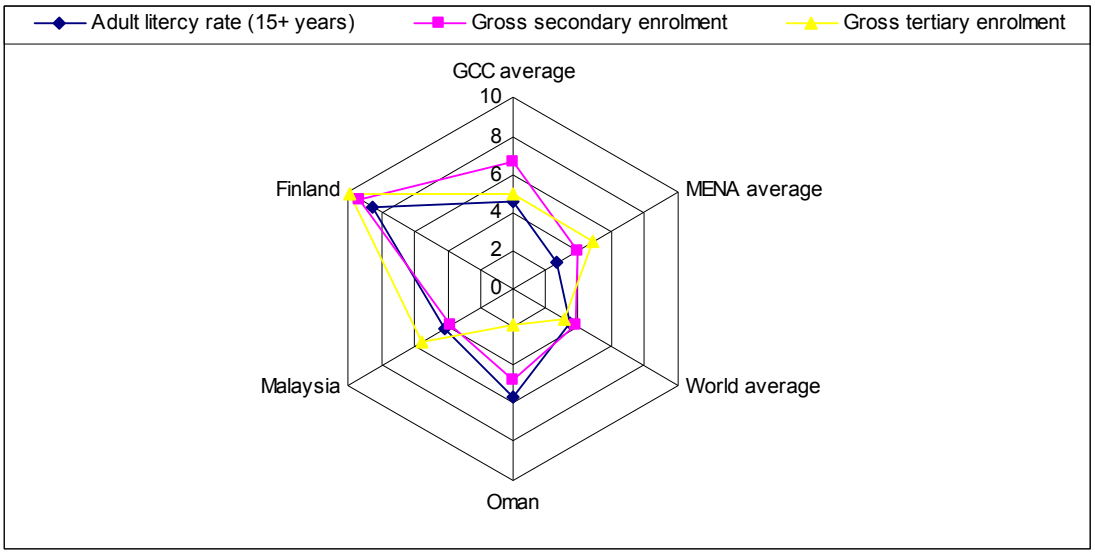


Source: World Bank (2006).

Education and training

In education and training, the literacy of people above fifteen years and gross secondary enrolment which stand at 5.63 and 4.71 normalised values respectively, are another positive performance areas of the knowledge economy in Oman. These indicators stand above the 50th and the 40th percentiles which come second and third best among this benchmarking group. The literacy rate is second best just behind Finland while gross secondary enrolment is third after Finland and the GCC averages. This positive performance has been attributed to the government's emphasis in promoting the 'education for all' campaign since 1970, offering elementary and secondary schooling to all people in the country regardless of their age, gender or location. These high rates of achievement of 81 and 76 per cent, respectively, have been hailed by one of the UNESCO's experts Rassekh (2004) as an education development success story in the MENA region. Figure 6.7 illustrates comparative education and training indicators.

Figure 6.7 Education and training indicators



Source: World Bank (2006).

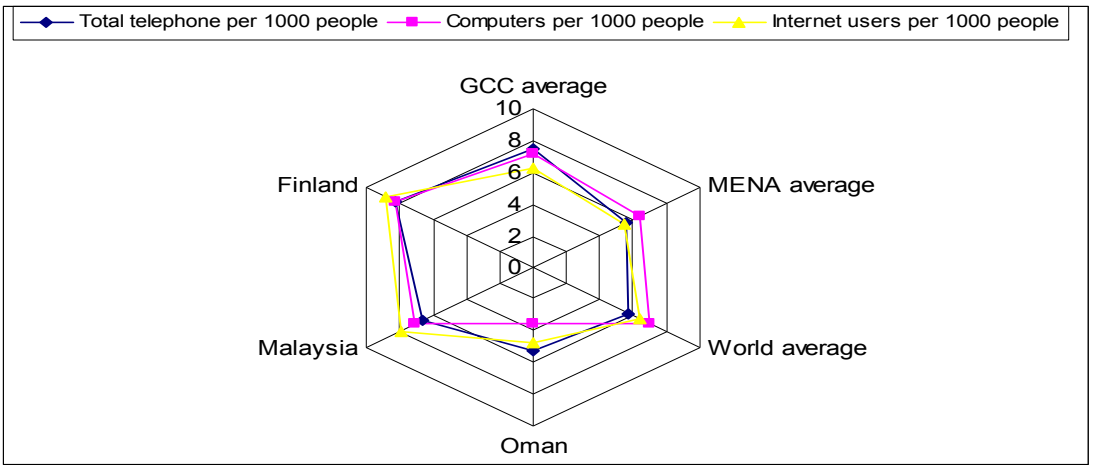
However, this strong and positive performance in literacy rate and gross secondary school enrolments is in contrast with the third education indicator namely the tertiary education enrolments, which stands at about 13 per cent of the total tertiary education eligible population. As a result, Oman ranks the lowest in the benchmarking group in tertiary education, behind 25 per cent in the MENA region, 26 per cent in Malaysia, 30 per cent in the world, and 85 per cent in Finland. Oman's poor performance in this

important education indicator is partly the result of the absence of a higher education promotion strategy in the country, where the first university was inaugurated as recently as in 1986 with 5 specialised colleges and had an intake of about 2000 out of more than 32,000 secondary school graduates. In the absence of tertiary education facilities, the majority of these graduates were directed towards technical education and vocational training, where the country has provided enough semi-skilled labour for the local market which is still saturated with more than 87 per cent of expatriates. According to the World Bank (2004), low tertiary education enrolments appear to be a major factor hindering economic progress both at the country level and in the MENA region collectively.

Information and communication technologies (ICTs)

Looking at the main information and communication technologies indicators, Oman appears to fall behind the entire benchmarking group in all of the three indicators as represented in Figure 6.8. Only the number of telephones is ranked above the 50th percentile benchmark, while internet users and number of computers both per 1000 inhabitants are in the 40th and 30th percentiles respectively. This is compared to above the 80th percentile on the three indicators average in Finland, and between the 50th and the 70th percentiles for the rest of the benchmarking group.

Figure 6.8 ICT indicators



Source: World Bank (2006).

According to Gartner (2002) and Al-shihi (2006), Oman's poor performance in ICTs has been related to many factors, most notably to ineffective management, lack of proper competition between ICT providers, high fees, and the lack of public and

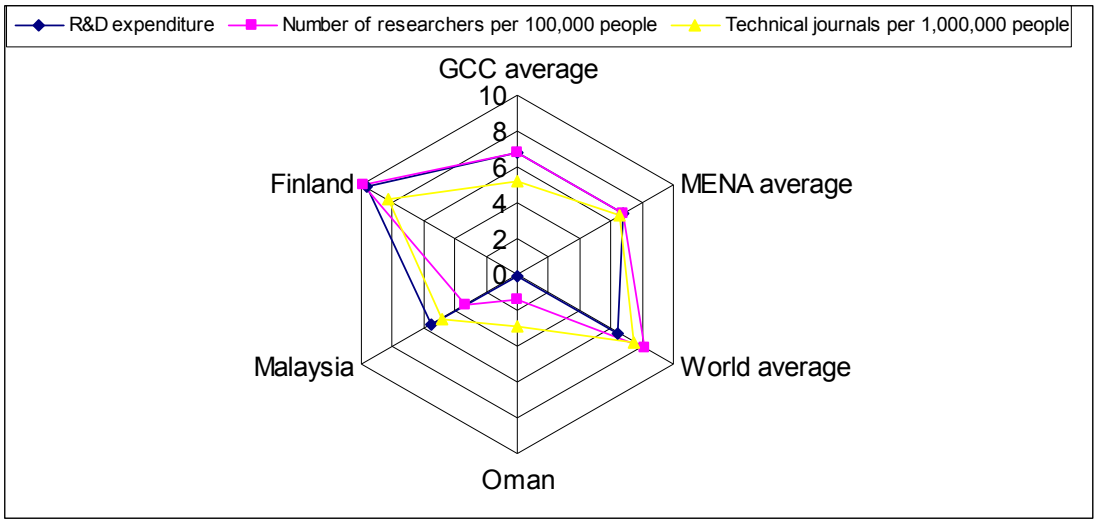
business awareness of the importance of ICT in today's globalised world. This is also attributed to the fact that the telecommunications market in Oman is mainly dominated by the state-controlled incumbent operator, the Oman Telecommunications Company (Omantel), which is still the sole licensed operator of public fixed-line telecommunications services, including local, long-distance and international telephony, as well as data communications, value-added services and internet access services.

The government seems to be aware of these ICT development barriers. An Information Technology Authority was established in 2006 to serve as a competency centre on the best ICT practices with the aim of harnessing its potential throughout all of the stakeholders in Oman. In fact, enhancing public and business awareness, further liberalization of the ICT sector, and more importantly removing any barriers (technical or physical) to trade in these products are believed to be the way forward in order to enhance productivity and international competitiveness.

Research and development, and innovation (R&D and innovation)

In R&D and innovation, Oman is significantly weak in all of the main indicators of this pillar compared to its benchmarking group. In fact, its R&D expenditure as a percentage of GDP is the lowest in this group with 0.1 normalised value, which put Oman at 0.10^{th} percentile, while its number of researchers and technical journals being published per 1,000,000 inhabitants are at 1.3 and 2.9 normalised values respectively. This puts Oman in only 1 and almost 3 percentiles, respectively. Such ranking is not the lowest among this benchmarking group but does put Oman among the lowest worldwide. Figure 6.9 illustrates the status of R&D and innovation indicators.

Figure 6.9 R&D and innovation indicators



Source: World Bank (2006).

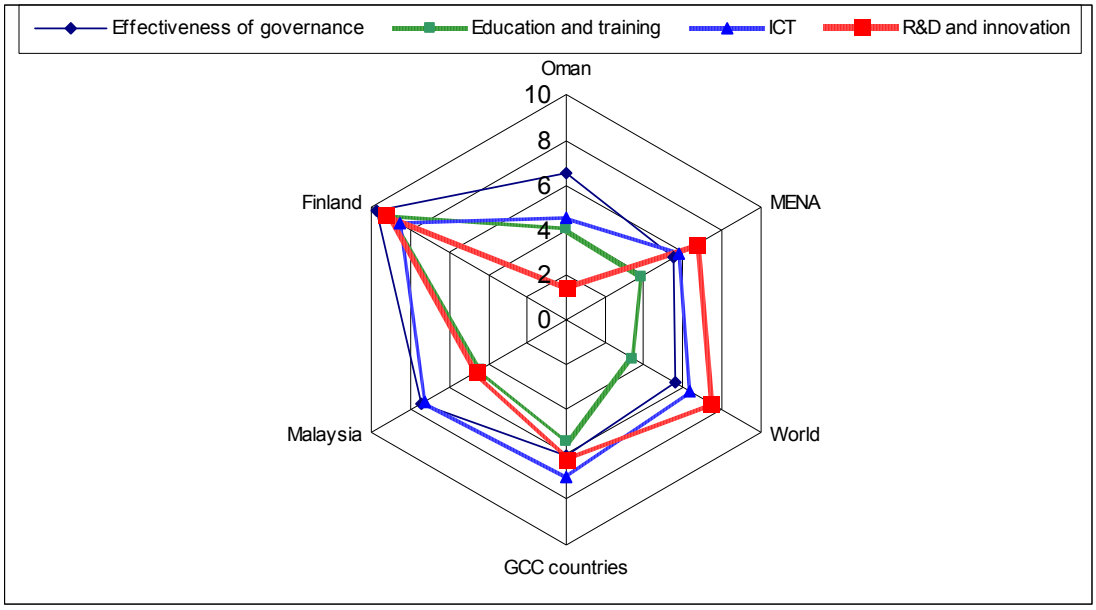
The knowledge economy literature indicates that R&D and innovation is the most important among the knowledge economy pillars, as many empirical studies suggest a positive relationship between R&D spending from both public and private sectors and economic development (OECD, 1996, 2002; World Bank, 2004). The weakness of this main pillar seems to be rationalised by the fact that given Oman's limited natural resources, its previous economic concentration was directed towards building physical infrastructure. However, in recent years the government has recognised the importance of R&D and innovation, as it has established its first national scientific research council in 2005 for fully developing the potential of this vital pillar.

6.2.3 The basic scorecard

This is the fourth phase of this benchmarking process. It presents an overview of a country's overall performance in knowledge economy development particularly in the four main pillars where indicators are weighted, normalised and added up together to form coherent pillars. In terms of Oman's knowledge economy readiness scorecard, effective governance and economic incentives seems to be its strongest pillar as exemplified in Figure 6.10. However, at the 60th percentile it still comes third after Finland and Malaysia which have scored 90th and 70th percentiles respectively. Although studies point to the bureaucratic procedures, and stagnation of the e-government ineffectiveness as possible causes, many laws have been modified or

introduced recently to adapt to WTO requirements to speed up the reform process in this regard.

Figure 6.10 Knowledge economy overall pillars



Source: World Bank (2006).

On the education and training pillar, Oman falls behind its benchmarking peers being in the 40th percentile as represented also in Figure 6.10. Such ranking puts it last compared to MENA, the world, and GCC averages of the 50th, 60th, and 70th percentiles, respectively. As indicated before, this was related to the low performance in the tertiary education enrolment which was among the lowest in the world. Some corrective measures have been implemented in recent years where private universities have been granted permission to operate in the country. In 1986, there was only one university in Oman, whereas now there are 5 universities operating in all of the main regions of Oman. In addition, more than a dozen specialised colleges of higher education and training which are anticipated to increase the intake capacity to about 50 per cent by 2020 compared to 13 per cent at the current level. Government spending on overall education has also been on the rise reaching 26 per cent of government spending to tackle education output quantitatively and qualitatively. Such spending is considered among the higher levels in the world.

On the ICT pillar, Oman recorded the lowest average performance falling to the 40th percentile, even below MENA and world averages on 50th and 60th percentiles,

respectively. This low scoring according to the World Economic Forum (2007), explains Oman's non-existence in the networked readiness index 2007 which evaluates and ranks the ICT readiness of 122 countries around the globe based on the degree of their preparation to participate in and benefit from ICT development. This indicates that the environment for ICT development is not conducive to employ and leverage the potential of ICTs particularly in internet services which is the driver of today's business development.

However, the overall picture of this sector in Oman is expected to change significantly as the Telecommunications Regulatory Authority (TRA) is expected to license a second national public fixed-line network operator and a second national public data network operator this year since the liberalization of mobile services with the second mobile provider in 2005. This step is believed to contribute to strong growth in the ICT sector over the short run as expected to affect significantly internet usage and penetration, which have been held back by comparatively poor quality of lines and unreliability of services. In the long run, such liberalisation could boost e-commerce, internet banking and e-government initiatives as most studies suggest at the OECD level (OECD, 2001).

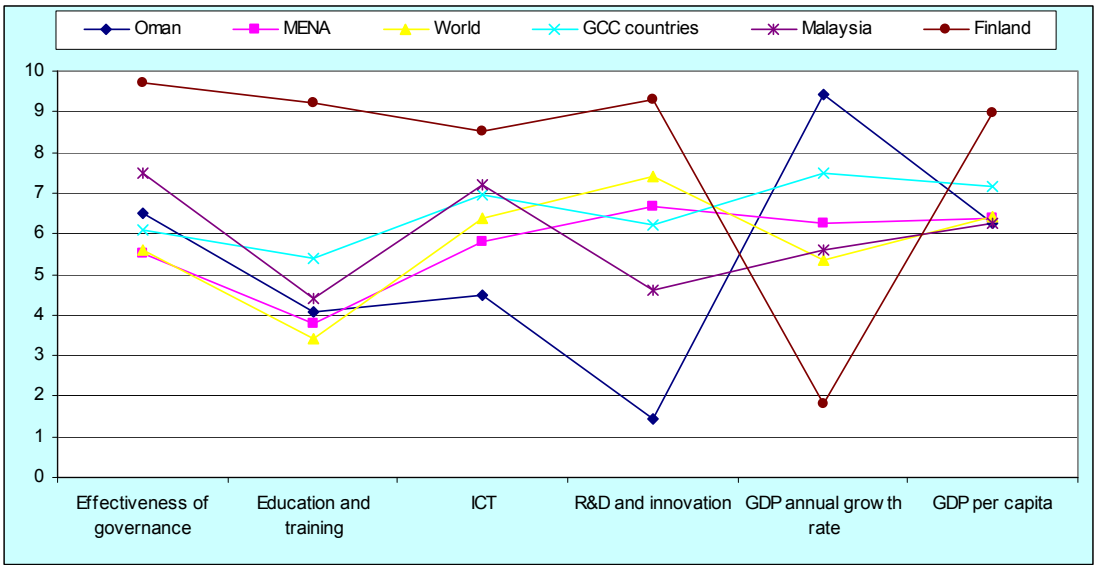
As shown in Figure 6.10, the research and development and innovation is the weakest pillar in this chain of knowledge economy development. This is based on the fact that for this pillar, Oman's performance is in the 10^{th} percentile compared to the 60^{th} percentiles for GCC and MENA countries, 70^{th} percentile for the world average, 40^{th} percentile for Malaysia and 90^{th} percentile for Finland. This clearly indicates this pillar's weakness in Oman's case.

It seems the major deficiency in this regard is the low level of spending on R&D as a ratio of GDP. In fact, Oman's 0.10 per cent of GDP spending on R&D in general seems to have held back the development of the other two indicators namely number of researchers and number of technical journals being published as a direct consequence of such under investment. However, the establishment of the Scientific Research Council in 2006 is a step forward with which the government aims not only close the gap in the research and development pillar, but also to develop a national research policy that takes into consideration all stakeholders in this system.

6.2.4 Knowledge economy index (KEI)

As indicated in the previous section, the basic scorecard was used to derive the knowledge economy index (KEI). The KEI is the fifth step in the benchmarking process which is calculated as the average of the performance scores of a country or a region, in all of the knowledge economy four pillars - effectiveness of governance and economic incentive regime, education and training, information and communications technology, and research and development and innovation. The aggregate score for each pillar is derived based on the calculation of the average normalized scores of the three indicators that describe each pillar. Figure 6.11 depicts the KEI for Oman against the benchmarking groups and countries.

Figure 6.11 Knowledge economy index and economic performance



Source: World Bank (2006).

Figure 6.11 clearly indicates the current KEI for Oman stands below other indexes in this benchmarking process. As an advanced knowledge based economy, all of Finland's knowledge economy pillars are running comprehensively on a horizontal line which indicates an optimal status of knowledge economy achievement. Likewise Malaysia seems to be heading towards the same direction though to a lesser extent. In Oman's case where the fluctuation between the pillars is so obvious, there is an urgent need to set a dynamic strategy that tackles the deficiencies in the overall knowledge economy index in more comprehensive and integrative manner. The establishments of the Higher Education Board, the Information Technology Authority, the Scientific

Research Council, and the enactment of new laws and modifications of the current regulatory regime that deal effectively with the new reality are steps in the right direction that could play a crucial role in eradicating the hurdles toward better knowledge economy development.

6.3 The Qualitative Approach

Upon completion of the benchmarking process, the interest turns to obtain an in-depth understanding of the issue under investigation. The fact that the government in Oman is the main driver of economic development and thus any study in this regard must take into consideration plans, opinions and feedback of those who are responsible for formulating government plans and strategies. Several experts, including Malhotra (2003), World Bank (2004) and Aubert and Reiffers (2004), suggest that a complementary data gathering method be utilised to gain such an in-depth understanding due to the lack of comprehensive and consistent data and information, particularly in the developing countries in which national data and statistics bureaus often either do not exist or are unable to coordinate, analyse and provide the necessary information. As a result, in-depth interviews were conducted with nine senior government officials in Oman who have direct involvement and supervision of government initiatives for knowledge economy development.

6.3.1 Interview questions

This qualitative approach deals with answering the following key question and its four sub-questions that are relevant and representative of knowledge economy pillars:
What is the potential role of the government in Oman in enhancing the knowledge economy development in terms of:

- *plans to stimulate education and training outcomes;*
- *mitigating obstacles that hinder optimal utilisation of ICT capabilities;*
- *plans in regards to the research and development, and innovation system that boosts internal and external knowledge absorptive capabilities; and*
- *enhancement of governance effectiveness to promote the above pillars.*

The common themes that have emerged from these interviews seem to concentrate on the importance of developing economic development alternatives that react positively to the current and future needs of economic and social development in Oman. Interestingly, although there is no direct knowledge economy blueprint that has been developed to guide the government towards knowledge economy pursuance, there was a consensus among the interviewees that a knowledge economy is the way forward in this regard. According to participants (1, 3, 6 and 9):

> The development of local knowledge and acquisition of global knowledge, information and technology, and well developed human resources are vital drivers and essential prerequisites to achieving sustainable economic development in Oman.

This consensus seems to have originated from three sources:

- The directives of His Majesty the Sultan who emphasised the need for useful and meaningful socio-economic development that takes into consideration Oman's needs and peculiarities. In fact, these directives have been cited by most of the interviewees as being guidance toward sustainable economic development.
- Oman's socio-economic development plan (Oman 2020) which was enacted in 1996 in which strong emphasis was put on human resource development through education and training to meet local businesses requirements.
- International bodies and think-tanks which have conducted studies and conferences on Oman and the MENA region which constantly stress the urgent need to develop more dynamic and responsive economic strategies that take into consideration the new economic reality exemplified in better investments in education and training, ICTs and research and development.

This consensus is insightful given that Oman's benchmarking process has revealed low ranking in most of the knowledge economy drivers. In fact, most of the interviewees were aware of this fact and indicated the determination of their ministries to alter this situation. According to the majority of the participants, the following priorities are going to be addressed by their ministries as outlined by the Oman 2020 plan where education and training seemed to be the focal point of the next phase of the economic development up to 2020.

The importance of basic education to eradicate illiteracy, and higher education that creates a life long education culture

The focus of the education policy is to improve the general education output, expand higher education opportunities and restructure the training philosophy to reflect more the local market needs. This would increase the percentage of intake into the General Certificate (secondary graduates output in higher education institutions), as well as upgrading and spreading basic education to enable Omani youth to fill new employment opportunities and substitute more expatriates, and to increase the productivity of Oman's youth and prepare them for the upcoming business tasks.

> The government allocates almost 26 per cent of its annual budget to fund education which is among the highest in the world. Luckily, recent higher oil prices have boosted the government's efforts in this manner. Nonetheless, fluctuations and unpredictability of such prices puts education at the risk of sudden funding cuts in case of oil instabilities. It is hoped that by 2020 the general percentage of higher education intake would be 50 per cent, provided that enough alternative funding is available in light of the decreasing oil reserves (Participant 2).

In this new education strategy, the following ambitious goals were targeted:

- 100 per cent school enrolment up to year 12;
- increase of higher education enrolment to about 50 per cent compared to only 13 per cent at present, of students of 18-24 years of age: and
- purposeful and life-long learning through training.

Such an ambitious task goes in accordance with the Sultan's speech before the Opening of the Annual Session of the Council of Oman (2006) in which he emphasised the importance of useful education in general and higher education in particular.

Vocational training and technical education that meets the business sector's requirements

The most notable development in this regard is the inauguration of the First Symposium on National Manpower Employment held in 2001 under the direction of His Majesty the Sultan. The recommendations included the development of vocational training and technical programs and curricula in cooperation with the private sector. It

also included upgrading vocational training centres and technical education colleges to accommodate the new intended role as a way of lifelong learning. The aim is to produce educated and qualified graduates for the local labour force and prepare them to compete in regional and international markets. To produce such quality of graduates:

> The government has initiated a direct relationship with the private sector to identify its training needs through forming independent bodies comprising representatives of the government and the private sector to identify and classify all occupations needed for the private sector; as well as setting up occupational standards and curricula as per skill levels required for each occupation to ensure training quality outcomes (Participant 5).

This approach seems to benefit from international experiences which tend to empower the link between training centres and the business community to initiate plans for education and training that keep up with the evolving nature of practical business needs. This is reflected recently in the implementation of new training programs with only 40 per cent theoretical training and the rest practical training. In doing so, the government aims at creating new jobs for the number of the education system outputs that meet the labour market's needs in various disciplines and skill levels. This emphasis on the quality of education and training is highly justified as the government expects that between 2006 and 2020, the workforce in the 18-24 years age group will represent about 750,000 people or about 80 per cent of the total workforce in Oman.

Improvement of ICT infrastructure to leverage its potential

The sixth economic plan (2000-2005) and the current seventh economic plan (2006-2010) had special emphasis on the ICT sector. One of the main aims is to leverage ICT as the means of providing collaborative services to government, business society and local residents. In fact, both plans have allocated sufficient resource for providing the entire Omani population with adequate ICT education, specialization and technical skills that help the nation keep pace with the technological progress and international competitiveness. One very promising achievement in this regard was the creation of the Knowledge Oasis Muscat (KOM), the first technology park which represents a major leap towards boosting knowledge creation in Oman. In fact, this park has

already started attracting e-commerce, international call centres, IT colleges and many other ICT industry niches.

This positive move toward improving the role of ICTs in Oman has been strengthened recently by the setting up of the Information Technology Authority (ITA) in 2006. Some of the key initiatives of ITA for a 'digital Oman' have been summarized by participants 4, 8 and 9 as follows:

- setting up a unified e-government architecture including IT infrastructure, applications and shareable databases of services and public information;
- creating an IT governance framework, standards and guidelines for national information and communication technologies sector infrastructure, and a security framework;
- enabling customer-centric e-government services for both individuals and businesses and streaming them within the common IT infrastructure;
- developing plans and policies for training and development of human resources in IT while enhancing existing competencies; and
- developing ICT education and training programs suitable for various segments of the society based on systematic studies and comprehensive planning.

No doubt the above initiatives would be of great value if they are executed effectively and in a timely manner. In the past, Oman's experience with utilizing the potentials of ICT has been hampered by several obstacles. According to a report prepared by Gartner (2002), Oman was found lacking confidence in undertaking ICT initiatives. This was related to low levels of national IT usage, the small number of computer graduates and the lack of entrepreneurial spirit among the Omani population. In addition, Oman's e-government initiative which was supposed to be fully implemented ten years ago is still facing some difficulties, including the lack of public awareness, high costs of services, poor management and non-existence of e-government legislation.

More seriously, according to participants 8 and 9:

> Business process within government remains paperbound, bureaucratic and lacks coordination between ministries. Many ICT initiatives are undertaken in a piecemeal, standalone fashion, leading to poor results and wastage of resources.

Effective coordination between the government and the private sector

Another notable feature of these interviews is the emergence of the importance of the digital society and e-governance. This aspect involves the designing and management of e-governance services and the setting up of a unified government network linking all government institutions in a process that would yield better, faster, and more transparent, efficient and cost effective delivery of government services. According to Gartner (2002), the government's international consultant, to make a digital society really effective, broadband services should be available to people and businesses at reasonable prices. Without such a move, people and businesses will not communicate electronically.

On the legislative front, Oman has also made considerable progress towards trade liberalisation. In fact, new laws have been enacted and existing ones have been amended so that they conform to the requirements of e-commerce, intellectual property right and international standards measures. This legislative progress has been echoed by one of the participants when he noted that:

> In terms of e-legislation, existing laws have been modified, and new legislation are planned to adapt a number of international and regional templates. In fact, the government is in a position to acquire OECD Guidelines, The Indian Information Technology Act 2000, and European Community Directive on Electronic Commerce 2000/31/EC (participant 2).

Furthermore, strengthening the private sector's role in Oman was among the governance themes of these interviews. Most of the respondents have indicated their desire for widening the role of the private sector to enable it to be more independent and competitive so as to take the lead in the future economic development in the country and in generating employment to ease the pressure on the government. According to participants, 4, 5 and 6:

> It is our aim at this stage to create a strong and innovative business community. The government is working towards strengthening the role of this sector in general through e-government initiatives, relaxation of investment and business rules and regulations, more integration in the global economy, and cooperation with different economies through free trade treaties with major economies in the world.

The need to strengthen the role of the business sector has been reflected in the actual data of 2005 which indicate that the business sector's performance during the previous economic plan period (2000-2005) was positive as its contribution to GDP has increased at an average rate of about 8.5 per cent. In fact, the service sector seems to be the driving force behind this non-oil growth which has the lion's share in this positive performance of the private sector. In 2005, economic contribution of the business sector reached an impressive 74 per cent of non-oil activities and about 35 per cent of total local employment in Oman (MNE, 2006). The significance of enhancing the role of the service sector in particular, grows further as the government mandate on Omanisation (employment of locals) targets is the highest among the economic activities of the business sector in general. For example, these targets range from 90 per cent of employment in the banking sector to 60 per cent in transport and communication, to 45 per cent in financial intermediaries, insurance and real estate (AL-Lamki, 2005).

This importance of the private sector in Oman has been the focus of the Sultan's speeches in the last five years. He has been urging the private sector to do its level best to employ Omanis in the various sectors as the public sector has become virtually saturated with more than 132,000 employees. In a parallel approach the government has been urged to ease and facilitate the private sector's role through business-friendly governance and regulatory regime, and supportive economic incentives.

According to participants 4 and 5:

> As the government sector has no capacity to employ more Omanis, and the education system output is outpacing current economic development, the government has no choice but to enable greatly the local business sector to take the lead and complement the government's role in job generation and employment.

In fact, as the pressure is mounting on the government to create new jobs, the attention has been focused on certain economic activities in the country that could provide fast and appealing solutions both to the government and local job seekers. As indicated above, the service sector has been on high Omanisation mandate as a potential source for generating new jobs. This tendency has been echoed by several interviewees when they indicated that:

> The service sector provides a relief for the government that should be explored further to employ and generate new job opportunities for the Omanis. This is based on the fact that this sector not only provides decent jobs that suit both genders of local job seekers, but it also offers lucrative salaries that could reduce the queues of job seekers before the government departments (participants 1, 4, 5 and 6).

This keenness towards developing a better private sector is undoubtedly a positive step toward a more productive and competitive private sector. Although such enthusiasm is unequally distributed among the different industries, the aim is to generate valuable practical lessons from the service sector that can be learned and shared with other private sector industries for potential application and implementation.

This enthusiasm was common among most of the participants when they indicated their desire to provide genuine policies that could serve both the government and the private sector on a win-win bases:

> Away from our official meetings with the private sector representatives where we usually get praised for our achievements, we are eager to know their naked truth and opinions about what we have been implementing and facilitating and how it could be improved (participants 1, 2, 3, 4, 6 and 9).

Development of a research and innovation culture

Research and development and innovation constitute the last, but not the least, element that was discussed with the interviewees. The discussions were held in the context of Oman's very recent initiative for R&D in the establishment of a new national organisation called the Research Council by Royal Decree (number 54/2006) issued in the first half of 2006. Hence, it was natural that the interviewees were keen to discuss the initiative but were unable to provide a critical assessment of Oman's research and development capabilities.

As noted above, Oman is currently a very low R&D spending country, as it spends only 0.10 per cent of GDP compared to 3.4 per cent in Finland, 1.26 per cent regionally and 1.05 per cent internationally. This is partly related to the fact that

socio-economic development has been a priority in the government's agenda in which R&D was seen as a luxurious expense that could not be afforded by a small developing country. This reality was expressed by two of the participants when they noted that:

> Scientific research is an important element that has contributed greatly to the prosperity of the developed economies; however, the Omani government's underspending on R&D should not be interpreted as undermining its essential role in the country's economic development, rather Oman's basic necessities in the last 36 years were so tremendous and challenging and the government had to meet these necessities before moving on to the next phase of its socio-economic development (participants 4 and 7).

Given the level of maturity in Oman's current stage of socio-economic development and the future challenges facing the country, the government now seems more convinced that the pursuance of R&D is an essential factor that must complement its current socio-economic development. This new approach has been reflected in the establishment of the Scientific Research Council and the consequent hiring of an international R&D consultant to assess and assist establishing a R&D body in Oman according to international standards.

Although the formation of this important R&D body is still at an early stage, one of the participants summarised the main task of this body to be:

> The creation of a national applied R&D strategy based on the examination of the current R&D situation, recommending ways to tackle deficiencies that may hinder successful R&D development, and setting up a vision that goes in parallel with the socio-economic development in Oman up to 2020 (participant 7).

Most of the respondents acknowledged that the R&D task is not easy as Oman possesses limited research capacities. Nonetheless, they were determined to sow the seed now in order to cultivate in the future. According to a paper presented by CRA International (the R&D consultant in Oman) at the first workshop for Science and Technology Strategy in Oman, held in 2007, R&D in Oman is suffering from the following deficiencies:

- expenditure on research is extremely low by international standards;

- research efforts are scattered, disorganised and often irrelevant to the needs of the Omani society.
- R&D is not directed by a national vision;
- the education output does not provide a sufficient number of graduates qualified to initiate research;
- the education system does not foster intellectual curiosity and entrepreneurship;
- Oman's education has lop-sided enrolments where: 81 per cent of students enrol in education, social science and business; only 13 per cent in science and engineering; and the remaining 6 per cent were enrolled in other fields.
- lack of incentives as research is not adequately rewarded;
- the linkages between government, academic institutes and the private sector in Oman are weak; and
- research is not client-focussed or client-influenced.

6.3.2 Key points from the qualitative approach

The qualitative phase of data collection identified the following knowledge economy drivers from the point view of the senior government officials who were interviewed:

- The knowledge economy option seems to be gaining momentum and acceptance among the policy makers in Oman. This change reflects the government's keenness to take the lead in promoting and facilitating the knowledge economy key drivers through better governance and incentives. This tendency is line with the literature which encourages governments to be the driving force towards knowledge economy development particularly in developing countries (APEC, 2003; World Bank, 2004).
- According to the interviewees, education was the first of the five key drivers required to transform Oman's economy towards a knowledge-based economy. Similar views on the importance of education in economic development have also been reported by many studies on the knowledge economy (e.g., OECD, 1996; Neef, 1998; ILO, 1999; Grewal et al., 2002; World Bank, 2002; APEC, 2003; Shapour, 2004; Sluis et al., 2005; UNESCO, 2005).

- Training was identified as the second essential driver of knowledge economy in Oman. Although the literature on the knowledge economy considers both education and training as a single life long learning process, from the point view of the interviewees the emphasis on training was based on many studies that have tried to diagnose the poor performance of both the local workers and the private sector in Oman (AL-Lamki, 2002; 2005; Wilkins, 2002; McElwee and Al-Riyami, 2003). Indeed, the importance of vocational and technical training in producing semi-skilled, skilled, craftsmen, technical and specialised technical manpower has also been recently emphasised as a practical solution to bridge the gap between the education system outputs and business sector requirements worldwide (Neef, 1998; Cairney, 2000; OECD, 2002).
- Information and communication technologies (ICTs) have been identified as the third most common factor required for transforming Oman to a knowledge-based economy. The potential benefits of ICT in the form of acquisition, dissemination and utilisation of knowledge is undeniable. Although the literature acknowledges the importance of ICT in any knowledge economy transformation, such importance should not be over emphasised as a generator of change. Indeed, many studies reveal that the introduction of ICT does not by itself bear fruitful results unless structural reforms are also undertaken in terms of human resources development, organisational management restructuring and legislative reforms (Milgrom and Roberts, 1990; Black and Lynch, 2000, 2001)
- Effective coordination between the government and the private sector is the fourth key factor that emerged from this interview phase. In Oman, the key concern of the government seems to be the creation of enough jobs to absorb the rapidly growing population. This may be in contrast to the common theme found in the literature on the knowledge economy, which views the role of the government as providing effective governance and economic incentives to facilitate and promote the application of knowledge (e.g., through policies for innovation and competition) by the private sector firms (Padmanabhan, 1993; Gregersen and Johnson, 1997; OECD, 2002). The Omani government's preoccupation with job creation is believed to be responsible for lop-sided policies which have ignored until recently the development of e-governance

and e-commerce, and are considered as being responsible for the stagnation of innovation and productivity levels in Oman.

- Somewhat surprisingly, development of scientific research was identified as the least common theme among the interviewees. Although the lack of scientific research in Oman could be rationalised in terms of the highest priority in the past being on developing the socio-economic infrastructure of the country, this view is not in line with the knowledge economy development literature which considers R&D and innovation as essential knowledge creation channels. A system of scientific research provides the environment that nurtures innovation, which results in new goods, new processes and new management systems. These together become the foundation for a diversified and competitive market economy and for sustainable economic development (Mintzberg, 1994; OECD, 1996; Porter, 1998; Sheehan, 1999; World Bank, 2002; APEC, 2003).

6.4 The Quantitative Approach

The aim of this section is to answer the following key question quantitatively.

What are the potential key drivers (factors) of a sustainable knowledge economy development in Oman?

The purpose of this quantitative approach is to identify the key factors that contribute to the knowledge creation, adoption, dissemination and use in major service companies in Oman. The aim was also to prioritise the importance of these factors from the business sector's point of view. For this purpose, a mail questionnaire survey was conducted that targeted 310 major service companies (graded 'Excellent' according to the OCCI as of the 2005 registration). Analysis of the results was based on the procedures specified in the methodology in Chapter 5. The SPSS for Windows (version 15.0) was used in this regard to analyse the collected data.

From the sample of the major business firms in Oman, 310 questionnaires were distributed and the useable response rate was 63.5 (n = 197). Especially when targeting high profile respondents such as CEOs and managing directors of major

companies, this response rate was considered sufficiently high (Cavan et al., 2001; Creswell, 2003). The high response rate could be attributed to several factors such as: the new topic under investigation that tries to assist the private sector in creating a more business friendly environment in Oman; the confidentiality procedures in accordance with Victoria University's ethics policy that guaranteed the respondents' anonymity; and the extensive follow-up procedure that was undertaken by the researcher.

6.4.1 Accuracy of data

The data were checked for accuracy using SPSS to examine descriptive procedures for each item and question; that is to verify that there were no out-liers and the number of questionnaires matches the number of respondents. A SPSS frequencies analysis was conducted to check the accuracy of the data and related measures such as mode, median, and minimum and maximum range, all of which were found to be plausible as can be seen in the following sections. The following were the main components of the questionnaire survey:

- Part 1 of this survey was designed to gain some demographic and general information about the participating companies. This part was made up of nineteen questions (1 – 19) ranging from the type of service activity that is provided, legal status, number of employees, gender ratio, average education level of the majority of their employees, main future education requirements, investment in continuous learning, and spending on research and development.
- Part 2 was designed to investigate the role of government institutions in assisting the local business sector in creating, disseminating and using effectively knowledge economy elements. It also tries to identify the role of government's economic incentives manifested in the rules and regulations promoting a business friendly environment. In total, 27 items were used to measure this part.
- Part 3 was designed to investigate the contribution of the education system in Oman to the development of the service sector in terms of assisting its productivity and competitiveness. This part contained 25 items.
- Part 4 was designed to measure the contribution of information and communication technologies (ICTs) in enabling the service sector to carry out

its activities effectively. A total of 19 items were utilised to evaluate respondents' feedback.

- Part 5 was designed to explore the research and development capabilities in the service sector in Oman. This part consisted of 14 items to evaluate the R&D and innovation capabilities.
- Part 6 was made of 18 items to represent the knowledge outcome and it was designed to gauge the outcome of the implementation of the previous four parts that were related to knowledge creation, dissemination, and utilization.

6.4.2 Descriptive analysis

Results of the first descriptive question are illustrated in Table 6.1 which presents types of activities of the participating companies.

Table 6.1 Type of activity

Activity	*Frequency*	*Valid percentage*
Finance	46	23.4
Consultancy	36	18.3
Tourism	27	13.7
Communications	19	9.6
Education	30	15.2
Health	21	10.7
Other	18	9.1
Total	197	100.0

These companies were asked: what is the service activity that your organisation provides? Finance constitutes the largest portion of respondents with 23.4 per cent of respondents. Banks, money exchange and other financial institutions were representatives of this sector. Consultancy respondents accounted for the second largest portion with 18.3 per cent. This sector consisted of consultancy activities such as engineering, law, environment, etc., that having capital value above Omani Rial 250,000 which qualifies them to be graded as 'Excellent' according to the Oman Chamber of Commerce and Industry registration as of 2005.

Education was the third largest portion of respondents with 15.2 per cent which was represented by respondents from private universities, colleges and other education institutions; followed by tourism which was fourth with 13.7 per cent, represented

mainly by hotels and restaurants. Health-related activities came fifth with 10.7 per cent representing private hospitals, clinics and pharmacies. Communications representing mainly telecommunication companies, ICT technologies and related service providers was sixth with 9.6 per cent. The last category was 'Other' with 9.1 per cent of respondents. This category was dominated by 16 insurance companies while the remaining 2 companies were uncategorized. In fact, the dominance of the finance sector is explained by the fact that banks and related financial companies were among the pioneers of the service sector in Oman since the early 1970s (Al-Lamki, 2005). The strong presence of service activities in this category represents a positive growth of these knowledge based activities in the country where consultancy, tourism, communications, education and health are taking up more prominent role in the economic development as part of the government's plan to widen this sector's economic contribution and job generation.

The next question was: What is the legal status of your organisation? As can be seen from Table 6.2 below, a partnership was the dominant legal status of service companies participating in this survey with 40.1 per cent of respondents. Privately-held corporation was the second largest in this legal status category with 24.4 per cent. Stock exchange listed companies was the third largest category in this context with 17.8 per cent, single proprietorship with 16.2 per cent as fourth, and government owned company was last with 1.5 per cent. The dominance of partnership, privately-held corporation and stock exchange listed corporation which collectively represent 82.3 per cent of the legal status of respondents, confirms the fact that these activities require large investment and capital to enable them to be more innovative and competitive through R&D and acquisition of new knowledge.

Table 6.2 Legal status of respondents

Legal status	*Frequency*	*Valid percentage*
Single proprietorship	32	16.2
Partnership	79	40.1
Corporation privately-held	48	24.4
Corporation listed on a stock exchange	35	17.8
Government owned company	3	1.5
Total	197	100.0

Table 6.3 represents the originality of the respondents' companies. In this question participants were asked: How was your organisation established? This is an indicator

of the entrepreneurship environment in the country. The majority (74.6 per cent) of respondents were private from the time of start up. This indicates that the business environment in Oman is supportive to some extent to new businesses. In fact, a conducive business environment that entices new businesses is one of the preconditions of the effective governance and economic incentives pillar for flourishing business sectors in knowledge economy development. Joint ventures constituted 16.8 per cent of respondents and the remaining 8.6 per cent were established as a result of privatization of a state-owned firm, private subsidiary of a formerly state-owned firm and royal decrees.

Table 6.3 Establishment of participating companies

How established	*Frequency*	*Valid percentage*
Originally private from time of start up	147	74.6
Privatization of a state-owned firm	8	4.1
Private subsidiary of a formerly state-owned firm	6	3.0
Joint venture domestic and foreign private owners	33	16.8
Royal decree	3	1.5
Total	197	100.0

Respondents were also asked to indicate if they have holdings or operations in other countries. Of the total respondents, only 11.2 per cent indicated that they have overseas branches outside Oman as depicted in Table 6.4. In fact, most of these companies were in the finance and consultancy sectors where they usually have some sort of partnership with international companies. However, this percentage indicates the limitation that major service companies possess in acquiring new knowledge through collaboration or alliances.

Table 6.4 Overseas holdings and branches

Overseas branches	*Frequency*	*Valid percentage*
Yes	22	11.2
No	175	88.8
Total	197	100.0

Generally, a company's size is determined by quantifiable indicators such as number of employees, annual sales or fixed assets. However, OCCI bases its classification on fixed assets alone, though number of employees is widely recognised as a better representative of a company's size. In this question respondents were asked: How many employees are there in your organisation? As Table 6.5 shows, companies that

have 300 to 400 employees are dominant with a 42.2 per cent share. This is related to the fact that this category includes finance and tourism activities which are characterised by labour intensive activities.

Table 6.5 Number of employees

Number of employees	*Frequency*	*Valid percentage*
Less than 100	45	22.8
101-200	32	16.2
201-300	21	10.7
301-400	83	42.2
More than 400	16	8.1
Total	197	100.0

This seems to offer some relief for the government as a greater potential job generator sector that could ease the pressure on it as a source of local labour force employment. Companies that employ less than 100 employees which represent 22.8 per cent of respondents, are mostly in the consultancy sector as they participate in more technology and information intensive activities. Companies that employ between 100 and 200 employees represent 16.2 per cent which are mainly representative of education and health activities (teachers, nurses and medical staff), which are to some extent labour intensive activities but do require highly trained professionals. The group between 200 and 300 number of employees represents 10.7 per cent while those more than 400 employees represent only 8.1 per cent, which include a mixture of telecommunication, tourism, and finance companies.

Table 6.6 represents the gender status among respondents. Respondents were asked: What is the gender ratio in your organisation? The results show that 76 per cent of the respondents indicated that their businesses have a male majority, while a female majority was reported by only 15.8 per cent of respondents. Companies with equal gender composition represent 8.2 per cent. Although Oman's private sector is characterised by its male labour force dominance, both female and equal composition seem to be in line with the government figures which show some improvement in closing the gender gap in the private sector (MNE, 2006).

Table 6.6 Gender

Gender	*Frequency*	*Valid percentage*
Male	150	76.0
Female	31	15.8
Equal	16	8.2
Total	197	100.0

In the next question, respondents were asked: What is the education average level of the majority of employees? Table 6.7 shows that university level education was the dominant average education level among respondents' companies with 34.5 per cent. As expected, secondary education was the second highest education level with 29.4 per cent, while college was third with 28.4 per cent. The postgraduate studies average constituted only 5.2 per cent of the education level, which was mainly masters degrees, concentrated in the education sector. Below secondary was counted for only 2.5 per cent. These results represent a good indication of the importance of higher education in job qualification requirements, as the preference from the service sector seems to be biased toward higher education particularly university degrees. This trend has been supported by empirical evidence identifying higher education as a critical factor in preventing future high levels of long-term unemployment. This argument is further supported by the empirical evidence of a strong correlation between educational level achieved and high income over a lifetime (Sweeney, 1998; OECD, 2001; World Bank, 2004; UN, 2005).

Table 6.7 Current education levels

Education level	*Frequency*	*Valid percentage*
Below secondary	5	2.5
Secondary	58	29.4
College	56	28.4
University	68	34.5
Postgraduate	10	5.2
Total	197	100.0

About the training programs, the respondents were asked: What kind of training programs does your company require now? Survey results presented in Table 6.8 show that all three types of training mentioned in this study seem to contribute to the majority of requirements with 40.6 per cent of respondents indicating that vocational, technical and management training are essential for their businesses. However, at the

individual level, both vocational and technical training have equally been reported by respondents at 23.9 per cent, as the second important training type required by their companies. Management training was identified as the third single important type of training with 9.6 per cent of respondents' preference, while others which included very specific training courses that could fit vocational and technical training was only 2.0 per cent.

Table 6.8 Types of training

Types of training	*Frequency*	*Percentage*
Vocational	47	23.9
Technical	47	23.9
Management	19	9.6
All three	80	40.6
Others	4	2.0
Total	197	100.0

The findings in this question support the general perception among knowledge economists and researchers that training in general is now seen as a key part of the human resource management process where workers are viewed as a source of wealth creation, rather than a cost to the company (Neef, 1998; OECD, 2000). Rodrigues (2002) notes that skills and knowledge, as developed through education and training, are one of few areas where a country can engineer a competitive advantage. Psarras (2006) points out that the education and training system is one of the few factors advantageous to the economy that is controllable by governments.

In relation to the professional development of employees, the respondents were asked: What is the percentage of total employees that have participated in training programs in the last three years? Table 6.9 reveals that 39.1 per cent of respondents indicated that less than 10 per cent of their total employees have had some sort of external training. Those companies whose 30 to 40 per cent of their employees have had external training contributed to 21.3 per cent of the total sample as the second highest category in this context. Companies that 20 to 30 per cent of their employees participated in training came third with 16.2 per cent, while those with 10 to 20 per cent were fourth at 14.7 per cent. Others, where more than 50 per cent of their employees engaged in external training, accounted for only 8.7 per cent as the last in this category.

Table 6.9 Percentage of total employees participating in training

Percentage of total employees	*Frequency*	*Percentage*
Less than 10%	77	39.1
10-20%	29	14.7
20-30%	32	16.2
30-40%	42	21.3
More than 50%	17	8.7
Total	197	100.0

These results indicate that 91.3 per cent of service companies represented by the surveyed respondents had less than 50 per cent of their employees participated in external training. This low participation in training could be explained by the perception that most of local training institutions are not capable of meeting local businesses training requirements (Ministry of Manpower, 2006). In addition, recent studies in this regard indicate that rapid obsolescence of work knowledge and skills in knowledge intensive activities make it more difficult and challenging for firms to find exactly what they need in a competitive and open market environment. As a result, they tend to develop in-house training programs to minimize costs and provide opportunities for on-the-job self development (Stern, 1998).

The results represented in Table 6.10 seem to complement and support the above argument where respondents were asked: How much do you invest on your staff training from your annual budget? In fact, 21.8 per cent of respondents indicated that they did not invest in staff training, while 49.3 per cent invested only between 1 to 3 per cent of their annual budgets on training. Of the total respondents, only 21.8 per cent invested between 4 to 6 per cent of their budgets, while 7.1 per cent of them spent between 7 and 9 per cent on training activities. In addition to the rationales given previously to explain the low investment on training in Oman, the government's keenness in addressing the skill and knowledge shortages among the Omanis through its allocation of about 3 per cent of government spending on vocational training and technical education, seems to have contributed to this reluctance among the business sector to invest in training.

Table 6.10 Annual investment on training

Spending percentage	*Frequency*	*Valid percentage*
None	43	21.8
Between 1-3 %	97	49.3
4-6%	43	21.8
7-9%	14	7.1
Total	197	100.0

Table 6.11 represents survey results of two questions where respondents were asked to indicate if they have R&D entities within their firms and the type of this R&D entity. The vast majority of respondents (93.4 per cent) indicated that they do not have any sort of R&D entities, while only 6.6 per cent indicated that they do have R&D entities. In fact, the financial sector reported having 7 of these 13 R&D entities.

Table 6.11 Cross-tabulation of availability of R&D entities, type and percentage

Availability of R&D	*R&D type*					*Total*	
	Financial	*Management*	*Technical*	*Scientific*	*Others*	*Nos*	*%*
Yes	7	5	1	0	0	13	6.6
No	0	0	0	0	0	184	93.4
Total						197	100

This result supports the general perception that businesses in developing countries lack involvement in R&D activities (World Bank, 2004). According to OECD (2000), the importance of R&D activities stem from the fact that they provide the capacity necessary to absorb scientific and technical knowledge. In such a situation as shown in Table 6.11, the current local business R&D capabilities are unlikely to provide an absorptive environment and hence competitive advantage in the global market.

This trend of low spending on R&D seems to support the benchmarking result which indicated Oman's low preparedness in this R&D pillar (noted above). This situation can also be seen in Table 6.12 which reflects the current status of R&D investments and staff within the major service firms in Oman where the 13 respondents reported having R&D entities within companies with 1 to 5 R&D staff and spend up to 1 to 3 per cent of their budgets. Although this percentage is close to the world average of 3.4 per cent, its effectiveness is minimal as it is concentrated on financial and management study areas only and none of them on scientific research.

Table 6.12 Cross-tabulation of business R&D spending and staff

		Number of R&D staff		
		None	*1-5*	*None*
% R&D spending	None	184	0	184
	Between 1-3%	0	13	13
	4-6%	0	0	0
Total		184	13	197

Challenges and requirements

Within the descriptive section of this survey, respondents were asked to identify major challenges and obstacles that are expected to affect their business performance in the next five years. Results of their responses are summarised in Table 6.13. This shows, 32 per cent of respondents identified low qualification of the local labour force as the main obstacle.

Table 6.13 Cross-tabulation of obstacles

Obstacles/challenges	*Number*	*Percentage*
Unqualified local labour force	63	32.0
Government bureaucracy	32	16.3
Foreign competition	52	26.4
Taxation and government fees	10	5.0
Other (incl. ineffectiveness of local ICTs)	40	20.3
Total	197	100

These results brought out for Oman what the World Bank (2004) and Al-Lamki (2005) call the mismatch between the education and training systems outcomes and the local market needs. Foreign competition accounted for the second most expected challenge with 26.4 per cent of respondents. This suggests that the gradual opening up of Oman's market in accordance with its obligation to the WTO agreement seems to have threatened the existence of many businesses in Oman which depend heavily on government initiatives, directions and spending.

Ineffectiveness of local ICT infrastructure accounted for the third most common obstacle with 20.3 per cent of respondents. This finding has been supported by ICT related studies on Oman such as Al-Shahi (2006) and Al-Wohaibi (2006) that relate such obstacles to barriers ranging from lack of public awareness, high fees, and

ineffective e-governance and e-commerce to optimal utilisation of ICT in the country. Government bureaucracy was identified as the fourth major obstacle with 16.3 per cent of respondents showing mainly the service sector's concern. This finding is line with various studies particularly in developing countries which indicate that government institutions' ineffectiveness hampers economic development that nurtures a productive, innovative and competitive business culture (Grimes and Collins 2003; World Bank, 2004; Yousef, 2004). Taxation and government fees were identified by only 5 per cent of respondents as an obstacle. This positive reflection towards the government's main economic incentive has been explained by the fact that Oman is almost a tax free country where tax on business income averages about 4.2 per cent, among the lowest in the world (MNE, 2005).

A detailed analysis of the effect of the above obstacles and challenges on respondents according to their activities is presented in Table 6.14. The finance sector seems to be the most affected sector by these obstacles as reported by 25.4 per cent of the total respondents. The consultancy sector was the second most affected with 18.3 per cent followed by the tourism sector with 14.2 per cent of total respondents. The education sector was fourth with 13.7 per cent; the health sector fifth with 10.7 per cent, the communications sector accounted for 9.6 per cent and others 8.1 per cent of total respondents. Excluding the consultancy and communication sectors from the above results as knowledge intensive activities, labour intensive activities which represented 64 per cent of the total respondents are going to be affected mainly by an unqualified labour force, foreign competition, and ineffectiveness of ICTs, respectively, which could be explained by the low utilization of ICTs.

Table 6.14 Cross-tabulation effect of obstacles and challenges on service activities

Activity	*Unqualified local labour force*	*Government bureaucracy*	*Foreign competition*	*Taxation & government fees*	*(Others) Ineffectiveness of local ICTs*	*Total*	*%*
Finance	11	9	17	1	12	50	25.4
Consultancy	7	8	12	0	9	36	18.3
Tourism	13	4	2	3	6	28	14.2
Communications	6	1	8	0	4	19	9.6
Education	12	10	4	0	1	27	13.7
Health	7	0	8	2	4	21	10.7
Others	7	0	1	4	4	16	8.1
Overall total	63	32	52	10	40	197	100

In terms of education requirements in the next five years, respondents were asked to indicate what type of education was necessary for their business development. As can be seen in Table 6.15, 49.7 per cent indicated that university level education is their main requirement. Technical education in the form of ICT related, engineering and finance constituted 23.4 per cent as the second most required education type while postgraduate education accounted for 14.2 per cent as the third category of education level required by respondents. A mixed education level where companies require a mixture of different education levels recorded 6.1 per cent, and secondary education 4.6 per cent were both fourth and fifth as the required education levels respectively. Vocational education was the lowest nominated recording 2.0 per cent of the respondents surveyed. The expected decline in secondary and vocational education requirements is based on the fact that the service sector is expected to be more knowledge intensive and thus requires higher education levels as is the case in most of the developed economies (OECD, 2002).

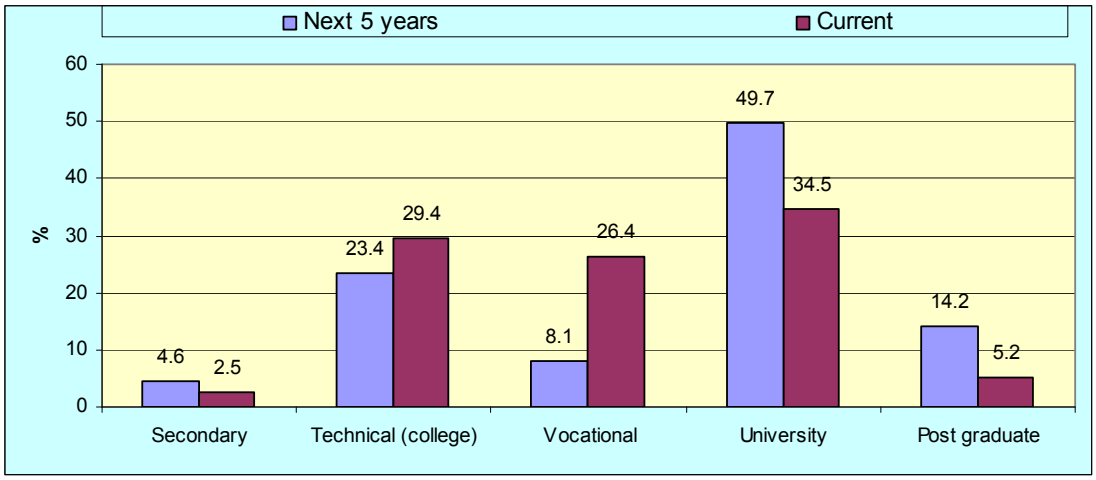
Table 6.15 Types of future education requirements

Type of education	*Frequency*	*Percentage*
Secondary	9	4.6
Technical	46	23.4
Vocational	4	2.0
University graduate	98	49.7
Postgraduate	28	14.2
Mix	12	6.1
Total	197	100.0

The survey results also indicate that there is a major change in the education level requirements in the prominent service sector for the next five years. This is based on the fact that university education, technical education and postgraduate education collectively constituted 87.3 per cent of total respondents' future education requirements. Compared to 68.1 per cent of the current education situation in the companies surveyed as depicted in Figure 6.12, this indicates a significant increase.

This positive trend in greater higher education requirements in Oman has been supported by similar trends worldwide. For example, OECD estimated in 2000 that over 60 per cent of production in OECD countries is created by knowledge workers who have tertiary education qualifications.

Figure 6.12 Education, current and future requirements



Source: Developed for this research.

The trend in hiring more educated workers is also supported by the International Labour Organization (ILO) which indicates in its report on *labour 1998/1999* that an additional year added to average schooling years will result in a 5 to 15 per cent increase in labour productivity (ILO, 2001). Sluis et al. (2005) have reached a similar conclusion at the firm level that an extra year of schooling raises enterprise income in developing countries by an average of 5.5 per cent. More importantly for Oman, university graduates tend to earn more income and find a job relatively easier than people who have not had any university education, and these advantages could be reflected positively in the employment opportunities being filled by locals and the overall economic growth (Al-Lamki, 2002).

Respondents were also asked about their training requirements in the next five years and the results are summarised in Table 6.16. Unlike the education requirements which indicated preference for higher education, training requirements seem to cover a wider spectrum where all three main training areas of technical, vocational and management contribute to 47.2 per cent of total respondents' training requirements. On the type of training level, technical training in the form of ICT, engineering, finance, etc., constituted 20.3 per cent of total respondents' requirements followed by vocational training with 17.8 per cent, and management with 14.7 per cent.

Table 6.16 Future training requirements

Type of training	*Frequency*	*Percentage*
Vocational	35	17.8
Technical	40	20.3
Management	29	14.7
All three	93	47.2
Other	0	0.0
Total	197	100.0

This diverse requirement of training appears to be in line with the literature on training which considers it as an essential element in maintaining and upgrading the learning capacity of all segments of an innovative workforce to enhance employment opportunities. Indeed, training is now seen as a key part of the human resource management process where workers are viewed as a source of wealth creation, rather than a cost (OECD, 2001; Mouritseen et al., 2002). Miller (1995) and Harkins et al. (2002) note that, knowledge and skills, as developed through education and continuous training, are one of new areas where a country can engineer a competitive advantage controllable and adjustable by governments.

6.4.3 Factor analysis

The factor analysis technique was applied to group the survey items into a meaningful pattern with the aim of isolating and identifying key factors that are deemed to be successful in enhancing the prospects of the knowledge economy in Oman. Further, factor analysis was also used to prioritise the importance of these factors according to their loading values. Two groups of variables were formed: the first group included the knowledge economy inputs or drivers represented by the four knowledge economy pillars (noted above); and the second group of variables represented the knowledge outcomes manifested in better productivity and knowledge acquisition.

Deriving factors and assessing overall fit

The principal component factor analysis of the knowledge economy input factors contained 85 items. As indicated in the methodology chapter 5, eigenvalue greater than 1.00 and scree plots are the most commonly used criteria in choosing factors. Based on that, initially 17 factors after 25 iterations were identified as their eigenvalues were greater than 1.00. These factors represented an explained variance

of 76.5 per cent as can be seen in Appendix (7). There is no specific percentage of acceptable explained variance that could be significantly relied on. Although, in natural sciences it is acceptable at the 95 per cent level. In social sciences where data is less precise, 50 per cent of total variance is considered satisfactory (Tabachnick and Fidell, 2001). This indicates the reported 76.5 percentage of explained variance as significant and acceptable.

Knowledge economy input factors (pillars)

To determine the appropriateness of factor analysis, examining the correlation among all of the questionnaire items is essential which can be obtained through the Bartlett test of sphericity which tests the presence of nonzero correlations among the variables. Kaiser-Meyer-Olkin (KMO) the measure of sampling adequacy (MSA) is another indicator of factor analysis appropriateness, which ranges from 0 to 1. According to Tabachnick and Fidell (2001) and Pallant (2006) factor analysis is acceptable if the value of KMO is greater than 0.5. As Table 6.17 indicates, it has been verified that factor analysis in this study is appropriate as Kaiser-Meyer-Olkin measure of sampling adequacy = 0.679, Bartlett's test of sphericity is highly significant with Chi-Square value = 8961.105, at p value = 0.000 and degree of freedom = 1711.

Table 6.17 KMO and Bartlett's test

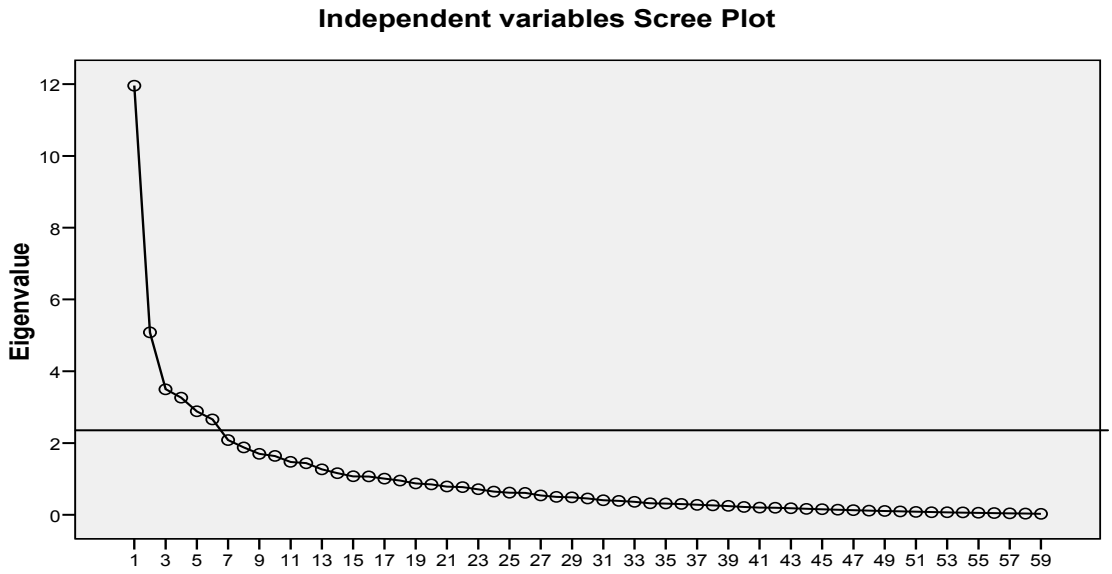
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.679
Bartlett's Test of Sphericity	Approximate Chi-Square	8961.105
	df	1711
	Sig.	0.000

This indicated that it was appropriate to proceed with factor analysis. As noted before, examination of the initial statistics revealed that a total of 17 factors have been produced with a total of 44 items of the knowledge input questions out of 85 items (questions and sub-questions). The remaining 41 items have fallen below the 0.5 loading threshold which according to Hair et al. (2006) and Pallant (2006) could be omitted from this analysis. Out of the 17 factors 5 did not meet the basic threshold of at least 3 items in every factor as can be seen in Appendix (8). According to Hair et al. (2006) and Tabachnick and Fidell (2001), to meet the above criteria additional factor

reduction must be performed, where the researcher is permitted to nominate the number of factors to reach the minimum threshold of 3 items in every factor.

After ten trials of factor reduction, six factors were obtained that met all of the criteria identified in the methodology chapter. The final statistics showed that these six factors accounted for about 50 per cent of the variance which was an acceptable percentage according to Tabachnick and Fidell (2001) as can be seen in Appendix (9). It appeared that these six factors were dominant with eigenvalues of 34 of the total 59 eigenvalues. In addition, the scree-plot test also supports the six factors solution as the most appropriate factor solution as depicted in Figure 6.13 below.

Figure 6.13 Knowledge economy input factors (independent variables) scree-plot test



The factor analysis solution extracted factors according to their importance:

- the first factor contained 12 items;
- the second factor 8 items;
- the third factor 6 items;
- the fourth factor 6 items;
- the fifth factor 6 items; and
- the sixth factor 5 items.

More importantly, all extracted items were loaded significantly and heavily on these six factors that ranked in order of the strongest factor loadings. Since there are more than one item in each factor, Hair et al. (2006) and Pallant (2006) suggest that the use of surrogate factors truly representing the items included in the formation of these new factors is highly recommended. The following surrogate factors were used to describe the six factor solution:

Factor 1: ICT infrastructure and services in Oman

Most of the ICT infrastructure items and services have loaded significantly and heavily on the first factor indicating its importance and priority ranking. The reliability test of the composite scales of all twelve items reveals a significant Cronbach alpha of 0.905. The mode of most of these items (6 out of 12) was 3 and the median was 3 as well indicating neutral or no satisfaction with the ICT infrastructure and services in the country. Put differently, although ICTs are a very important contributor to major service companies in the country, respondents saw almost no role of ICTs in the knowledge outcome in the form of better productivity and knowledge acquisition.

This result seems in contrast to what the knowledge economy literature suggests, that substantial productivity growth has been experienced from ICTs usage as a result of overcoming geographical boundaries to share information, reduce uncertainty, reduce transactions costs and increase competitiveness across borders, all of which have produced a competitive edge in other economies (OECD,1999; World Bank, 2002). According to Al Shihi (2006) and Al-Wohaibi (2006), the Omani perspective could be due to the lack of real competition between local ICT providers, poor public awareness of full benefits of ICTs, high costs and poor services provided by local ICT companies.

Factor 2: Local R&D capabilities

All of the eight items have loaded significantly on this second important factor indicating its importance in this regard. The scale incorporating all of the eight items was found to have an acceptable degree of reliability, as the Cronbach alpha was 0.864. In contrast to the first factor, the frequent mode was 4 (7 out of 8 items), with a similar median indicating its weakness in contributing to the knowledge outcome as

manifested in better productivity and knowledge acquisition. While factor analysis indicates that local R&D capabilities is second most important among these six surrogate factors, this result does not support the notion that the local R&D environment nurtures innovation in the form of new goods, new processes and new knowledge, and hence is a source of a competitive edge in Oman's service sector. This result is line with the literature and the benchmarking analysis result which indicated low R&D readiness in developing countries in general and in Oman in particular.

Factor 3: Training support

In this factor, six items were extracted and incorporated representing the third important factor. All six items have produced a significant alpha value of a Cronbach alpha of 0.905 with a mode of 3 (5 out of 6 items) as well as median 3, indicating also its absent role in providing skills for the local market. Separation of training support from the education pillar in Oman can be explained by the fact that both the government and the private sector in general consider it as an important educational element that complements the education system. This can also be related to the government's commitment towards rectifying the general education shortcomings by providing generous training support to both businesses and trainees to overcome such shortcomings.

The tendency in emphasising the importance of training support has its roots in the literature. The World Bank (1998) and OECD (2001) emphasise this notion by indicating that people need knowledge that is not only relevant today but also durable for tomorrow. Thus, they require not only skills that are immediately applicable to work, but also a knowledge base that will enable them to adapt as products and production methods advance (Bontis, 2002; Marginson, 2006).

Factor 4: General education

In this fourth ranked factor, there were six items extracted. Most of the education items have loaded significantly and heavily on this fourth factor indicating its importance and ranking. The reliability test of the composite scales produced an acceptable value as the Cronbach alpha was 0.820 with mode and median of 3 (5 out of 6). This factor represented no relevance to the knowledge outcome as this result

represents the common perception that education systems in developing countries, in particular, are characterised by their irrelevance to the local market needs.

This perception comes at a time despite the fact that human resource development was extensively emphasised in Oman's economic development vision (Oman 2020) which has been hailed by one of the UNESCO's experts as a positive step in restructuring the education system including the higher education to make it more relevant to the local market's needs (Rassekh, 2004). This negative perception could be explained by the fact that the new education restructuring can not be realised at this stage, as this reform was started in 1995 and it may take longer to reach its fruition (Ministry of Education and UNICEF, 1999).

Factor 5: Governance and regulatory regime

The fifth factor consists of six items and most of the governance items loaded significantly and heavily on this factor indicating its importance and ranking. The Cronbach alpha test of reliability produced an acceptable value of 0.768. The frequent mode was good at 2 (4 of 6) with a similar median value of 2. This result indicates that governance and regulatory regime in Oman has good relevance in explaining and enhancing knowledge outcomes.

This result does not reflect the ongoing perception – at least in Oman – as the current state of governance and regulatory regimes in the MENA region in general is rather ineffective and is creating major obstacles towards knowledge-based economic development (World Bank, 2004; IMF, 2005). This according to Al Markazi (2007) could be attributed to the government's keenness to update and modernize its administrative and legal systems to meet its WTO obligations, such as the launching of the e-governance initiative more than ten years ago, along with updating and reforming of regulatory regime. This result acknowledges that the governance system could play a positive role in establishing and enhancing an environment conducive to business development and investment in general, promoting knowledge generation and absorption that stimulates sustainable growth and competitiveness.

Factor 6: ICT status

The final and sixth factor consisted of five ICT-related items which loaded heavily and significantly on this factor indicating its importance and ranking. The composite scale of these items was acceptable as Cronbach alpha was 0.868. The frequent mode was 3 (3 out of 5) while the frequent median was 2 (3 out of 5) indicating its neutral relevance to the knowledge outcome. This result reveals that the ICT status is relevant but at a neutral level to knowledge outcome. This could be explained by the fact that ICT status is an internal matter where service companies have some control in engineering a competitive advantage.

Although, this factor is the last among the independent variables, it is not the least in expanding the realm of accessible knowledge to local service companies as a new mode of economic functioning. This importance has been recognised and supported by the fact that over 60 per cent of production in the OECD countries is created by knowledge workers who utilize internal ICT as their main input (Lim, 2002; Rodrigues, 2002). In fact, it is evident that no company in today's world affords to be left out of the information technology system where competitive edges and new knowledge could be facilitated and used.

A summary of the six factors extracted along with their items, mode, median, factor loading, number of items and Cronbach's alpha is presented in Table 6.18.

Table 6.18 Knowledge Economy Input Factors

Knowledge input factors	*Extracted items*	*Mode*	*Median*	*Factor loading*	*Number of items*	*Cronbach's alpha*
ICT infrastructure and services in Oman	- Local system solutions	3	3.00	0.829	12	0.905
	- Technical expertise	3	3.00	0.766		
	- Service being provided	3	3.00	0.743		
	- ICT infrastructure	2	2.00	0.710		
	- Internet service	3	3.00	0.680		
	- ICT public awareness	3	3.00	0.679		
	- Mobile telephone service	2	2.00	0.640		
	- Telephone service	2	2.00	0.634		
	- ICT legislation	4	3.00	0.593		
	- Evaluation of the overall ICT telecommunication services in Oman	2	2.00	0.554		
	- Competition between local ICT companies	3	3.00	0.527		
	- Fees	4	4.00	0.520		

Knowledge input factors	*Extracted items*	*Mode*	*Median*	*Factor loading*	*Number of items*	*Cronbach's alpha*
Local R&D capabilities	- Government laws and regulations in support of R&D in your organisation	4	4.00	0.749	8	0.864
	- Availability of local researchers	4	4.00	0.723		
	- Collaboration with the government in terms of your R&D needs	4	4.00	0.706		
	- Government financial incentives for your organisation's R&D	4	4.00	0.698		
	- Collaboration with local academic community	4	4.00	0.648		
	- Collaboration with international research centres	4	4.00	0.636		
	- Sultan Qaboos University research centre capabilities	3	3.00	0.603		
	- Availability of expatriate researchers	4	4.00	0.589		
Training support	- Training programs	3	3.00	0.784	6	0.905
	- Training expertise	4	3.00	0.762		
	- I consider the government's coordination regarding my organization's training needs as	3	3.00	0.752		
	- Financial support	3	3.00	0.748		
	- I consider the government's coordination regarding my organization's technical education needs as	3	3.00	0.743		
	- I consider the government's coordination regarding my organization's educational needs as	3	3.00	0.728		
General education	- Private general education	2	2.00	0.689	6	0.820
	- Public general education	3	3.00	0.668		
	- Public tertiary education	3	3.00	0.642		
	- Technical education	3	3.00	0.606		
	- Vocational training	3	3.00	0.566		
	- Private tertiary education	3	3.00	0.540		
Governance and regulatory regime	- Ministry of National Economy	2	2.00	0.673	6	0.768
	- Oman Chamber of Commerce and Industry	2	2.00	0.626		
	- Ministry of Commerce and Industry	2	2.00	0.618		
	- The Central Bank of Oman	3	3.00	0.610		
	- Muscat Municipality	3	3.00	0.585		
	- The commercial law	2	2.00	0.513		
ICT status	- Organisational ICT awareness	2	2.00	0.711	5	0.868
	- Expertise	3	2.00	0.685		
	- Usage	2	2.00	0.651		
	- Technical management	3	3.00	0.647		
	- Training	3	3.00	0.594		

Note: Scale in the questionnaire survey is: 1 = very good, 2 = good, 3 = neutral, 4 = bad, 5 = very bad.

Knowledge economy outcome factors

After incorporating the same criteria that were used to extract knowledge economy input factors, examination of the items of knowledge economy outcomes produced six

factors. On the basis of a Kaiser-Meyer-Olkin measure of sampling adequacy = 0.827, a highly significant Bartlett's test of sphericity with chi-square value = 1529.736 at p value = 0.000 with 78 degrees of freedom, factor analysis was verified and considered appropriate to proceed with, as shown in Table 6.19. An examination of these initial statistics revealed that a total of 6 factors have been extracted with a total of 15 items accounting for 85.57 per cent of variance (Appendix 10).

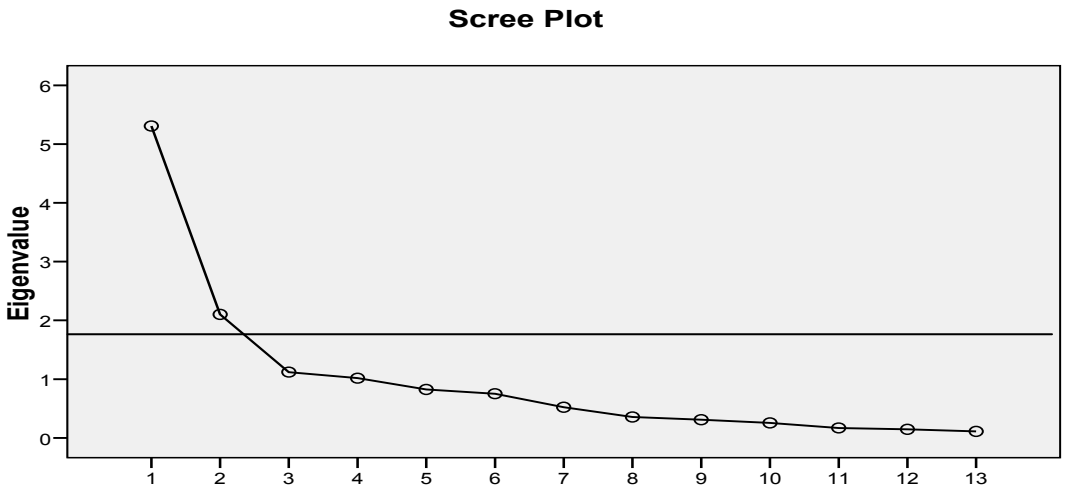
Table 6.19 KMO and Bartlett's test of dependent variables

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.827
Bartlett's Test of Sphericity	Approximate Chi-Square	1529.736
	df	78
	Sig.	0.000

However, one factor had no items at all, two factors contained single item only, and one factor was with two items all of which do not meet the three-item threshold criteria implemented on the input stage of factor analysis. This indicates the need to further reduce the set of factors. After 3 iterations, the final statistics showed that there are only two factors that meet the three-item threshold criteria, which accounted for 56.99 per cent of the variance which was an acceptable percentage according to Tabachnick and Fidell (2001) as can be seen in Appendix (11).

For these two factors, it appeared that they were dominant with eigenvalues of 7 out of 13 eigenvalues. In addition, the scree-plot test also supports the two factors solution as the most appropriate factors as can be seen in Figure 6.14.

Figure 6.14 Scree-plot test of knowledge outcome factors (dependent variables)



The factor matrix showed the following two factors:

- factor one contained (7) items; and
- factor two contained (3) items.

All of the extracted items were loaded significantly and heavily on these two factors that ranked in order of the strongest factor loading. The following surrogate variable names are used in an attempt to assign some meaning to the newly extracted factors according to Table 6.20.

Table 6.20 Knowledge outcome factors

Knowledge output factors	*Extracted items*	*Mode*	*Median*	*Factor Loading*	*Number of items*	*Overall Cronbach's alpha*
Productivity	- Improvement of productivity	2	2.00	0.859	7	0.923
	- Improvement of an existing product, process or service	3	3.00	0.847		
	- Improvement of profitability	3	3.00	0.830		
	- Increase in sales or revenues	3	3.00	0.800		
	- Improved understanding of new market needs and trends	2	3.00	0.779		
	- Development of a new product, process, or service	3	3.00	0.770		
	- Generation of new jobs and employment	3	3.00	0.764		
Knowledge acquisition	- Attention to better quality	3	3.00	0.784	3	0.738
	- Improvement of management and employee skills and know how	2	2.00	0.618		
	- Acquisition of external knowledge through online information sources, fairs, exhibition, market scanning, consultants, and other external sources	2	2.00	0.591		

Note: Scale in the questionnaire survey is: 1 = very good, 2 = good, 3 = neutral, 4 = bad, 5 = very bad.

Factor 1: Productivity (performance)

As mentioned before, 7 items of knowledge outcome have loaded significantly and heavily on the first factor indicating its importance and priority ranking. The reliability test of the composite scales of all of seven items revealed a significant Cronbach alpha of 0.923. The mode of most of these items was 3 (5 out of 7) and median was 3 as well (6 out of 7 items) indicating neutral or low relationship between the knowledge input factors and productivity level.

This result showed that the effect of incorporating ICT infrastructure and services, local R&D capabilities, training support, general education, governance and regulatory regime, and ICT status, had minimal effect on the productivity level and performance in general for major service companies surveyed in Oman. Such result seems to be in line with previous studies conducted on the MENA region both at the macro level (World Bank, 2004) and the micro level (Bontis, 2004). This, according to Bontis (2004) and Abouzeedan and Busler (2006), is a direct consequence of the low readiness of the knowledge economy drivers.

Factor 2: Knowledge acquisition

In terms of the knowledge acquisition as the second knowledge outcome factor, 3 items extracted to form this factor that have loaded significantly indicating its importance and priority ranking. The reliability test showed a significant Cronbach alpha of 0.738 indicating its appropriateness for this factor analysis. Further, the frequent mode of these three items was 2 (2 out of 3 items) and similar result of the median indicating its relevance to the knowledge input factors.

In contrast to the previous knowledge outcome factor (productivity), there was a good relationship and relevance between this factor and the six knowledge economy inputs suggesting a positive effect between knowledge acquisition and knowledge input factors. Three explanations could be provided to rationalising this positive relationship:

- Knowledge acquisition is the easiest part among the knowledge economy output chain as most companies in Oman are net importers of new knowledge as is the case in most of the developing countries due to the availability of

internet and conferences which are main and affordable sources of new knowledge in developing countries (World Bank, 2004; Bontis 2004).

- The major service companies are good utilisers of internal ICT as indicated by factor six of the knowledge input factors which enabled the major service firms to harness knowledge acquisition easily and affordably.
- Education levels of the service sector's employees - where the majority were university graduates according to the descriptive analysis - are in a better position to search for, acquire, and digest knowledge to up-skill their job capabilities.

6.4.4 Pearson correlation

In fact, the success in conducting the factor analysis permits or leads the researcher to proceed with the correlation analysis to better understand the interrelationships among the 6 knowledge economy input factors and the 2 knowledge output factors, as this would provide a more robust empirical basis for judging the structure of the factors and the impact of this structure on the results interpretation. Such an analytical step would also assist in identifying the subsequent application of other statistical techniques to be utilised in this regard if further analysis is necessary.

Correlation among knowledge economy input factors and knowledge outcome factors

The relationship among the six surrogate knowledge economy input factors as identified earlier – ICT infrastructure and services in Oman, local R&D capabilities, training support, general education, governance and regulatory regime, and ICT status, and knowledge economy output factors manifested in productivity, and knowledge acquisition - is presented in Appendix (12). It is interesting to observe that among the twelve relationships between these eight factors, there are four low correlations:

- local R&D capabilities and productivity with a correlation coefficient of 0.211 significant at 0.01 level (2-tailed);
- training support and knowledge acquisition with a correlation coefficient of 0.196 significant at 0.01 level (2-tailed);

- ICT status and knowledge acquisition with a correlation coefficient of 0.157 significant at 0.05 level (2-tailed); and
- local R&D capabilities and knowledge acquisition with a correlation coefficient of 0.139 which has no significance.

The rest of the eight correlations indicated negligible correlations with coefficient values below the 0.10. In such a situation according to Hair et al. (2006), Tabachinik and Fidell (2001) and Pallant (2006), any subsequent analysis will not produce useful empirical results. These results seem to be in line with the literature which suggests low preparedness for the knowledge economy in developing countries and in the MENA region in particular. This also confirms the benchmarking result which showed low readiness in knowledge economy readiness in Oman.

6.5 Summary of the Chapter

This chapter provided a thorough analysis of the research problem and tried to answer the research questions through different research approaches. The triangulation of the analysis has helped narrow the gap in knowledge economy measurement particularly in Oman as a small developing country. This triangulation of the data analysis appeared to be useful, given the inclusion of potential main developers, providers and users of the knowledge economy in Oman.

The first phase of this data analysis involved applying a benchmarking process in the form of knowledge assessment methodology (KAM) which enabled the researcher to assess the current knowledge economy readiness in Oman. The result of this phase showed an existence of a knowledge economy base exemplified in the knowledge economy pillars. However, the existence of this base appeared to be ineffective due to the Omani economy's low and varying degrees of readiness.

The second phase of analysis consisted of a qualitative phase where nine senior government officials were interviewed. The aim of this qualitative approach was to provide insights into the role of the government in identifying the key drivers of the knowledge economy. The result of this phase identified five knowledge economy drivers that could lead Oman to a successful knowledge economy pursuance.

Although these five drivers appeared to add training as an additional driver to the four drivers initially identified through the knowledge economy literature, these five drivers are still focused on the knowledge economy main pillars (drivers) and the fifth driver seems necessary at this stage from the interviewees point of view to complement the education system in Oman which has been characterised by its mismatching of the local market's needs.

The third and final phase of this analysis applied a quantitative approach where 197 survey questionnaires were analysed using non-parametric analysis techniques. Factor analysis and Pearson correlation statistics were applied. The findings of this phase seem to complement the qualitative phase where six factors were identified as drivers of knowledge economy development in Oman though with varying degrees of importance. These six factors added two more drivers to the four main knowledge economy drivers identified by the literature. However, the additional two factors namely, training support and ICT status, still fall within the knowledge economy main pillars.

The next chapter will summarise the main findings of the previous chapters along with recommendations for implementing the knowledge economy initiative in Oman. It will also provide some recommendations for future studies on the knowledge economy in Oman.

Chapter 7. Conclusions and the Way Forward

7.1 Introduction

The aim of this research was to explore the prospects of developing a knowledge economy as a feasible route to economic diversification and sustainability in Oman. In the process, the thesis has reviewed an extensive armament of literature on the knowledge economy and developed a knowledge framework for Oman, which is based on qualitative and quantitative analysis of the data collected and interviews conducted for this purpose. This chapter summarises the main findings and outlines the way ahead for establishing a knowledge based economy in Oman.

This study was the first attempt to delineate key factors that may assist the government of Oman in developing a sustainable knowledge economy. The conceptual framework used to guide this study, the methodology conducted in collecting data, and the analytical techniques used to analyse such data were generated from different studies and experiences worldwide, and have provided a wealth of knowledge that could establish the foundation for sustainable knowledge economy development in Oman.

Indeed, many studies have tackled the development of the knowledge economy in terms of the benchmarking and the measurement processes from developed or major developing countries' point of views. However, very little has been examined regarding the relevance and potential of this new economic path for the MENA region economies and for Oman in particular.

This chapter is organised in the following manner. Section 7.2 summarizes the importance of the knowledge economy and its relevance to Oman's economic development in particular. Research questions are addressed in Section 7.3 which relates them to the research results. Section 7.4 discusses briefly the research phases and their findings. The way forward is presented in Section 7.5, where lessons extracted from this study are discussed. The limitations of this research are outlined in Section 7.6, where conclusions reached may be constrained by certain factors that

should be kept in view in any similar future studies on Oman. Section 7.7 highlights the recommendations for further research.

7.2 Importance of the Knowledge Economy for Oman

The apparent promise of the knowledge economy for Oman and the other developing countries lies not only in the fact that economic contribution of physical resources can be greatly augmented through knowledge accumulation and utilisation, or that knowledge economy provides a viable solution for the current socio-economic stagnations. The promise of the knowledge economy is also that it represents a real and achievable opportunity that may not be repeated in the foreseeable future to put Oman's economy on the trajectory of sustainable economic development, provided that a meaningful and relevant environment and strategies are put in place. This requires the inclusion of all stakeholders, decision makers and interest groups in this process.

As noted in Chapter 2, Oman has made admirable progress in the last 35 years in respect of socio-economic development. However, it is widely recognised that in view of the gradual decline of production and the depletion of oil reserves, oil prices fluctuations, increase in population, and globalization of the world economy, Oman's current model of economic development cannot be sustained. The Omani government is also aware of these challenges and has launched new initiatives aimed at economic diversification. These initiatives include: gradual privatization of public companies, laws to attract foreign direct investment, development of human resources, broadening private sector participation, and development of gas and tourism industries (MNE, 1996).

Although endorsed by international institutions such as the World Bank, these economic initiatives fall far short of a strategy for creating an internationally competitive and sustainable economy that is gainfully engaged with the world economy (McBrierty and Al Zubaire, 2004).

The basic premise of this study is that Oman urgently needs to take concrete steps towards developing a knowledge based economy. This premise is supported by

extensive literature that reveals that knowledge has become the key driver of sustainable economic growth and that developing countries should introduce policies for the enhancement of government institutions, raising the standards and coverage of education and training, and promoting information and communication technologies, and research and development as integral parts of a strategy for knowledge economy pursuance.

7.3 Research Questions

In this context, the following questions were addressed in this study:

Q1. What is the current readiness of Oman's knowledge economy drivers (pillars) in terms of the quality and effectiveness of:

a. government institutions and economic incentives;
b. education and training;
c. information and communication technologies (ICTs); and
d. research and development and innovation.

The benchmarking process provided useful insights for answering this question.

Q2. What is the potential role of the government in Oman in enhancing the knowledge economy development in terms of:

a. plans to stimulate the education and training outcomes;
b. mitigating the obstacles that hinder optimal utilisation of ICT capabilities in Oman;
c. plans in regards to the research and development, and innovation systems that boosts internal and external knowledge absorptive capabilities; and
d. enhancement of governance effectiveness to promote the above knowledge economy pillars.

The qualitative approach manifested in the interview phase of nine senior government officials generated an answer to this question.

Q3. What are the potential key drivers (factors) of knowledge economy development in Oman?

The quantitative approach provided an answer to this question. This question was divided into five sub-questions that represented the knowledge economy four pillars and the knowledge outcome.

7.4 Research Investigation Phases and Results

This research incorporated qualitative and quantitative approaches in addition to the benchmarking process to gather relevant information. The decision to use both these approaches was necessary due to the current level of Oman's socio-economic development, where useful and relevant output indicators of the knowledge economy are yet to be realised. This research indicates that Oman needs to continue to increase efforts to enhance its knowledge economy drivers, particularly its education, ICTs and R&D systems. In addition, a more proactive policy response is required from the government and the private sector to achieve more balanced economic development across the different sectors and industries of the economy.

As noted earlier, the following three phases of research methodology were utilised to investigate the main research questions raised in this thesis:

- the benchmarking analysis;
- the qualitative analysis; and
- the quantitative analysis.

7.4.1 Results of the benchmarking process

This benchmarking process revealed Oman's strength in respect of its regulatory regime and governance effectiveness. In terms of regulatory regime, Oman's comparative standing was at the 80th percentile while it was at the 70th percentile in

terms of governance effectiveness (World Bank 2007). Indeed, Oman was found to be second best among the comparator group in regulatory regime - just after Finland, and third best in the effectiveness of governance - after Finland and Malaysia. Oman's commitment to the WTO obligations as well as the steady expansion of the role of the private sector in the Omani economy appears to have contributed to this positive performance. However, when taking into consideration the third indicator of this knowledge economy factor, namely the economic incentives in the form of the law on intellectual property rights, Oman's aggregate standing was not as competitive as that of the other members of the benchmarking group. As noted by Aubert (2004), this is likely to be due to the late and slow introduction of legal protection of intellectual property rights in Oman.

In the education and training factor, the literacy of population above fifteen years of age and the gross secondary enrolment rate were the two positive performance areas in Oman. These indicators stood above the 50^{th} and the 40^{th} percentiles respectively, placing Oman in the second and third best position among the benchmarking group. The literacy rate was second best with 81 per cent of total population, just behind Finland (with 97 per cent), while gross secondary enrolment rate was third, after Finland and the GCC countries averages. This positive performance has been related to the government's emphasis in promoting a campaign for universal education since 1970, offering elementary and secondary schooling to all people in the country regardless of their age, gender or location.

However, this strong and positive performance in literacy rate and gross secondary school enrolment was in contrast with the third education indicator, namely the tertiary education enrolment, which stood at about 13 per cent of the population in the age group eligible for tertiary education. As a result, Oman lags far behind the benchmarking group in tertiary education – being the lowest among them compared to 25 per cent in the MENA region, 26 per cent in Malaysia, 30 per cent in the world and 85 per cent in Finland. Oman's low performance in this important education indicator has been related to the lack of a higher education promotion strategy. The first university in the country was inaugurated only in 1986. According to the World Bank (2004), the low tertiary education enrolment was a major factor hindering economic progress in the MENA region as a whole as well as in Oman.

Looking at the main information and communication technologies indicators, Oman appeared to fall behind the entire benchmarking group in all of the three measuring indicators. Only the number of telephones is ranked above the 50th percentile, while internet users and the number of computers both per 1000 inhabitants were in the 40th and 30th percentiles respectively. These figures compared with Finland's figures which were above the 80th percentile on the three indicators. The figures for the rest of the benchmarking group were between the 50th and the 70th percentiles. These figures seemed surprisingly low for Oman, which possesses a modern ICT infrastructure in common with its GCC neighbouring countries. According to Gartner (2002) and Al-shihi (2006) this poor performance in ICTs in Oman has been related to a multitude of factors, most notably ineffective management, lack of proper competition between ICTs providers, high fees and lack of public and business awareness of the importance of ICTs in today's globalised world.

In R&D and innovation, Oman was significantly weak as compared to its benchmarking group in all the main indicators of this pillar. In fact, its R&D expenditure as a percentage of GDP (10th percentile) is the lowest not only in this benchmarking group but also worldwide.

To sum up the results of the benchmarking process, Oman generally stands below the benchmarking group with varying degrees of readiness:

- The effective governance and economic incentive factor scored the best readiness among the benchmarking group *albeit* it is still below the competitive edge.
- Notwithstanding the impressive standing in respect of the literacy rate and secondary school enrolment, Oman's low tertiary enrolment seems to pull the country down in respect of the education and training factor, hindering its knowledge economy readiness.
- ICTs, R&D and innovation factors represent a further challenge to policy makers in Oman as they were the weakest of four essential driving factors among the knowledge economy chain.
- Inconsistency and incomprehensiveness of policies are common weaknesses in Oman's knowledge economy factors, which unless addressed through a more

comprehensive strategy consisting of coordinated policies, could limit and slow down Oman's progress in developing a knowledge based economy in a timely manner.

7.4.2 Results of the qualitative approach

The second phase necessitated a qualitative data gathering strategy in the form of an interview approach where participants' profiles, techniques, justification and limitations were discussed. The aim of this stage was to collect information from knowledgeable informants who were in a position to provide directions, insights and useful information on the problem under investigation.

The interview phase consisted of in-depth interviews in Oman targeting nine senior government officials from seven ministries, one partially government-owned company, and one government-owned and run ICT park. The interviews conducted with these officials were based on their direct involvement in planning and supervision of economic development strategies that are related to the knowledge economy pillars.

The key findings of the qualitative phase are noted below.

In the context of the current pressure on Oman's limited natural resources, in addition to the increasing shift from resource-based economies with traditional factors of production to knowledge and information based economies, the knowledge economy option seems to appeal to the policy makers in Oman.

Although the literature identified four drivers of the knowledge economy, the interview phase revealed five common themes that are believed to be important for transforming Oman into a knowledge-based economy. Education was on the top of these five drivers of knowledge economy in Oman. This is consistent with the findings reported by many international knowledge economy studies, including OECD (1996), Neef (1998), ILO (1999), Grewal et al. (2002), World Bank (2002), APEC (2003),

Rassekh (2004), Sluis et al. (2005) and UNESCO (2005a), all of which stress the importance of education in economic development.

Training was identified as the second essential and separate driver of the knowledge economy in Oman. Although the literature on the knowledge economy generally considers both education and training as two parts of a single life-long learning process, the emphasis on training by the Omani interviewees was based on many studies that have tried to diagnose the poor performance of both local workers and of the private sector in Oman (Wilkins, 2002; ESCWA, 2003; Al-Lamki, 2005). These studies have revealed a major disconnection between Oman's vocational training system and the skills required by a competitive private sector. Indeed, vocational and technical training have also been emphasised for similar reasons by several international studies as a practical solution to bridge the gap between the education systems outputs and business sector requirements worldwide (Becker et al., 1993; Neef, 1998; OECD, 2001).

Information and communication technologies (ICTs) have been identified as the third most common factor required to assist in transforming Oman to a knowledge-based economy. The potential benefits of ICTs in the form of acquisition, dissemination and utilisation of knowledge were considered to be undeniable, once again consistent with the lessons of the literature on the knowledge economy (Milgrom and Roberts, 1990; Black and Lynch, 2000; Black and Lynch, 2001).

Effective coordination between the government and the private sector as a form of effective governance was the fourth common factor that has emerged from this interview phase. However, the main motivation behind this factor in Oman was somewhat different from that in the international literature. While international studies (e.g., Padmanabhan, 1993; Gregersen and Johnson, 1997; OECD, 2000; Wood, 2003) view effective governance as a means of facilitating effective application of knowledge economy policies, in Oman the main reason for favouring effective governance appears to be to create new employment opportunities in the country. This is understandable because the government remains, as noted above, the leading source of employment in Oman.

Development of scientific research has been identified as the fifth common theme among the participants, although it is not considered by the interviewees to be a very strong driver of the knowledge economy in Oman. This view of R&D may appear to be inconsistent with the literature, but could be justified in terms of the relative weight of this factor in comparison to other more urgent priorities in Oman, such as education and training and ICT infrastructure, and the need for new employment opportunities for Omani workers. In other words, the interviewees appear to assign a lower pay-off value to investments in R&D and innovation at this stage than the expected pay-offs from investments in the other knowledge economy priorities mentioned above. The reason for this may be that currently Oman is so far behind in R&D and innovation indicators that in the initial stages new investment in this direction is not expected to make much difference. This attitude does not necessarily deny that R&D is an essential knowledge creation tool. Instead, what the interviewees seem to indicate is that it will take a very long time for Oman to develop an R&D system and that there are more urgent priorities that need to be met in the meantime.

7.4.3 Results of the quantitative approach

The third data collection phase required the use of a quantitative data collection technique. The research instrument for collecting such data was a mailed survey. The aim was to measure the current knowledge economy outcome in Oman. In fact, similar questionnaire surveys were utilised in some developed countries in Europe and in some developing countries such as Malaysia (European Innovation Commission, 2002; and Department of Statistics Malaysia, 2002; Saisana, 2005). These questionnaire elements and variables provided guidance on the development of this questionnaire survey in Oman.

As most of the population would not have been able to provide the appropriate information for a new phenomenon like the knowledge economy in this study, 310 ‘grade excellent’ companies in the service sector in Oman were selected as the target group. The Chief Executive Officers (CEOs), managing directors and general managers of these companies were chosen as the survey objects for this study, as they were providers of the relevant information on the potential utilisation of the knowledge economy.

Utilisation of the factor analysis has yielded six (independent variables) factors that are believed to facilitate knowledge economy development in the form of better productivity and knowledge acquisition. Although the general literature identified four knowledge economy drivers, and the interview stage revealed five factors, the generation of six factors by the questionnaire stage still falls within the boundaries of the four key drivers of the knowledge economy, as summarised in the sub-section below.

ICT infrastructure and services in Oman

ICTs are very important to major service companies in Oman as they have been identified as the most important potential factor in a knowledge economy outcome (dependent variable). However, in accordance with the benchmarking result, the current ICTs in Oman are of minimal effect, as participants saw ICTs currently playing almost no role in the knowledge outcomes (in the form of better productivity and knowledge acquisition). This result seems to be in contrast to what the knowledge economy literature suggests, i.e., that substantial productivity growth has been experienced from the usage of ICTs as a result of overcoming geographical boundaries to share information, reduce uncertainty, reduce transactions costs and increase competitiveness across borders, all of which have produced a competitive edge for these economies (OECD, 1999; World Bank, 2002). The explanation of the apparent contradiction may lie in the low level of current status of ICTs in Oman. More on this point will be said further below when ICTs status is discussed.

Local R&D capabilities

Local R&D capabilities as part of the R&D and innovation process has been identified as the second most important among these six factors. Despite this importance of local R&D capabilities, however, the current local R&D capabilities do not support better productivity and knowledge acquisition which again seem to be consistent with the low readiness of R&D and innovation in Oman noted earlier in the benchmarking stage. This result is in line with the literature which suggests that low R&D and innovation readiness does not nurture innovation and competitiveness.

Training support

This factor was identified by the survey respondents as the third most important factor in promoting the knowledge economy. Separation of training support from the education pillar in Oman can be explained by the fact that both the government and the private sector in general consider 'training' as an important educational policy instrument for rectifying the currently low skill levels of Oman's workforce. This emphasis on the importance of training support has its roots in the literature on life long learning, which is considered to be crucial for a modern economy in which workforce is all the time required to master new technologies, new processes and new skills. Despite the importance of this factor as a potential knowledge economy driver, the quantitative phase of this research found little evidence of the contribution of training to Oman's knowledge outcomes in the form of higher productivity and knowledge acquisition. As suggested by Wilkins (2002), this may be explained by the current mismatch between the contents of training programs and the skill requirements of the local market. In other words, to make positive contribution to knowledge outcomes, it is not sufficient to have any type of training programs. Rather, training programs must also be relevant for addressing the market requirements.

General education

This is the fourth most important ranked factor. This is because developing human capital has been positively related to higher income, better public health, political and community participation, social cohesion and greater complementarity with new technologies, all of which are essential to the development of knowledge economy (Lee et al., 2002). However, according to the survey, the effect of the education system on the knowledge economy outcome is considered to be neutral in Oman. Despite the continuous reforms of the education system in Oman, this neutral result could be explained by the fact that the new education restructuring cannot be realised at this stage as this reform was started only in 1995 and it may take up to 2010 to bear fruit in terms of better outcomes (ESCWA, 2003).

Governance and regulatory regime

This was the fifth ranked most important factor in knowledge economy pursuance. Interestingly, the descriptive analysis revealed a positive relevance to the knowledge

outcome in the form of better productivity and knowledge acquisition. This positive result is in contrast with the literature – at least in Oman – which perceives the current state of governance and regulatory regimes in the MENA region (including Oman) as ineffective and a major obstacle in economic development (World Bank, 2004; Yousef, 2004). As a result, this finding acknowledges that the governance and regulatory regime in Oman has a positive role in enhancing an environment that is conducive to higher competitiveness, productivity and knowledge acquisition, and that could stimulate sustainable growth. This according to *Al Markazi* (2007) could be attributed to the government's keenness to update and modernize its administrative and legal systems in meeting its WTO obligations, such as the introduction of the e-governance initiative more than ten years ago, along with updating and reforming of the regulatory regime in the country.

ICT status

Although this factor is ranked last among the six important factors, it is by no means the least important. Indeed, this factor has been identified in the literature as part of the ICT system (World Bank, 1998; OECD, 2001; APEC, 2003). In contrast to the first factor (ICT infrastructure and services), which was until recently provided exclusively by the government, the descriptive analysis shows that ICT status has made positive contribution to knowledge outcomes manifested in better productivity and knowledge acquisition. This could be explained by the fact that major service companies in Oman have invested in good internal ICT systems, and in management and human resources that have assisted them in acquiring better productivity and knowledge acquisition. This internal ICT relevance to a better knowledge outcome has been supported by the literature as over 60 per cent of production in the OECD countries is attributed to knowledge workers who utilise internal ICTs as their main input (Lim, 2002; Rodrigues, 2002).

7.4.4 Knowledge outcome factors

The following knowledge outcome factors (dependent variables) have been extracted from the factor analysis:

Productivity (performance)

This was the first of two factors that resulted from the knowledge outcome indicators. In fact, it was performed separately from the knowledge input factors to show the effect, relationship and strength of relationship between knowledge economy input factors and output factors.

The result of correlation analysis generally showed that although there was some relationship between productivity as an output factor and the knowledge economy input factors, the relationship was not statistically significant. In fact the correlation matrix showed correlation coefficients between 0.211 as the highest score and 0.139 as the lowest score. This means that after incorporating ICT infrastructure and services, local R&D capabilities, training support, general education, governance and regulatory regime, ICTs status had a low and negligible effect on the productivity level and performance in general in the major service companies in Oman. Following the interpretations given by Hair et al. (2001), Tabachinik and Fidell (2001) and Pallant (2006), the presence of such low correlation generally means that any subsequent analysis is unlikely to produce useful empirical results in such cases.

Knowledge acquisition

This is the second knowledge economy output factor which showed similar low and negligible correlations results between knowledge economy input factors represented by ICT infrastructure and services, local R&D capabilities, training support, general education, governance and regulatory regime, ICT status and knowledge acquisition.

Similarly, the correlation matrix showed a low correlation coefficient that ranged between 0.211 and 0.139 indicating that ICT infrastructure and services, local R&D capabilities, training support, general education, governance and regulatory regime, and ICT status had a low and negligible correlation effect on the knowledge acquisition in major service companies in Oman. This correlation result confirms the benchmarking result which showed a low readiness in knowledge economy in Oman. Such a result seems to be in line with previous studies conducted on the MENA region both at the macro level (World Bank, 2004) and the micro level (Bontis, 2004) suggesting a similar outcome. According to Bontis (2004), and Abouzeedan and

Busler (2006) these are direct consequences of the low readiness of the knowledge economy drivers.

7.5 The Way Forward: Government Must Lead

Seven key lessons have been learned from this research project, all of which suggest that Oman's government needs to play the leading role in the country's quest for sustainable knowledge based economic development. These lessons are briefly noted below.

1. The knowledge economy development experiences emphasize a gradual, step-by step coordinated and complementary development of all knowledge economy key factors or drivers, synchronized with the country's current level of economic development. A comprehensive and more integrated knowledge economy strategy is required in which all knowledge economy drivers are equally promoted.
2. Because the knowledge economy approach is broad – it permeates many areas of the economy and involves many actors. Thus it is important to include all stakeholders in building a national consensus and achieving a set of coherent strategies across different of parts of the government, the private sector and civil society.
3. As a result, the triangulation of data collection for this research – where a benchmarking process, qualitative and quantitative approaches were used – seems to add to the robustness of the empirical findings, as all potential stakeholders were involved in this study. The findings of these different data collection approaches have complemented one another where six factors were identified in the final quantitative stage as drivers of knowledge economy development in Oman. These six key factors added two more factors to the four main knowledge economy drivers identified by the literature. However, the additional two factors namely, training support and ICT status, still fall within the knowledge economy main pillars.
4. The successful transition to a knowledge economy typically involves elements such as making long-term investments in modernizing the ICT infrastructure and services, local R&D capabilities, training, general education, enhancing the governance and regulatory regime that is conducive to market transactions,

and internal ICT culture for promoting higher productivity and new knowledge acquisition within the business sector in Oman. These drivers together constitute the knowledge economy framework.

5. Contrary to some beliefs, the concept of the knowledge economy is not restricted to only high technology or information technology. In fact, all economic sectors, including agriculture, light and heavy manufacturing and the service sector, can benefit from applications of new knowledge, technology and innovation, provided that right and effective plans are in place.
6. The importance of a national knowledge economy development vision and ensuring that the country's political and business leaders understand, support, and are fully committed to such a vision. In fact, this is critical to the successful implementation of a knowledge economy approach
7. Successful knowledge economy development must be safeguarded by an expanding social safety net that helps in mitigating any negative effects of economic restructuring against the possibility of rising inequalities in income and in accessing education and ICT services (e.g., the digital divide).

All these lessons are important and it is clear that the leading role of the Omani government is crucial in every one of these lessons. This is because the current status of the Omani economy is such that the public sector plays a vital role in its economy and society. As noted in the earlier chapters, the private sector in Oman is not yet developed sufficiently, and is basically oriented towards meeting domestic demand, with little engagement with the global economy. Under these conditions, a sudden wave of deregulation and privatisation is not likely to benefit the private sector because of its low level of readiness. Instead, gradual opening up of the domestic markets to private sector enterprises under guidance and support from the government might be a better approach. Lessons could be learned in this regard from Finland, Ireland and Malaysia where experimentation, pilot projects and many other forms of gradualism have been used during the process of marketization of the economy.

Thus, the government will need to lead the transformation of the Omani economy into a knowledge-based economy. This would require much more than only new investment in education and training, modernizing the information and communication infrastructure and developing a culture of innovation in both the

private sector and the public sector. The transformation of the economy would also require public service reforms and development of new organisational structures for enhanced the role of government in coordination with the private sector.

International experience suggests that the combination of globalisation and knowledge economy development has been accompanied by increasing income inequalities in most parts of the world (IMF, 2007; Al-Rahbi et al., 2008). The inequalities rise when the benefits of economic change are captured by the elites, or when access to education and training is denied to the poor households, or when ownership of income producing assets – land, skills, and new technologies – is restricted to only certain privileged sections of the population. Some East Asian countries have managed to avoid the rise in income inequalities because they have undertaken serious reforms in education and training, R&D and innovation, ICTs and governance, resulting in all sections of the population having benefited from new economic growth. This suggests that the Omani government will also need to undertake such reforms and to build social safety nets to protect the vulnerable sections of its population.

Finally, the knowledge economy is not going to emerge in Oman in the short run or even in the medium term (three to five years). This transformation will take much longer. It is essential therefore to put in place institutions and organisational structures that support the economic transformation, monitor emerging trends, anticipate emerging problems and find innovative solutions. In this regard, the deficiency of economic and social data on Oman's economy must be addressed as a priority. Progress towards knowledge economy would be easier to monitor with consistent series of statistics on the knowledge economy indicators and factors. Also, the development of new innovative solutions is also enhanced if analytical studies of policy options are founded in up-to-date statistics on relevant sectors and industries of the Omani economy and society.

7.6 Limitations of this Research

Conclusions reached throughout this thesis have been limited by the following factors which should be considered in future knowledge economy development studies:

- The knowledge economy is still an evolving phenomenon and represented a new area of research to the majority of the surreys' participants. This was evident during the interview and pre-testing phases where participants requested that many terminologies, statements and questions should be explained and put in layman's format.
- This research was conducted on one country only. It may not be possible to generalise the findings based on this research to other countries, but this study should still serve as a foundation for further research on the development of knowledge economy in other countries, particularly in the GCC countries where similar socio-economic peculiarities exist.
- In this study, only those input indicators were used in the benchmarking process and in the questionnaire survey, which were representative of Oman's socio-economic development level and its specific peculiarities. In a different country, different input indicators might be more suitable.
- The survey questions (elements) were designed to suit the conditions in Oman, but were based on the literature resulting from similar surveys conducted in Europe and Malaysia, with one caveat in mind. In Europe and in Malaysia, the purpose of the surveys was to measure the effectiveness of existing knowledge economy strategies. The survey questions in this study had to be modified due to the fact that such a strategy has not yet been developed in Oman.
- The quantitative survey was biased and confined to only one segment of the service sector, namely major service companies in the service sector in Oman. Other business segments were excluded as they were least likely to provide useful information on knowledge economy development. In such a situation the results may not represent the situation prevailing in the other business sectors.

In spite of these limitations, the study was widely welcomed by the survey participants. Their enthusiasm was reflected in the number of senior government officials who agreed to take part in the interview stage and the high response rate in the questionnaire survey. It should also be stressed that the seeding process of a knowledge economy foundation in Oman seems to be gaining momentum through the

development of knowledge economy drivers, although there is no explicit knowledge economy strategy in the country.

7.7 Recommendations for Future Research

It is clear from the foregoing discussion that Oman's economy would benefit from further research on several aspects of the knowledge economy. In particular, future research should be conducted in view of the following recommendations:

- Future research could replicate this study in other major business sectors in Oman such as manufacturing, trade and transportation, as this could further evaluate the current status of knowledge economy readiness in Oman from other important business angles.
- Inclusion of small and medium-size companies in future research is essential to complement this study and reach a better and more comprehensive assessment of knowledge economy readiness in the country provided that local SMEs are capable of providing useful feedback on this issue.
- Future research could also be carried out studying knowledge economy output indicators which represent more advanced economic development and could add valuable knowledge to this study by complementing its input indicators results.
- The replication of this study in other national contexts could further improve an understanding of the factors important to develop knowledge economy strategies especially at the GCC countries level due to socio-economic, cultural, historical and religious similarities which would enhance and speed up their socio-economic integration.

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Appendix 1. Interview invitation letter and consent form

Date:

Name:

Position & Address:

Re: Key knowledge economy factors for sustainable economic development in Oman

The government in Oman has been working extensively and on many fronts to diversify the economy to reduce its dependents on non-renewable natural resources such as oil, gas, and minerals. Recent economic studies in developed and major developing countries show that a shift is occurring towards more sustainable economic development. As a result, remarkable economic achievements have been accomplished. There is a consensus among economists, international bodies, and academics that these new achievements have been attributed to the application of knowledge-based economy strategies in developed economies, where 70 per cent of employment and job generation is attributed to this phenomenon. It is evident that knowledge has become the main engine of economic growth, social development and the primary source of competitiveness in today's world market.

The term knowledge-based economy refers to an economy in which the use of knowledge, as manifested in new technologies, better processes and workforce skills are applied to a broad range of industries and sectors, and are the main drivers of growth across all industries. Initiating knowledge economy development is a viable alternative that Oman should consider to create a sustainable economic development.

This survey is part of Doctor of Business Administration (DBA) study being sponsored by Muscat Municipality and undertaken by the researcher Ibrahim AL-Rahbi and supervised by Professor Bhajan Grewal from the Centre for Strategic Economic Studies at Victoria University. It aims at exploring and identifying key factors that would contribute to the development of knowledge-based economy in Oman. In this research, success is related to those factors that will help the government achieve its economic development in a transition process that will lead to economic diversification and sustainability in the next twenty years. Oman's successive five-year economic plans, in addition, to its economic development vision – Oman 2020, seem to have paved the way to facilitate this important transitional process.

In order to achieve the desired goals, the researcher is hopping to **conduct an interview for 30 minutes** with officials such as yourself, who is in a position to provide valuable information on economic decisions, policies, suggestions or any related data. Based on that, we would like to invite you to be part of this study, which will help the researcher identify the specific key factors that would lead to possible creation, adoption, and diffusion of knowledge-based initiatives in Oman. This study has major significance to Oman's economic diversification process as a feasible alternative that should be considered seriously not only to create more decent jobs for Omanis and improving their productivity output, but as a sustainable economic development that the government has been hoping for.

I assure you that all responses will be confidential. Could I ask you please to complete the attached consent form prior to our interview.

Thank you in anticipation of your involvement

Yours sincerely,

Ibrahim Abdullah Al-Rahbi

Any queries about your participation in this project may be directed to the researcher (Name: Ibrahim Al-Rahbi phone number. In Oman 968-99541533, in Australia + 61 3 92481170) or Supervisor (Name: Prof. Bhajan Grewal. Phone number + 61 3 99191344). If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University of Technology, (Phone number: + 613-99194148) PO Box 14428 MC, Melbourne, 8001, Australia.

CONSENT FORM
FOR THE INTERVIEW PARTICIPANTS
INVOLVED IN RESEARCH

INFORMATION TO PARTICIPANTS:
We would like to invite you to be a part of Doctor of Business Administration (DBA) study into **'An Empirical Study of the Key Knowledge Economy Factors for Sustainable Economic Development in Oman'** which is sponsored by Muscat Municipality.

The objective of this study is to explore and identify factors that would contribute to the development of knowledge-based economy in Oman. In this research, success is related to those factors that will help the government achieve its economic development in a transition process that will lead to economic diversification and sustainability in the next twenty years. Specifically, this study includes the examination of government institutions and economic incentives, education and training, information and communication technologies, research and development and innovation. This project has commenced with a general literature search process focused on key concepts from the following areas: Economic development in Oman, economic development in developed and major developing countries, World Bank (WB), Organization for Economic Cooperation and Development (OECD) studies. This literature search helped to set and refine the study's aims and the research questions. The study will further undergo a more focused literature search on successful knowledge economy experiences in the world in order to identify feasible knowledge economy take-up factors. Thus, structured interview will be conducted by Mr. Ibrahim Al-Rahbi to explore more information on this issue from some government policy-makers who will be targeted to enrich the data gathering. The interview will be taped or note taken according to the participant's preference in order to record information accurately. The information gathered will be kept confidential along with the identity of the participant. Serious measures will be taken to insure the anonymity and confidentiality of the participant and the information collected.

CERTIFICATION BY SUBJECT

I,

of

certify that I am at least 18 years old* and that I am voluntarily giving my consent to participate in the study:
'An Empirical Study of the Key Knowledge Economy Factors for Sustainable Economic Development in Oman'] being conducted at Victoria University under the supervision of: **Prof. Bhajan Grewal**.

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by the researcher: **Ibrahim Al-Rahbi**

and that I freely consent to participation involving the use on me of these procedures:

- I am participating on voluntary bases.
- The interview will be: Audio taped Notes taken. (please circle your preference)
- The interview will take place in my office
- The information gathered from me will be kept confidential along with my identity.
- Serious measures will be taken to insure anonymity and confidentiality of participants and information collected.

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

Signed:

Witness other than the researcher:

Date:

Any queries about your participation in this project may be directed to the researcher (Name: **Ibrahim Al-Rahbi. Phone number in Oman: +968 99541533. Phone number in Australia:** + **61 3 92481170 or + 61 3 424259660)** or Supervisor (Name: **Prof. Bhajan Grewal**. **Phone number + 61 3 99191344)**. If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University of Technology, Phone number: (61 3) 99194148. PO Box 14428 MC, Melbourne, 8001

Interview Invitation Letter (Arabic)

المحترم

سعادة / الفاضل:
الوظيفة:
الوزارة / المؤسسة:
الموضوع: إقتصاد المعرفة من اجل تنمية إقتصادية مستدامة بسلطنة عمان

السلام عليكم ورحمة الله وبركاته ... وبعد

إن الحكومة الرشيدة سعت ولازالت تسعى جاهدة في تنويع مصادر الدخل بالسلطنة للحد قدر الإمكان من الاعتماد على مصادر الثروات الطبيعية خاصة البترولية منها القابلة للنفاذ . إن الدراسات الاقتصادية الحديثة بالدول المتقدمة تحديدا تؤكد أن هناك تحولا هاما قد طرأ على مفهوم الإنتاجية بالاقتصاد التقليدي الذي يعتمد أساسا على مدخلات الأرض والمال والعمالة . هذا التحول مرده إلى دخول عناصر جديدة في مدخلات الإنتاج التي أصبحت أكثر أهمية من العناصر السابقة في تحديد مستوى نوعية وكمية الإنتاج. .إن هناك إجماعا لدى الكثير من الاقتصاديين والأكاديميين والمنظمات الاقتصادية الدولية إن هذا التحول أضحى حقيقة اقتصادية واقعة في ما بات يعرف باقتصاد المعرفة الذي اصبح المصدر الرئيس في خلق وتوفير فرص العمل لشعوب الدول المتقدمة وبعض الدول النامية. كل ذلك يؤكد إن اقتصاد المعرفة أصبح بلا منازع المجال الاقتصادي الأرحب لتوسيع وتنويع مصادر الدخل للوصول الى التنمية المستدامة.

إن مفهوم إقتصاد المعرفة يشمل الإستخدام الأوسع والأمثل للمعارف الحديثة المتمثله في تكنولوجيا المعلومات والخبرات المكتسبة في جميع المجالات الإقتصادية خاصة تلك المتعلقه بقطاع الخدمات بما يحقق الكفاءة والجودة في الإنتاج .

ان هذا اللقاء جزء من عملية جمع البيانات والمعلومات لدراسة الدكتوراه في إدارة الأعمال بعنوان ' دراسة بحثية لأهم عناصر إقتصاد المعرفة من اجل تنمية إقتضادية مستدامة بسلطنة غمان ' والتي تنفذ بواسطة الفاضل/ إبراهيم بن عبدالله الرحبي وبإشراف البرفيسور بهاجان جروال من مركز الدراسات الإقتصادية الاستراتيجية بجامعة فيكتوريا بإستراليا . تهدف هذه الدراسه الى معرفة العوامل التي يمكن ان تساعد الحكومة في وضع السياسات الإقتصادية لمفهوم الإ قتصاد الجديد. من خلال هذه الدراسة فإن عوامل نجاح سياسات إقتصاد المعرفة تكمن في إستبيان الأسس التي سوف تمكن الحكومة من التعرف على مقومات ومدى إمكانية تطبيق سياسات إقتصاد المعرفة بالسلطنة من اجل التوسع في تنويع مصادر الدخل . ذلك أن خطط الحكومة الخمسية المتعاقبة وكذلك الرؤية المستقبلية للإقتصاد العماني 2020 قد أسسا لبناء إقتصاد المعرفة.

من أجل تحقيق أهداف هذه الدراسة فإن الباحث يتطلع لإجراء مقابلة مع شخصكم الكريم مدتها 30 دقيقة من اجل الاسترشاد والوقوف على أرائكم من خلال موقعكم الهام في هذه الوزارة / المؤسسة الموقرة فيما يتعلق بدورها في بناء بعض أسس اقتصاد المعرفة لتكون رافدا هاما و متجددا للتنمية بالسلطنة. من المتوقع أن تسهم نتائج هذه الدراسة ولو بقدر يسير على دفع عجلة التنمية الاقتصادية المستدامة بالسلطنة بما يحقق الآمال المرجوة.

نؤكد لكم أن مضمون هذا اللقاء وكذلك أجوبتكم على جميع استفسارات الباحث المشار إليه سوف تكون سرية ولن يتم ذكر أية أسماء سوف تأتي في سياق مشروع جمع البيانات والمعلومات وإعداد هذه الدراسة. في حالة الموافقة على ذلك فإننا نرجو التكرم بتكملة البيانات والتوقيع على استمارة الموافقة المرفقة قبل البدء بهذه المقابلة.

شاكرين ومقدرين لكم حسن تعاونكم في كل مما شأنه إنجاح هذه الدراسة.

وتفضلوا بقبول وافر الاحترام والتقدير

إبراهيم بن عبدالله الرحبي

أية أستفسارات حول مشاركتكم في هذه الدراسة يمكن أن توجه إلى الباحث : إبراهيم بن عبدالله الرحبي هاتف رقم 99541533 هاتف الباحث بإستراليا 0 006139248117 أو مشرف هذه الدراسة البروفيسور بهاجان جروال هاتف 006139919344 . في حالة وجود أي استفسارات أضافية أو شكوى حول الطريقة التي تمت مقابلتكم بها فإنه يمكن الإتصال بسكرتيرة لجنة البحوث الإنسانية بجامعة فيكتوريا على هاتف رقم 0061399194148 أو صنوق بريد : .14428 MC Melbourne - Australia

إستمارة موافقة مشارك في مجال بحث دراسي Consent Form (Arabic)

معلومات للمشاركيين في هذه الدراسة

يسرنا دعوتكم للمشارك في دراسة الدكتوراه الخاصة بإدارة الأعمال تحت عنوان "دراسة بحثية لأهم عناصر اقتصاد المعرفة من أجل تنمية إقتصادية مستدامة بسلطنة عمان".

هذه الدراسة تهدف إلى التعرف على العوامل التي يمكن لحكومة السلطنة من خلالها تبني مشروع اقتصاد المعرفة . إن إستيبان عوامل نجاح هذا الاقتصاد الجديد سوف يمكن الحكومة من الوقوف على السياسات المطلوبة التي تؤهل القطاع الاقتصادي بالسلطنة من الدخول بنجاح في عامل إقتصاد المعرفة. الدراسة سوف تركز على أربعة عناصر من مقومات نجاح تطبيق إقتصاد المعرفة والتي تشتمل على فعالية المؤسسات الحكومية, التعليم والتدريب , تكنولوجيا المعلومات والاتصالات, وتنمية البحوث.

إن مشروع هذه الدراسة قد بداء بالبحث والتقصي في مجال إقتصاد المعرفة بدول منظمة التعاون الاقتصادي والتنمية , البنك الدولي , و تجارب بعض الدول المتقدمة و النامية في هذا الجانب, الأمر الذي ساعد في تحديد أسس هذه الدراسة. إضافة إلى ذلك فإن هذه الدراسة سوف تخضع لمزيد من البحث من خلال عملية جمع البيانات للوقوف على العوامل الأساسية لنجاح إقتصاد المعرفة بسلطنة عمان بشكل خاص.

عليه, فإن هناك لقاءات سوف يجريها الباحث إبراهيم بن عبدالله الرحبي لجمع البيانات والمعلومات مع بعض المسوؤلين ذوي الإختصاص بحكومة سلطنة عمان. علما الكيفية التي سوف تتم بها عملية تدوين هذه اللقاءات سوف تترك لإختيار المشاركين بين الكتابة أو التسجيل الصوتي. كما سوف يتم إتخاذ كافة الإحتياطات الازمة لضمان سرية المشاركين في هذه الدراسة والمعلومات التي سوف يدلون بها.

أقر أنا بأنني فوق الثامنة عشرة من العمر وابدي موافقتي للمشاركة الطوعية في اطروحة الدكتوراه لإدارة الاعمال حول "دراسة بحثية لأهم عناصر اقتصاد المعرفة من أجل تنمية إقتصادية مستدامة بسلطنة عمان" والتي تنفذ بجامعة فيكتوريا باستراليا تحت إشراف البرفيسور بهاجان جروال .

أوكد بأن مضمون هذه الدراسة وما يتبعها من مخاطر ومحاذير قد تم شرحها بواسطة الباحث وبموجب ذلك فإني أقر بموافقتي المشاركة في هذه الدراسة وفقا للاتي :

- مشاركتي سوف تكون طوعية.
- المقابلة سوف تكون إما
  - ☐ مكتوبة
  - ☐ مسجلة صوتيا
- المقابلة سوف تكون في مكتبي.
- المعلومات والبيانات التي سوف ادلي بها تكون كاملة السرية .
- إتخاذ كافة الإجرات والتدابير الجادة للحفظ على سرية وحفظ المعلومات التي سوف ادلي بها .

أقر ايضا بحصولي على الفرص الكاملة والمناسبة من قبل الباحث للرد على أية إستفسارات ومحاذير قد أبديها في هذا الجانب . وبموجب ذلك فإن لي الحق الكامل للإنسحاب من هذه المقابلة في حالة عدم رغبتي في مواصلة هذا اللقاء.

تم التأكيد مجددا من قبل الباحث على السرية الكاملة للمعلومات المستقاة من هذه المقابلة.

التوقيع

الشاهد (غير الباحث)

التاريخ

أية أستفسارات حول مشاركتكم في هذه الدراسة يمكن أن توجه إلى الباحث : إبراهيم بن عبدالله الرحبي هاتف رقم 99541533 هاتف الباحث بإستراليا 92481170 3 61 + أو مشرف هذه الدراسة البروفيسور بهاجان جروال هاتف 006139919344 . في حالة وجود أي استفسارات أضافية أو شكوى حول الطريقة التي تمت مقابلتكم بها فإنه يمكن الإتصال بسكرتيرة لجنة البحوث الإنسانية بجامعة فيكتوريا على هاتف رقم 0061399194148 أو صندوق بريد : 14428 MC Melbourne – Australia

Appendix 2. Interview procedures

Before the interview

Calls to the intended participants' offices were made by the researcher to inform the participants' office directors of the project, its aims, and the rational for choosing specific informants for this project. Verbal requests for interview meetings with informants were made to determine the participants' willingness to participate in this research project. Two days latter subsequent calls were made by the researcher to follow up the interview request and to determine whether the informants are willing to participate and if so to set date, time, and place for the interview. One week before the intended interviews, a word document with Victoria University letterhead was sent to the participants (Appendix 1) explaining in details the purpose of the research, the rights of the participant, confidentiality of the interview, and the procedure of documenting and analyzing of the collected data.

The following steps describe how the interviews were conducted. Each interview was divided into three stages. The first stage was used to introduce the research, as well as to establish rapport with the interviewee. The second stage was the interview proper, followed by a wrap-up of the interview in the third stage. All interviews were note taken with permission from the interviewee.

A.2.1 Establishing rapport

The interview started with the researcher explaining the purpose of the research, followed by asking the interviewee some factual questions about his experience and his ministry's involvement in the economic development in Oman. This initial stage of the interview was used to establish rapport with the interviewee.

A 2.1.1 Explain purpose of research

- The researcher is currently working on a Doctor of Business Administration research project at Victoria University.
- The purpose of this part of the data collection is an in-depth interviews with nine senior government officials who have direct involvement in the economic development, in general, and the knowledge economy four pillars in particular.
- The main problem that faces Oman's economy is its overdependence on oil revenues and inexistence of a feasible economic alternative that offers a sustainable economic development.
- Preliminary research shows that knowledge economy is the main ingredient for a sustainable economic development.
- This research investigates the key knowledge economy factors that could lead to a sustainable economic development in Oman.

A.2.1.2 Explain why the interviewee chosen

The reason that the interviewee was chosen for this interview was because of his unique background, position and direct involvement in the socio-economic development in Oman.

A.2.1.3 Explain confidentiality of the interview

The researcher mentioned to the interviewee that:

- The interview is confidential, and will not be disclosed to any person or organization.
- The interviewee's name will not be mentioned in the thesis.
- This interview will be taped or note taken depending on the interviewee's preference. These notes will be locked up in a safe place, and everything that the interviewee said will be confidential and will only be used for this research.

A.2.1.4 Letter of consent

After going through the above steps, and if the interviewee agrees to proceed, he will be asked to sign a letter of consent (see consent form in Appendix 1).

A.2.1.5 Warm-up questions

Now that the interviewee has understood the purpose of the research and his rights, the next step will be to establish a warm up in order to make the interviewee feel comfortable with the interview. The warm-up questions are factual, and are easily answered. They include:

- Name
- Position
- Number of years at the current position
- Area of responsibility
- Answers to research questions.

A.2.2 Interview proper

This is the second stage in the interview procedures. Formal interview starts once the appropriate forms have been signed, and the interviewee has warmed up to the interview. The formal session covers the qualitative stage questions which consists of one key question and four sub-questions mentioned in Chapter 1. These questions are:

What is the potential role of the government in Oman in enhancing the knowledge economy development in terms of:

a. *plans to stimulate the education and training outcomes;*
b. *mitigating obstacles that hinder optimal utilization of ICTs capabilities in Oman;*
c. *plans in regards to the research and development, and innovation system that boosts internal and external knowledge absorptive capabilities; and*
d. *enhancement of governance effectiveness to promote the above pillars?*

A.2.3 Wrapping up

At the end of the interview, the interviewee was asked to summarize the key points and main phrases that he has made. For example, ‘In summary, what are the key factors that the government needs to introduce and enhance in order to promote the knowledge economy in Oman?’. If they are not able to do so, propose a summary and ask them for their opinion and permission to be used as direct quotes in the thesis.

Appendix 3. Human Research Ethics Committee's approval

From	'Tina Jeggo' <Tina.Jeggo@vu.edu.au>
Date	Friday, February 2, 2007 7:26 am
To	'Ibrahim Abdulla Al-Rahbi' <ibrahimabdulla.al-rahbi@research.vu.edu.au>
Cc	'Bhajan Grewal' <Bhajan.Grewal@vu.edu.au>, 'Shashi Sharma' <Shashi.Sharma@vu.edu.au>
Subject	Out of Session Approval - Human Research Ethics Committee, Faculty of Business and Law

BHREC 2006/42 – Knowledge economy for sustainable economic development in Oman

I am pleased to inform you that the Chair of the Human Research Ethics Committee, Faculty of Business and Law has given out of session approval to the revised application submitted on February 2nd.

We wish you good luck with your research and data collection.

Regards,

Tina Jeggo

on behalf of

Professor Michael Polonsky
Chair, Human Research Ethics Committee
Faculty of Business and Law

Tina Jeggo
Student Advice Officer (Research and Graduate Studies)
Faculty of Business and Law
City Flinders Campus
Level 14, Room 14.18

Tel: (03) 9919 1549

Appendix 4. Questionnaire survey

See booklet enclosed inside back cover.

Appendix 5. Survey invitation letter

Date:
Name:
Position:
Company Name:
Address:

Ref: Key knowledge economy factors for sustainable economic development in Oman

As you know, the government has been working extensively and on many fronts to diversify the economy. Nevertheless, most of these efforts have been concentrated on the industrialisation sector that depends on depletable natural resources such as oil, gas, and minerals. Recent economic studies in developed and major developing countries show that a shift has occurred in these countries' economic strategies toward more sustainable economic development. As a result, remarkable economic achievements have been accomplished. There is a consensus among most of economists, some international bodies, and academics that these new achievements have been attributed to the application of knowledge economy strategies where 70% percent of employment and job generation in developed countries is related to this phenomenon. More importantly, knowledge has become the main engine of economic growth, social development and the primary source of competitiveness in today's world market.

The term knowledge economy refers to an economy in which the use of knowledge, as manifested in new technologies, better processes and workforce skills are applied to a broad range of industries and sectors, and are the main drivers of growth across all industries. Initiating knowledge economy policies is a viable alternative that Oman should consider to create more diversified and sustainable economic development. The apparent promise of this is that economic contribution of physical resources can be greatly augmented through knowledge accumulation and use; hence, knowledge economy provides the possibility to prolong natural resources through the effective use of knowledge and technology.

This DBA study aims to explore and identify key factors that would contribute to the enhancement of knowledge-based economy in Oman. In this research success is related to those key factors that will help the government achieve its economic development in a transition process that will lead to economic diversification and sustainability in the next twenty years. Oman's successive five-year development plans, in addition, to its economic development vision – Oman 2020-, which have touched most aspects of the knowledge economy main pillars such as reforms in government institutions and economic incentives; education and training; information and communication technologies (ICTs); research and development, and innovation, seem to have paved the way to facilitate this important transitional process.

In order to achieve the desired goals, the researcher is conducting a survey with officials such as yourself, who are in a position to provide valuable information on economic decisions, policies, suggestions or any related data. Based on that, we would like to invite you to be part of this study, which will help the researcher identify the specific factors that would lead to possible creation, adoption, and diffusion of knowledge-based initiatives in Oman. This study has major significance to Oman's economic diversification process as a feasible alternative that should be considered seriously not only to create more decent jobs for Omanis and improving their productivity output, but as a sustainable economic development that the government has been hoping for.

I assure you that all responses will be confidential. **Return of the survey form will constitute your consent to participate in the study.**

Thank you in anticipation of your involvement

Yours sincerely,

Ibrahim Abdullah Al-Rahbi

Any queries about your participation in this project may be directed to the researcher (Name: Ibrahim Al-Rahbi ph. In Oman 968-99541533, in Australia + 61 3 92481170) or Supervisor (Name: Prof. Bhajan Grewal. Phone number + 61 3 99191344). If you have any queries or complaints about the way you have been treated, you may contact he Secretary, University Human Research Ethics Committee, Victoria University of Technology, PO Box 14428 MC, Melbourne, 8001 (telephone no: + 613-99194148).

Survey Letter (Arabic)

الاخ الفاضل/ المحترم
رئيس مجلس الإدارة / المدير العام / المدير التنفيذي
العنوان:

السلام عليكم ورحمة الله وبركاته

الموضوع : دراسة بحثية لأهم عناصراقتصاد المعرفة من اجل تنمية إقتصادية مستدامة بسلطنة عمان

إن الحكومة الرشيدة سعت ولازالت تسعى جاهدة لتنويع مصادر الدخل بالسلطنة للحد قدر الإمكان من الاعتماد على مصادر الثروات الطبيعية القابلة للنفاذ خاصة البترولية منها. ان خطط الحكومة الخمسية المتعاقبة وكذلك الرؤية المستقبلية للإقتصاد العماني 2020 قد أسسا لبناء إقتصاد متنوع. إن الدراسات الاقتصادية الحديثة بالدول المتقدمة تحديدا تؤكد أن هناك تحولا هاما قد طرأ على مفهوم الإنتاجية بالاقتصاد التقليدي الذي يعتمد أساسا على مدخلات الأرض والمال والعمالة . هذا التحول مرده إلى دخول عناصر جديدة في مدخلات الإنتاج التي أصبحت أكثر أهمية من العناصر السابقة في تحديد مستوى نوعية وكمية الإنتاج . إن هناك إجماعا لدى الكثير من الاقتصاديين والأكاديميين والمنظمات الاقتصادية الدولية إن هذا التحول أضحى حقيقة اقتصادية واقعة في ما بات يعرف باقتصاد المعرفة الذي اصبح المصدر الرئيس في خلق وتوفير فرص العمل لشعوب الدول المتقدمة وبعض الدول النامية . كل ذلك يؤكد إن اقتصاد المعرفة أصبح بلا منازع المجال الاقتصادي الأرحب لتوسيع وتنويع مصادر الدخل للوصول الى التنمية المستدامة.

إن مفهوم إقتصاد المعرفة يشمل الإستخدام الأوسع والأمثل للمعارف الحديثة المتمثله في تكنولوجيا المعلومات والخبرات المكتسبة في جميع المجالات الإقتصادية خاصة تلك المتعلقه بقطاع الخدمات بما يحقق الكفاءة والجودة في الإنتاج .

ان هذا اللقاء جزء من عملية جمع البيانات والمعلومات لاطروحة الدكتوراه في إدارة الأعمال بعنوان ' **دراسة بحثية لأهم عناصراقتصاد المعرفة من اجل تنمية إقتصادية مستدامة بسلطنة عمان** ' والتي تنفذ بواسطة الفاضل/ إبراهيم بن عبدالله الرحبي وبإشراف البرفيسور بهاجان جروال من مركز الدراسات الإقتصادية الاستراتيجية بجامعة فيكتوريا بإستراليا . تهدف هذه الدراسه الى معرفة العوامل الأساسية التي يمكن ان تساعد في تطبيق مفهوم الإ قتصاد الجديد بالسلطنة.

من أجل تحقيق أهداف هذه الدراسة فقد تم اختياركم تحديدا من اجل التكرم بمساعدتنا في الاسترشاد والوقوف على ما تدلون به من معلومات قيمة من خلال موقعكم الهام في هذه المؤسسة من خلال دورها في بناء اقتصاد المعرفة المبني على أسس المعرفة الحديثة ليكون رافدا هاما و متجددا للتنمية بالسلطنة . من اجل ذلك فاننا ندعوكم للتكرم بمساعدتنا في هذا البحث للتعرف على العوامل التي يمكن ان تساهم فى خلق و استقطاب و نشر المعرفة الاقتصادية الحديثة بالسلطنة من خلال اجوبتكم على اسئلة الاستبيان المرفق.

نؤكد لكم أن مضمون هذا الاستبيان وكذلك أجوبتكم على جميع الاسئلة سوف تكون في سرية تامة ولن يتم ذكر أية أسماء سوف تأتي في سياق مشروع جمع البيانات والمعلومات وإعداد هذه الدراسة.ان اعادة الاستبيان المرفق بعد الاجابة على اسئلته سوف يلقى منا كل الاهتمام والتقدير وسيكون بمثابة موافقتكم الكريمة للمساهمة في هذا المشروع البحثي الهام.

شاكرين ومقدرين لكم حسن تعاونكم في كل مما شأنه إنجاح هذه الدراسة.

وتفضلوا بقبول وافر الاحترام والتقدير
إبراهيم بن عبدالله الرحبي

أية أستفسارات حول مشاركتكم في هذه الدراسة يمكن أن توجه إلى الباحث : إبراهيم بن عبدالله الرحبي رقم هاتف الباحث 99541533- بإستراليا 3 61 92481170 أو مشرف هذه الدراسة البروفيسور بهاجان جروال هاتف 006139919344 . في حالة وجود أي استفسارات أضافية أو شكوى حول الطريقة التي تمت مقابلتكم بها فإنه يمكن الإتصال بسكرتيرة لجنة البحوث الإنسانية بجامعة فيكتوريا على هاتف رقم 0061399194148 أو صندوق بريد 14428 MC Melbourne - Australia. :

Appendix 6. Reminding letter to survey participants

Date: DD, MM, 2007

Name:
Company:
Address:

Ref: Key knowledge economy factors for sustainable economic development survey

Dear Sir/Madame:

I refer to my letter dated on regarding the above subject. I am presently conducting a research for my doctoral thesis on 'An Empirical Study of the Key Knowledge Economy Factors for Sustainable Economic Development in Oman' to determine the key factors that would assist the government in Oman pursue a knowledge economy development. To explore this issue, I conducted a mail survey by sending the questionnaire to your company on February , 2007.

I would greatly appreciate if you could participate in this survey by filling in the questionnaire that has been sent to you few weeks ago. You can choose to complete either in English or Arabic version. Please return the completed questionnaire to me by using the stamped self-addressed envelope enclosed with the questionnaire.

Your kind assistance is important and valuable in the successful completion of my doctorate research. If you need further information concerning this survey, please feel free to contact me in Oman at 99541533, in Australia at 613424259660 or 0061392481170

Thank you so much for your kind consideration and assistance.

Yours sincerely,

Ibrahim Al-Rahbi

Any queries about your participation in this project may be directed to the researcher (Name: Ibrahim Al-Rahbi ph. In Oman 968-99541533, in Australia + 61 3 92481170) or Supervisor (Name: Prof. Bhajan Grewal. Phone number + 61 3 99191344). If you have any queries or complaints about the way you have been treated, you may contact the Secretary, University Human Research Ethics Committee, Victoria University of Technology, PO Box 14428 MC, Melbourne, 8001 (Phone number: + 613-99194148).

VICTORIA UNIVERSITY

A NEW SCHOOL OF THOUGHT

Reminder Letter (Arabic)

التاريخ : -

الأسم : -

الشركة : -

العنوان : -

السلام عليكم ورحمة الله وبركاته ،،، ... وبعد

الموضوع / استبيان الدراسة البحثية حول اقتصاد المعرفة بالسلطنة

أود الإشارة إلى الخطاب المؤرخ في / / بشأن الموضوع أعلاه. يسرني إفادتكم بأنني أقوم حالياً بإعداد بحث لنيل الدرجة الدكتوراه في الاقتصاد تحت عنوان (دراسة بحثية لأهم عناصر اقتصاد المعرفة من اجل تنمية إقتصادية المستدامة بسلطنة عمان) وذلك لتحديد العوامل الأساسية التي يمكن أن تساعد الحكومة في تطبيق اقتصاد المعرفة بالسلطنة. من اجل ذلك فقد تم عمل استبيان وأرسل إليكم في شهر فبراير 2007م .

عليه فإننا نكتب إليكم مجدداً راجين تكرمكم بمشاركتكم في هذا البحث وذلك بملء الاستبيان المناسب والذي سبق وان أرسل إليكم وإرساله عن طريق البريد في الظرف المرفق والمعنون على معد هذه الدراسة. ولا يسعني بهذه المناسبة إلا أن أتقدم إليكم بالشكر الجزيل على مشاركتكم القيمة في هذه الدراسة .

في حالة وجود أي استفسارات إضافية فإنه يرجى الاتصال بمعد الدراسة بعمان على الهاتف 99541533 أو باستراليا على الهاتف (0061392481170) .

شـــــــاكرين لكـــــــم مـــــــرة آخـــــــري حـــــــسن تعـــــــاونكم معنـــــــا .

وتقبلوا وافر الاحترام .

إبراهيم بن عبدالله الرحبي

أية أستفسارات حول مشاركتكم في هذه الدراسة يمكن أن توجه إلى الباحث : إبراهيم بن عبدالله الرحبي هاتف رقم 99541533 هاتف الباحث بإستراليا 0061392481170 أو مشرف هذه الدراسة البروفيسور بهاجان جروال هاتف 006139919344 . في حالة وجود أي استفسارات أضافية أو شكوى حول الطريقة التي تمت مقابلتكم بها فإنه يمكن الإتصال بسكرتيرة لجنة البحوث الإنسانية بجامعة فيكتوريا على هاتف رقم 0061399194148 أو صنوق بريد : 14428 MC Melbourne - Australia

Appendix 7. Explained variance of 17 knowledge input factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.957	20.266	20.266	11.957	20.266	20.266	4.007	6.792	6.792
2	5.082	8.613	28.879	5.082	8.613	28.879	3.858	6.539	13.331
3	3.498	5.928	34.808	3.498	5.928	34.808	3.788	6.421	19.752
4	3.263	5.531	40.338	3.263	5.531	40.338	3.702	6.275	26.027
5	2.883	4.886	45.224	2.883	4.886	45.224	3.500	5.933	31.960
6	2.657	4.504	49.728	2.657	4.504	49.728	3.073	5.209	37.169
7	2.084	3.532	53.260	2.084	3.532	53.260	3.008	5.099	42.268
8	1.877	3.181	56.441	1.877	3.181	56.441	2.820	4.780	47.048
9	1.698	2.878	59.319	1.698	2.878	59.319	2.307	3.910	50.958
10	1.639	2.777	62.097	1.639	2.777	62.097	2.241	3.799	54.757
11	1.473	2.497	64.594	1.473	2.497	64.594	2.127	3.605	58.361
12	1.439	2.439	67.033	1.439	2.439	67.033	2.116	3.586	61.947
13	1.265	2.145	69.177	1.265	2.145	69.177	2.044	3.464	65.412
14	1.158	1.963	71.141	1.158	1.963	71.141	2.032	3.444	68.856
15	1.073	1.818	72.959	1.073	1.818	72.959	1.650	2.797	71.653
16	1.068	1.810	74.769	1.068	1.810	74.769	1.436	2.433	74.086
17	1.008	1.708	76.477	1.008	1.708	76.477	1.410	2.391	76.477
18	.953	1.616	78.093						
19	.875	1.483	79.575						
20	.846	1.434	81.009						
21	.786	1.332	82.341						
22	.772	1.308	83.649						
23	.711	1.206	84.855						
24	.647	1.097	85.952						
25	.617	1.047	86.998						
26	.610	1.033	88.031						
27	.540	.915	88.946						
28	.499	.845	89.792						

29	.486	.824	90.615						
30	.454	.770	91.385						
31	.405	.687	92.072						
32	.389	.659	92.731						
33	.362	.614	93.344						
34	.321	.543	93.887						
35	.314	.532	94.419						
36	.304	.516	94.935						
37	.276	.468	95.403						
38	.263	.445	95.849						
39	.247	.419	96.267						
40	.220	.373	96.640						
41	.201	.341	96.981						
42	.195	.331	97.312						
43	.183	.310	97.622						
44	.164	.277	97.900						
45	.157	.267	98.166						
46	.143	.242	98.409						
47	.130	.220	98.628						
48	.115	.195	98.824						
49	.107	.182	99.006						
50	.093	.157	99.163						
51	.081	.137	99.300						
52	.070	.119	99.419						
53	.069	.117	99.536						
54	.067	.114	99.650						
55	.057	.096	99.747						
56	.048	.082	99.828						
57	.040	.068	99.896						
58	.034	.057	99.953						
59	.028	.047	100.000						

Extraction Method: Principal Component Analysis.

Appendix 8. Five knowledge input factors that did not meet the 3 items threshold, rotated component matrix (a)

	Component																
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*
Q5_1d	.832																
Q5_1c	.796																
Q5_1f	.795																
Q5_1e	.784																
Q5_1b	.652																
Q4_3d		.781															
Q4_3c		.736															
Q4_3e		.732															
Q4_3g		.673															
Q4_3f		.599															
Q4_3b		.571															
Q4_3a																	
Q4_2a			.741														
Q4_2d			.740														
Q4_2c			.725														
Q4_2b			.671														
Q4_1			.649														
Q4_6b				.858													
Q4_6c				.790													
Q4_6e				.757													
Q4_6d				.742													
Q4_6a				.636													
Q3_1b					.760												
Q3_1f					.733												
Q3_1a					.698												
Q3_1e					.694												
Q3_1d					.620												
Q3_1c					.571										.520		

Q3_7						.834											
Q3_8						.788											
Q3_6						.787											
Q5_1i							.814										
Q5_1h							.767										
Q5_1j							.756										
Q5_1g																	
Q5_1k																	
Q3_4c								.829									
Q3_4b								.793									
Q3_4a								.740									
Q2_1a									.744								
Q2_1f									.713								
Q2_1b									.543				.535				
Q2_4a										.913							
Q2_4b										.883							
Q5_1m											.889						
Q5_1l											.724						
Q5_1n											.576						
Q2_2b												.694					
Q2_2a												.671					
Q3_3												.504					
Q2_1e													.766				
Q2_1d													.651				
Q2_2c														.716			
Q2_2d														.686			
Q2_1c														.587			
Q2_2e															-.619		
Q5_1a															.610		
Q2_2h																.726	
Q2_2k																	.777

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 24 iterations.

Appendix 9. Total variance explained of the 6 statistically significant knowledge input factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.957	20.266	20.266	11.957	20.266	20.266	6.447	10.927	10.927
2	5.082	8.613	28.879	5.082	8.613	28.879	5.274	8.940	19.867
3	3.498	5.928	34.808	3.498	5.928	34.808	5.003	8.480	28.347
4	3.263	5.531	40.338	3.263	5.531	40.338	4.329	7.336	35.683
5	2.883	4.886	45.224	2.883	4.886	45.224	4.216	7.145	42.829
6	2.657	4.504	49.728	2.657	4.504	49.728	4.071	6.899	49.728
7	2.084	3.532	53.260						
8	1.877	3.181	56.441						
9	1.698	2.878	59.319						
10	1.639	2.777	62.097						
11	1.473	2.497	64.594						
12	1.439	2.439	67.033						
13	1.265	2.145	69.177						
14	1.158	1.963	71.141						
15	1.073	1.818	72.959						
16	1.068	1.810	74.769						
17	1.008	1.708	76.477						
18	.953	1.616	78.093						
19	.875	1.483	79.575						
20	.846	1.434	81.009						
21	.786	1.332	82.341						
22	.772	1.308	83.649						
23	.711	1.206	84.855						
24	.647	1.097	85.952						
25	.617	1.047	86.998						
26	.610	1.033	88.031						
27	.540	.915	88.946						
28	.499	.845	89.792						

29	.486	.824	90.615						
30	.454	.770	91.385						
31	.405	.687	92.072						
32	.389	.659	92.731						
33	.362	.614	93.344						
34	.321	.543	93.887						
35	.314	.532	94.419						
36	.304	.516	94.935						
37	.276	.468	95.403						
38	.263	.445	95.849						
39	.247	.419	96.267						
40	.220	.373	96.640						
41	.201	.341	96.981						
42	.195	.331	97.312						
43	.183	.310	97.622						
44	.164	.277	97.900						
45	.157	.267	98.166						
46	.143	.242	98.409						
47	.130	.220	98.628						
48	.115	.195	98.824						
49	.107	.182	99.006						
50	.093	.157	99.163						
51	.081	.137	99.300						
52	.070	.119	99.419						
53	.069	.117	99.536						
54	.067	.114	99.650						
55	.057	.096	99.747						
56	.048	.082	99.828						
57	.040	.068	99.896						
58	.034	.057	99.953						
59	.028	.047	100.000						

Extraction Method: Principal Component Analysis.

Appendix 10. Total variance explained by the knowledge outcome factors

Component	*Initial Eigenvalues*			*Extraction Sums of Squared Loadings*			*Rotation Sums of Squared Loadings*		
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	5.307	40.823	40.823	5.307	40.823	40.823	3.669	28.222	28.222
2	2.102	16.169	56.992	2.102	16.169	56.992	2.211	17.011	45.233
3	1.120	8.619	65.611	1.120	8.619	65.611	1.967	15.133	60.366
4	1.017	7.826	73.437	1.017	7.826	73.437	1.160	8.924	69.290
5	.824	6.342	79.779	.824	6.342	79.779	1.068	8.218	77.509
6	.753	5.791	85.570	.753	5.791	85.570	1.048	8.061	85.570
7	.524	4.027	89.597						
8	.356	2.740	92.337						
9	.310	2.385	94.722						
10	.255	1.965	96.688						
11	.171	1.312	97.999						
12	.148	1.135	99.135						
13	.113	.865	100.000						

Extraction Method: Principal Component Analysis.

Appendix 11. Total variance explained of the 2 statistically significant knowledge outcome factors

Component	*Initial Eigenvalues*			*Extraction Sums of Squared Loadings*			*Rotation Sums of Squared Loadings*		
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	5.307	40.823	40.823	5.307	40.823	40.823	4.844	37.260	37.260
2	2.102	16.169	56.992	2.102	16.169	56.992	2.565	19.732	56.992
3	1.120	8.619	65.611						
4	1.017	7.826	73.437						
5	.824	6.342	79.779						
6	.753	5.791	85.570						
7	.524	4.027	89.597						
8	.356	2.740	92.337						
9	.310	2.385	94.722						
10	.255	1.965	96.688						
11	.171	1.312	97.999						
12	.148	1.135	99.135						
13	.113	.865	100.000						

Extraction Method: Principal Component Analysis.

Appendix 12. Pearson correlations of the 6 knowledge input and the 2 knowledge outcome factors

		ICT infrastructure and services	*Local R&D support and coordination*	*Training coordination and support*	*General education and training*	*Governance and commercial law*	*ICT status*	*Better productivity*	*Better knowledge acquisition*
ICT infrastructure and services	Pearson Correlation	1	.275(**)	.426(**)	.372(**)	.269(**)	.362(**)	-.012	.044
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.868	.538
	N	197	197	197	197	197	197	197	197
Local R&D support and coordination	Pearson Correlation	.275(**)	1	.227(**)	.279(**)	-.022	.120	.211(**)	.139
	Sig. (2-tailed)	.000		.001	.000	.758	.094	.003	.052
	N	197	197	197	197	197	197	197	197
Training coordination and support	Pearson Correlation	.426(**)	.227(**)	1	.322(**)	.211(**)	.379(**)	.082	.196(**)
	Sig. (2-tailed)	.000	.001		.000	.003	.000	.254	.006
	N	197	197	197	197	197	197	197	197
General education and training	Pearson Correlation	.372(**)	.279(**)	.322(**)	1	.288(**)	.261(**)	.047	-.085
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.511	.236
	N	197	197	197	197	197	197	197	197
Governance and commercial law	Pearson Correlation	.269(**)	-.022	.211(**)	.288(**)	1	.331(**)	-.061	-.038
	Sig. (2-tailed)	.000	.758	.003	.000		.000	.392	.600
	N	197	197	197	197	197	197	197	197
ICT status	Pearson Correlation	.362(**)	.120	.379(**)	.261(**)	.331(**)	1	.054	.157(*)
	Sig. (2-tailed)	.000	.094	.000	.000	.000		.453	.028
	N	197	197	197	197	197	197	197	197
Better productivity and profitability	Pearson Correlation	-.012	.211(**)	.082	.047	-.061	.054	1	.296(**)
	Sig. (2-tailed)	.868	.003	.254	.511	.392	.453		.000
	N	197	197	197	197	197	197	197	197
Better knowledge aquisition	Pearson Correlation	.044	.139	.196(**)	-.085	-.038	.157(*)	.296(**)	1
	Sig. (2-tailed)	.538	.052	.006	.236	.600	.028	.000	
	N	197	197	197	197	197	197	197	197

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).