THE DEVELOPMENT OF E-COMMERCE TECHNOLOGY ADOPTION IN LIBYA: EVIDENCE FROM THE LIBYAN OIL AND GAS INDUSTRY

By

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A thesis submitted in partial fulfilment of the requirements of the degree of the University of Northumbria at Newcastle for the Doctor of Philosophy

Research undertaken in the Newcastle Business School

September 2005

PAGE NUMBERING AS ORIGINAL

ABSTRACT

The style of doing business electronically, especially using the Internet, is now popularly known as e-Commerce technology. It is generally acknowledged that e-Commerce is revolutionizing the way of doing business. Internet and e-Commerce experts and researchers have recognized the potential of e-Commerce applications for the success of any organization. There is evidence that many companies have benefited from such technology. However, despite numerous studies of e-Commerce, there is a little research identifying the factors associated with the adoption of e-Commerce within petroleum companies.

This research investigates factors that influence the adoption of e-Commerce in Libyan Oil and Gas Companies (**LOGCs**). The study provides insights into the perceptions of Internet and e-Commerce in Libyan petroleum companies who are developing or will develop Internet and e-Commerce technology. However, the **LOGCs** lack information technology (**IT**) infrastructure, technical expertise and good management, which appear to be real barriers to adopting e-Commerce. This study will assist those **LOGCs** that are considering or currently conducting their business using the Internet and e-Commerce.

A framework of e-Commerce adoption will be developed to investigate the factors that potentially influence the adoption of e-Commerce. Many oil and gas companies are transferring part of their businesses to the Internet. So how are the **LOGCs** rising to face the challenges of the fast moving information age? The Libyan petroleum industry seems to be very slow in responding to this area of information technology. If so, then the full potential of the industry and economy will be compromised. This research examines the factors that hinder or facilitate e-Commerce adoption.

A questionnaire was developed utilizing ideas from the existing literature. The sample consisted of top managers in **LOGCs** (n=211). Multiple methods were used to collect and analyse the data: descriptive statistics, correlation and regression analysis. All analysis was performed using the Statistical Package for Social Sciences.

The results confirmed the findings of the literature survey, in that organizational characteristics influence e-Commerce adoption level. This study proposes a theoretical framework with influential factor groups including organizational, innovation, industry, and environmental factors. Some themes have emerged from previous literature explaining the reasons for rejecting e-Commerce adoption. The results confirm that organizational factors are highly significant in explaining e-Commerce adoption. The results also confirm that environmental factors are crucial and there was a significant relationship between the level of e-Commerce adoption and environmental factors. It is also confirmed that the perceived benefit coefficient has a negative sign and it is not significantly related to adoption level. Finally, the industry factors are not related to e-Commerce adoption level as hypothesized. This study has various limitations, and further research is needed in order to develop a more comprehensive e-Commerce technology adoption model.

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ABBREVIATIONS

B2B: Business-to-Business
B2C: Business to Consumer
B2G: Business to Government
DLDC: Developed and Less Developed Countries
e-Business: Electronic Business
e-Commerce: Electronic Commerce
EDI: Electronic Data Interchange
EFT: Electronic Funds Transfer
e-Mail: Electronic Email
EPSA: Exploration and Production-Sharing Agreements
FDI: Foreign Direct Investment
GATT: General Agreement on Tariffs and Trade
G2B: Government to Business
G2C: Government to Consumer
GDP: Gross Domestic Product
GNP: Gross National Product
GPTC: General Post Telecommunications Company
ICTs: Information Communication and Technologies
IMF: International Monetary Fund
IS/IT: Information Systems/Information Technology
ISPs: Internet services providers
LD: Libyan Dinar
LNAID: Libyan National Authority for Information and Documentation
LOGCs: Libyan Oil and Gas Companies
MNCs: Multinational National Corporations
NGOs: Non-Governmental Organizations
NOC: National Oil Corporation
OAPEC: Organisation of Arab Petroleum Exporting Countries
OECD: Organisation for Economic Co-Operation and Development
OPEC: Organisation of Petroleum Exporting Countries
SMEs: Small and Medium-sized Enterprises
UNCTAD: United Nations Commission on Trade and Development
XML: Extendible Mark up Language

ACKNOWLEDGMENTS

I would like to express my sincere appreciation and gratitude first and foremost to my family for their support, patience and encouragement in helping me to complete this research. Without their prayers and inspiration this study would have never been accomplished.

I also sincerely recognize my research supervisors, Dr. Barrie Craven and Dr. Richard Li-Hua. Their honest critiques, assistance and encouragement, helped me shape many of the ideas in this study. I would like to acknowledge my special thanks to Professor Barry Howcroft and Dr. Majid Taghavi for their encouragement and guidance.

I also wish to convey special thanks to Professor Pandeli Glavanis, Dr. Peter Wynarczyk, and Dr. Jim Grieves for their support and guidance during the early stages of my study. I would also like to thank Mr. Othman El-Houderi for his tremendous help and support. I thank especially the interviewed Libyan Oil and Gas Companies for their valuable time and shown interest. Special thanks also to all managers of those companies who took time to answer the survey questions despite their busy schedules.

Special thanks go to the Newcastle Business School for their support and guidance. Finally, I would like to thank my PhD colleagues at Newcastle Business School for their support and encouragement.

DEDICATION

To My Family.

CHAPTER I

INTRODUCTION TO THE STUDY

1.1 Introduction

This introduction presents a brief background of the problem to be investigated in this study, including the purpose and rationale of the study. This current research study focuses on the area of e-Commerce adoption factors in Libyan Oil and Gas Companies **(LOGCs)**. This research study seeks to assess the elements and factors in e-Commerce adoption relevant to **LOGCs** context.

The Libyan petroleum industry has not utilised the Internet and e-Commerce technologies as broadly as it could have. This research is designed to investigate some of the reasons for this phenomenon. The purpose for this study is to understand the determinants of e-Commerce adoption within **LOGCs**, to test various factors explaining e-Commerce adoption, and to contribute to the emerging literature of technology innovation. An e-Commerce adoption theoretical framework is proposed, which includes internal and external factors. The research hypothesizes that these factors may or may not facilitate or hinder the adoption/development of e-Commerce technology in **LOGCs**. Since there is little research into e-Commerce adoption in developing countries such as Libya, the adoption and diffusion of e-Commerce in firms remains a critical area of investigation.

1.1.1 Background to the Research

The Internet is becoming a truly global technology and the enabler of a new business phenomenon. Internet e-Commerce has made business organizations technically viable. Since the advent of the World Wide Web, businesses have adopted and implemented a number of technologies and applications to effect Internet commercialisation. Studies pointing to a technologically uncertain and globally focused economy have examined the adoption of e-Commerce by business firms. This study examines the adoption of e-Commerce by 30 **LOGCs** using the findings from a study of 211 respondents. The study examines a number of factors that determine the adoption of e-Commerce.

1.1.1.1 e-Commerce Definitions

e-Commerce technology is the process of buying, selling, or exchanging products, services, and information using computer networks including the Internet (Turban et al., 2002). Kalakota and Whinston (1997) and Turban et al (2004) define e-Commerce using the perspectives of network communications, automated services, business processes, and online buying and selling. Deise et al. (2000) describe the e-Selling process as enabling customers through e-Browsing (catalogues), and e-Buying (ordering, processing, invoicing, and cost determination).

Deitel et al. (2001) claim that e-Commerce involves exchanges among customers and business partners. Poon (1999) has defined e-Commerce as the use of Internet technology and applications to support business activities in a firm. Partial e-Commerce occurs when the processes do not wholly use networks.

After examining many different definitions proposed by different researchers and writers, the most appropriate definition of e-Commerce for the purpose of this research shall be as follows:

> *"Sharing business information, maintaining business relationships, and conducting business transactions by means of telecommunications networks"* (Zwass, 2001).

1.1.2 Types of e-Commerce

The term "commerce" is viewed by some as transactions conducted between business partners. This refers to buying and selling as well as serving customers and collaborating with business partners, and conducting electronic transactions within an organization. In order to focus on Business to Business **(B2B)** e-Commerce; historically, many of the processes have been managed with paper transactions (e.g., purchase requisitions and orders, invoices, and so forth). This is where **B2B** e-Commerce applications come into play and take part in business trading.

B2B e-Commerce is a transaction conducted electronically between businesses over the Internet, extranet, intranet, or private networks (Jennex et al., 2004; Turban et al., 2004; Noyce, 2002; Palvia and Vemuri, 2002). Initially, **B2B** was used almost exclusively by large organizations to buy and sell products and services (Domaracki, 2001; Noyce, 2002). Business to Consumer **(B2C)** e-Commerce, on the other hand, is the electronic sale of goods, services, and content to individuals (Noyce, 2002; Turban et al., 2002). **B2B** transactions tend to be larger in value, more complex, and longer term when compared to **B2C** transactions.

1.2 The Subject of the Debate

The research in this study begins to conceptualise and organize the changes that are likely to transfer the traditional petroleum economy from a physical marketplace to an Internet based economy (Platts, 2000; Tippee, 2000; Zhida, 2000; Management of Oilfield Capital, 2000). It is argued that it is likely that e-Commerce reduces costs and increases efficiency in existing business processes (Microsoft, 2000; al-Qirim and Corbitt, 2002). The researcher particularly discusses the impact of e-Commerce on Libyan petroleum industries. It is essential in this to obtain a good understanding of e-Commerce issues, for example e-Commerce infrastructure, attitudes, and technology involvement from economic and managerial perspectives.

How is the Libyan petroleum sector rising to the challenges of the fast moving and ever changing information age, and especially e-Commerce? The Libyan petroleum industry seems to be very slow in responding to **IT**. If that is the actual situation, their future will be at risk and this will not be good for the development of the Libyan petroleum economy.

This research assesses the readiness for Internet applications and e-Commerce usage among **LOGCs,** and hopefully helps them to introduce awareness towards e-Commerce and to speed up their involvement in e-Commerce adoption. In this study a positive approach to the phenomenon of e-Commerce is used to identify and discuss potential adoption barriers, and threats, and the strategic implications of e-Commerce adoption in the Libyan petroleum sector.

1.2.1 Research Problem

The research problem investigated in this study involves a determination of the level of e-Commerce adoption related to Libyan petroleum companies. Nine relationships were proposed for investigation. The theoretical framework to investigate this problem is as e-Commerce adoption theoretical framework.

One can argue that a traditional economy is sufficiently profitable and that, therefore, there is no need to institute costly technological strategic plans. However, various authors (e.g. Cuningham 2001; Turban, 2002; Zwass, 2001 and 1998; al-Qirim and Corbitt, 2002; Seyal, 2003; UNCTAD Report, 2003; Whiteley, 2000; Winston and Dologite, 1999) point out that e-Commerce can provide the competitive advantage and global reach that business organisations need in order to be lucrative. In fact, today, many business organizations are beginning to recognise the importance of restructuring the traditional economy by adopting e-Commerce in their companies (UNCTAD Report, 2003). The present research argues that the full strategic practice and use of Internet applications can achieve a major development in the Libyan petroleum sector.

Although the idea of introducing e-Commerce to the Libyan economy sounds promising, it suffers from major shortcomings. It can be argued that the main problems stem from organizational inertia, management attitudes towards e-Commerce, and Information Communication and Technologies **(ICTs)** infrastructure within **LOGCs.**

Furthermore, there are other barriers such as cultural sensitivity and the level of e-Commerce awareness. It can be argued that, as with all technological advances, the Libyan petroleum economy could benefit greatly from using e-Commerce applications to derive strategies for identifying market share and new services. e-Commerce can provide a possible alternative to the Libyan petroleum sector to make investments and in order to avoid being left out in the digital economy.

The reality of e-Commerce is that it is changing the way companies do business (Chan, et al., 2001; Seyal, 2003; al-Qirim and Corbitt, 2002; Whiteley, 2000; Winston and Dologite, 1999). Efficiency, cost reduction, speed, market expansion and high rapid communication are the business drivers behind the adoption of e-Commerce, as will become clear from the literature review. So, what are the driving forces behind e-Commerce technology in Libya? Internet based e-Commerce technologies are increasing the speed of business operations, opening new global markets, and driving competition (Turban et al., 2004; Kalakota, and Robinson, 2001; Steinfield, 2003).

One might ask whether the Internet and e-Commerce exist as an opportunity or a risk to Libyan petroleum industries. The Internet and e-Commerce are likely to have a considerable impact on the structure of the Libyan petroleum market and on global markets. These developments require changes in approach and policies to enable the **LOGCs** to deal effectively with the current industry situation. It is opportune to examine how e-Commerce can contribute to enhancing trade and investment

opportunities in the Libyan petroleum sector through the effective take up of electronic trade.

Libyan petroleum companies are vulnerable because many international oil and gas companies are investing in their industry with advanced business technologies. Therefore, the Libyan Oil and Gas Companies **(LOGCs)** should adopt Internet technologies along with new attitudes toward modernisation to face future challenges, in order to avoid being left out with no future in international oil and gas business competition.

Many authors and e-Commerce experts argue that e-Commerce can make oil and gas companies viable and profitable (Zhida, 2000; Livesay, 2000; Management of Oilfield Capital, 2000; Oil and Gas Journal, 2002; Platts, 2000; Tippee, 2000). To achieve this aim, the recognised components of the e-Commerce technology framework will be adopted to determine the factors and barriers that facilitate or hinder the adoption of e-Commerce in Libyan petroleum companies. Therefore, the problem addressed in this research study is:

"What are the core issues and determining factors that facilitate or hinder the adoption/development of e-Commerce technology in the Libyan oil and gas industry?"

Essentially this research is designed to investigate and solve this research problem and answer the research question. Based on the adoption of framework; from previous studies of innovation, an e-Commerce adoption framework will be examined. This will

be used to test the role of internal factors such as organizational and innovation factors, and external factors related to the industry and the environment.

1.2.2 Aims and Objectives of the Research

The objectives of this study are as follows:

- To provide a comprehensive review of the literature on the subject of e-Commerce technology adoption.
- To review and theoretically assesses the Libyan technological landscape, to investigate policies directed towards technological adoption and evaluate them in relation to the major theories on adoption.
- To develop and test a theoretical framework and hypotheses that predict e-Commerce technology adoption in Libyan petroleum companies.
- To empirically and theoretically assess the current level of e-Commerce technology adoption in Libyan oil and gas firms, so that decision makers can address the current deficiencies in the process of making arrangements for e-Commerce adoption.
- From the literature, to examine and identify barriers and the determining factors that influence the adoption of e-Commerce.

1.2.3 e-Commerce Driving Forces

The driving forces behind Internet based e-Commerce technology bring tremendous cost efficiency and convenience (Burke, 1997; Jarvenpaa and Todd, 1997; Livesay 2000; Whiteley, 2000). For organizations, e-Commerce offers an opportunity for

operating costs reduction (Herbig et al., 1998; Rowley, 1996). The most obvious advantage of online business is increased convenience. As a matter of fact, convenience has been found to be the most important benefit of the Internet (Jarvenpaa and Todd, 1997). In short, e-Commerce is gradually taking control over business transaction processes.

There are other driving forces of e-Commerce. These include the following: **(1)** markets and economics, broad-reaching global and regional trade; and **(2)** increased innovation and new technologies (Turban et al., 2002; Handfield and Nichols, Jr. 1999; Fulkerson & Shank, 2000; UNCTAD Report, 2003; Whiteley, 2000, Aggrawal, 1991). There are various domestic issues involving e-Commerce, including understanding the conduct of business between buyers and sellers, Information Technology **(IT)** and training, security, public policies, legalities, and organizational management of infrastructure.

1.3 e-Commerce as a Dynamic Technology

e-Commerce adoption is closely related to **IT** adoption. In fact, e-Commerce is normally considered part of **IT** because e-Commerce is also based on the computer and network technology (Santos and Peffers, 1998). There are many issues involved in e-Commerce adoption. First, from as organizational point of view, e-Commerce is a strategic innovation that not only changes the internal business processes and the business processes that expand beyond the boundary of a single organization, but also requires the redesign of the organizations themselves. It not only involves more parties

and processes, but also changes the way of doing business by changing the relationships among partners.

Secondly, e-Commerce adoption is more complex technologically than any previous IT adoption. It requires that all of the IT technical components, such as databases, email and Internet as well as advanced applications, come together. Due to these significant differences, the literature about IT innovation is a necessary basis for studying e-Commerce technology, but it is far from sufficient. e-Commerce requires its own research body. In this study, the task is to determine what factors influence e-Commerce technology adoption levels in **LOGCs**.

Although e-Commerce still needs to overcome some barriers in order to gain a stronger presence in the petroleum sector, this new style of online trading has stepped on to the business stage as an unprecedented innovation in both technological and business terms. In fact, the adoption of e-Commerce is different from the adoption of other innovative technologies, mainly because at least two parties are involved in any e-Commerce transaction and they jointly determine the outcomes of such a transaction (Kosiur, 1997).

In this research, the concepts of e-Commerce adoption are similar to those of the rate of diffusion. As will be described in later chapters, the rate of diffusion is the relative speed with which members of a social system adopt an innovation. It is generally measured as the number of individuals who adopt a new idea in a specific time period

(Rogers, 1995; 2003). e-Commerce adoption levels are not concerned with the speed of adoption for the whole social system. They are concerned with how e-Commerce tools have been adopted among companies at specific points in time. Furthermore, the degree to which these companies are using these adopted e-Commerce tools is also crucial (Rogers, 1995).

1.4 The Digital Divide

The growing importance of the information economy and the world wide diffusion of the Internet and e-Commerce mean that a constantly increasing proportion of international communications, information, business, education, training and other activities are being conducted over the Internet in real time (Hoffman, and Novak, 1999). Various policy makers and international organizations such as the United Nations have warned that the gains in productivity produced by new **ICTs** may widen the differences in economic growth between the wealthiest nations and those that lack the skills, resources and infrastructure to invest in the information society (UNCTAD Report, 2003). This is likely to leave the poorer economies increasingly marginalized at the edge of the information and communication networks. This debate has generated a growing body of literature that speaks to the global digital divide which is a substantial gap between wealthy and poor countries with respect to access to and use of modern **ICTs.**

Libya lags significantly behind North America, Europe, Asia, and some Latin American countries in its adoption and use of the Internet and other forms of

information and communications technology (UNCTAD Report, 2003). Within the Arab and African region itself, there are significant variations in Internet and e-Commerce use and access. The study also analyses the nature and scope of the divide between the developed and the developing regions. This study argues that **ICTs**, and in particular the Internet and e-Commerce technology, offer developing countries the opportunity to share in the benefits of a global network- based economy (Domaracki, 2001; Heeks and Duncombe, 2001; Hoffman and Novak, 1999). Much of the promise of **ICTs** has been focused on the role of the Internet and e-Commerce, because of a wide variety of technological and economic characteristics that the Internet and e-Commerce possess. Heeks and Duncombe (2001) discuss how **IT** can be used in developing countries to build businesses. Domaracki (2001) discusses how the technology gap between different firms is closing and making e-Commerce available to any business with access to computers, web browsers, and telecommunication links (Hoffman and Thomas, 1998; Oakes et al., 1999; Seyal, 2003; Sharma, 2003; al-Qirim and Corbitt, 2002).

1.5 Structure of the Thesis

The thesis is organized as follows. Chapter **I** is the introduction. It provides a brief discussion of the research, its rationale, and its context. The introduction presents the scope of inquiry and the research problem and objectives. Chapter **II** addresses the characteristics of the Libyan economy and its development. Chapter **III** identifies and discusses in detail the historical growth, structural changes, technological readiness and contemporary development of the Libyan oil and gas industry. Chapter **IV** presents technological development in Libya and world regional differences of e-Commerce technology relevant to the research. Chapter **V** presents the theoretical framework of e-Commerce doption. It addresses the influential factors in adopting and developing e-Commerce technology and describes the theoretical foundation that underlies the adoption of e-Commerce. It also evaluates the influential factors associated with adopting e-Commerce technology. Chapter **VI** outlines the conceptual design, philosophical notions and research methodology. It also presents the research objectives, research question and hypotheses, as well as the methodological constraints and limitations. Chapter **VII** presents the empirical findings, analysis of the data, and interpretation of the results. Chapter **VIII** provides a discussion and conclusions of the study. Chapter **IX** presents, and summarizes the pertinent research findings and develops the policy implications and recommendations from the results. As such, it discusses some of the policies that enhance e-Commerce adoption and development. The chapter concludes by discussing the study's contribution and suggests some areas for future research.

1.6 Conclusion

This study covers the period of 1970-2004 in the Libyan economy. Given that the adoption of e-Commerce is a relatively recent phenomenon; this research study is limited to a single industry due to the limitations of technological data in Libya.

There is a significant body of research on technology adoption that examines e-Commerce adoption, using a theoretical framework for adoption. Given the nature of Libya's export driven petroleum economy and its enhanced linkages with global markets, e-Commerce developments at the international level will affect Libya which lags far behind in the e-Economy. e-Commerce has the potential to surpass the traditional media due to its increasingly easy access and global popularity. e-Commerce increases the range of options available in relation to the coordination of both intra and inter-organisational activities. e-Commerce has largely extended the depth of the relationships between business organizations, and is an excellent example of technological flexibility helping to extend business horizons.

In summary, this study investigates e-Commerce adoption along with the factors predicted to affect e-Commerce adoption among **LOGCs**. Getting **LOGCs** to adopt e-Commerce practices is crucial for their competitiveness internationally in the digital economy. However, the focus must be on getting the petroleum sector, which has the potential to grow, to be e-enabled for business. The next chapter will examine some of the literature relative to the broad framework of the Libyan economy during 1970-2004.

CHAPTER II

LIBYA'S ECONOMY: THE HISTORICAL AND CURRENT SITUATION AND ECONOMIC DEVELOPMENT

2.1 Introduction

Chapter one has examined background information together with a broad range of issues relevant to this study in discussing the problem to be investigated. This chapter identifies and analyses the strengths and weaknesses of the Libyan economy in terms of the macroeconomic aspects. The justification for addressing the Libyan economy is to evaluate the economic growth occurring in the period of 1970-2004. In order to more easily understand Libya's economy, this chapter explores the characteristics of the Libyan economy, and analyses the economic trends taking place during the study period.

At independence[1] Libya was viewed as one of the poorest countries in the world. During the early 1950s, Libya's per capital income was one of the lowest in the world at less than $40 (Harris, 1987). Besides this, the Gross National Product **(GNP)** for the same period was around $50m, with a negative rate of growth (Khader and El-Wifati, 1987). At that time, the small Libyan economy was weak because of its scarce resources, lack of management and no viable strategic and economic vision. However, since the early 1960s, the Libyan economy has depended primarily on oil revenues

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which constitute practically all of the export earnings (Gurney, 1996). These oil revenues and the small size of its population have given Libya one of the highest per capita Gross Domestic Products **(GDP)** in Africa (Gurney, 1996). According to official Libyan sources, the **GDP** in 1995 was $23.5 billion. In 2000, the **GDP** grew by 6.5% to a total of $39.2 billion. In 2002, growth was 1.2%, and in 2003, it was 2.1%. In 2004, real **GDP** growth was 3.1%. For, 2005, a real **GDP** growth of 6% is expected with consumer price inflation of 4.0% (Energy Information Administration, 2005).

In order to strengthen its economy, Libya aims to attract foreign investment and technical expertise and to encourage investors to realise projects in Libya (Economic Intelligence Unit, 2005). Following the removal of international sanctions[2], Libya has been trying to improve its image among foreign investors, but the perennial economic question is: how should Libya improve its economy and become more efficient technologically?

2.1.1 The Economy during the 1970s

1969 marked the beginning of a new Libyan regime (Metra Consulting, 1981).[3] The Libyan revolution had introduced a socialist system (Lawless, and Findlay, 1984), including different plans for different sectors. Throughout the 1970s, the agricultural sector received high priority for the establishment of important agricultural projects (Allan et al., 1989). Therefore, the agriculture industry grew during the 1970s and hundreds of factories were established and run by the public sector. However, the state

started to tighten its grip on the private sector in the mid-1970s (Khader and El-Wifati, 1987). The idea came from the 'Green Book'[4], which declared that workers are partners and owners of plants (Lawless, and Findlay, 1984). As a result, in 1979, the private sector had been completely abolished.[5] Because of the lack of managerial skills, technological skills, technical know-how and management expertise, however, the state continued having difficulties in implementing projects and achieving its goals.

2.1.1.1 Growth and Prosperity

The economy had grown thanks to the oil and gas revenues, which helped the state in planning, and in importing goods (Barker, and Mclachlan, 1982). The state was involved in heavy industry, but little attention was still paid to productivity and economic feasibility (Khader, and El-Wifati, 1987). Because of the higher priorities that the state gave to the agricultural and the industrial sectors, both sectors grew rapidly (Gurney, 1996). However, these sectors faced problems such as low productivity, lack of the skilled manpower, managerial techniques, technical skills and technological infrastructure to run these sectors. By the end of 1970s, the state was clearly uncertain as to how to get out of these economic difficulties (Gurney, 1996). The following period saw hard measures imposed to deal with the financial and economic difficulties that the Libyan economy was going through.

2.1.2 The Economy during the 1980s[6]

It was not a story of success in this period, when the Libyan economy witnessed many economic difficulties (Allan et al., 1989). Loss of revenues made the state more vulnerable and unable to continue its policies of importing commodities, spending money on development projects and satisfying local market needs (Khader and El-Wifati, 1987). The state's spending attitudes changed, and new policies had to be put in place to remedy the situation (Comet Report, 1985).

2.1.2.1 Economic Difficulties and Unsteadiness

There was a reordering of priorities so that national income could match expenditure (Libyan Ministry of Planning, 1981). Table 2.1 describes development expenditure up to 1985 plan. In 1983, the state decided to concentrate on heavy industry (Libyan Secretariat of Planning and Finance, 1985). After the1976-1980 plan, the Libyan economy experienced economic changes. Libya's economy had little success in making transformations. The total expenditure for the second five-year development plan of 1981-1985 was about 18.5mn Libyan Dinar (Comet Report, 1985).

Table 2.1: Expenditure under the Development Plan 1969-1985 (LD dinar mn)

Sector	1969-74	1972-75	1973-75	1976-80	1981-85
Agriculture	160	165	555	1,1911	3,100
Industry	91	174	260	1,334	4,000
Public works	177	125	295	1,131	3,000
Communication	163	164	199	930	2,100
Education	116	108	186	522	1,000
Health	53	47	70	276	560
Total	**1,150**	**1,165**	**2,586**	**9,350**	**18,5000**

Source: Middle East Economic Survey, 1987.

The economic transformation required high levels of imports, and when oil prices began to stumble; this dependence created difficulties in 1981 (Economic Intelligence Unit, 1987). The Libyan government tried to readjust its economy, and therefore some imports had to be cut (Khader, and El-Wifati, 1987). At the same time, foreign companies who were operating in Libya were also pressurised to become *Libyanised* through training programmes for Libyans to take over technical and administrative functions (Economic Intelligence Unit, 1987). However, the *Libyanisation*[7] of businesses and industries did not address how levels of managerial competence.

It was difficult for Libya to plan and finance different development projects because of oil market fluctuations in production and prices (Economic Intelligence Unit, 1987). The Libyan economy needed to introduce more effective management and economic policies. To summarise, the economy during the 1980s faced many difficulties. To overcome these, the following period saw reasonable economic policies implemented to readjust the troubled economy.[8]

2.1.3 The Economy during the 1990s

Libya's economy during the 1990s saw more reasonable policies introduced (LNAID, 2000). Nationally, there was the idea to permit a private sector, especially, small and medium-sized enterprises **(SMEs)** in manufacturing (El-Houderi, 1999). Therefore, the limited private sector and public sector could run together, where as in the past the private sector was strongly opposed by the state. In early 1988, a move towards

liberalisation and privatisation got underway. In 1992, a privatisation law was enacted, calling for the sale of public assets to private interests and for greater private sector participation in the economy (Amuzegar, 1999).

2.1.3.1 Policy Readjustment

In 1992, international economic sanctions were imposed on Libya which led to Libya's economy suffering and unfortunately Libyan standards of living declined (El-Houderi, 1999). The Libyan economy suffered from many economic problems such as budget deficits, a spreading of corruption, and weak agricultural, industrial, communications and technological infrastructure (Economic Intelligence Unit, 2003).

The Libyan state introduced new policies to improve the national economy. Libya tried to improve its image in the West (particularly the USA and Europe) in order to become a full member of the international community, Libya now seeks to have relations with every country (Economic Intelligence Unit, 2004). According to Libyan official sources, the state is trying to ease foreign investment restrictions and to open up its economic sectors to foreign investors (Adowa Iktesadia, 2002).

During the past three decades, Libya has initiated large development projects in order to diversify its economy. Libya now aims to attract foreign investment and technical expertise and to encourage investors to realise projects in Libya. In this period, however, there has been growth in **GDP** for all economic sectors due to the higher oil prices during 1990-2004. It can be seen in Table 2.2 that in 1990, **GDP** was 10,612 bn

LD, and in 2000, it was approximately 13,927 bn LD. The real **GDP** for 2004 was 28,006.6. It increased drastically due to high rises in oil and gas prices this had an impact on the performance of all the economic sectors.

Table 2.2: Real GDP at Current Factor Income During Period of 1990-2004 (L.D mn dinar)

Economic Sectors	**1990**	**1995**	**2000**	**2004**
Agricultural & Fishing	678.2	947.0	1455.5	1375.8
Oil & Natural Gas	3054.0	2468.0	3192.5	15782.6
Mining & Quarrying	72.5	148.6	244.0	382.6
Manufacturing	706.0	799.7	1001.0	764.7
Electricity & Water	177.0	216.7	256.5	303.2
Construction	1319.5	483.9	710.0	1326.7
Trade & Hotels	1041.5	1245.0	1673.0	2204.9
Transportation	812.0	892.6	1073.0	1530.1
Finance Insurance	370.5	286.2	318.5	439.9
Ownership of Houses	315.3	391.0	470.5	534.1
General Services	1030.5	823.1	1497.0	1305.3
Education	533.5	736.4	1026.5	1038.0
Health	330.0	293.8	540.0	567.5
Other Services	172.0	307.7	468.5	451.2
GDP Distributed:	**10612.5**	**10048.7**	**13927.0**	**28006.6**
A) Oil & Natural Gas	3054.0	2468.0	3192.5	15782.6
B) Non Oil	7558.5	7580.7	10734.5	12224.0

Source: Libya National Corporation Authority for Information and Documentation (LNAID), 2004; Secretariat of Planning and Finance, Tripoli, Libya, 1990-2004; Libyan Central Bank, 2004.

According to official Libyan sources (2004), there has been growth in all economic sectors (Libyan Central Bank, 2004). **GDP** in 1995 was 11,985.9mn at constant prices (Libyan Central Bank, 2000). Real **GDP** at constant prices achieved a total of 14,285.8mn in 2000. (see Appendix 1). In 2004, there was a significant growth in all sectors, and the real **GDP** reached a total of 15,736mn at constant prices in 2004 (Libyan Central Bank, 2004).

2.1.4 The Economic Future in the 21st Century

Libyan relations with the West are improving especially with the USA. Libya is continuing to normalise its relations with Europe more rapidly (Adowa Iktesadia, 2003). As a result, it will have the opportunity to improve its economy and modernize its technological infrastructure in all economic sectors.

2.1.4.1 The Economy during the 2000s -Coming in from the Cold

At this stage, Libya's fiscal position remains strong due to high oil prices (Economic Intelligence Unit, 2004). Libya continues to seek foreign direct investment **(FDI)** in strategic sectors, and especially in the oil and gas sector according to the chairman of the Libyan National Oil Corporation **(NOC)** (Adowa Iktesadia, 2003).

2.1.4.2 Gradual Liberalization and Economic Prosperity

The Libyan economy is growing, according to data published by the International Monetary Fund (IMF, 2003). The **IMF** (2003) report states that the main factor was the sharp rise in oil prices (Economic Intelligence Unit, 2005). The Libyan government continues to reform and liberalise its economy by introducing the concept of a market economy based on transparency and good economic policies (Adowa Iktesadia, 2003 and al Meshal, 2002). The Libyan market is large and likely to remain one of the most attractive oil and gas markets in the world. The Libyan market is an extremely rewarding market for foreign companies. Those companies can exploit their opportunities to the full potential in the Libyan market.[9]

2.1.4.3 Economic Indicators

Since commercial oil was discovered in Libya in 1957, Libya has become an important oil exporter, particularly to European markets (Gurney, 1996). Libyan oil revenues represent the main source of hard currencies and provide 95% of Libya's export earnings (LNAID, 2004). To understand the Libyan economy, it is necessary to look in depth at the sources of revenues. These can be seen in Table 2.3, in a comparison of significant indicators between 1970 and 2004.

Table 2.3: Libyan Economic Indicators 1970, 2000 and 2004 (2004 at Current Prices) $US Billion

Indicator	**1970**	**2000**	**2004**
GDP	$5.0 Billion	$39.6Billion	$ 40.2Billion
Oil Revenue	$2.7 Billion	$7.2 Billion	$11.5Billion
Labour Force	400.000	1.200.000	1.254.000
Current Account Balance	$0.9 Billion	$2.010 Billion	$2.236Billion
Merchandise Exports	$2.8 Billion	$7.7 Billion	$ 8.3Billion
Population	2.0 Million	5.5 Million	5.8 Million
Merchandise Imports	$0.8 Billion	$4.6 Billion	$4.5Billion
GDP per Capita	$2.500	$6.500	$6.750
Trade Balance	**$2.0 Billion**	**$3.1 Billion**	**$3.8Billion**

Source: Several reports from the Libyan Central Bank, vol.44, 2004, and the Libyan Ministry of Planning, 1970-1990, Economic Intelligent Unit, 2004; Libyan National Corporation for Information and Documentation (LNAID), 2004.

From the economic indicators, it can be seen that the Libyan economy has witnessed reasonable improvements throughout three decades, including an increase in **GDP**'s in all economic activities. The **GDP** structure has witnessed important changes in the contribution of the non-oil sectors, for example, construction, manufacturing, commerce, tourism, and agriculture. All these sectors and others have increased and contributed to **GDP** (Libyan Central Bank, 2004).

However, in presenting general information on some important indicators of the Libyan economy regarding its evolution from 1970 until 2004, Table 2.3 gives only a snapshot of the development of the Libyan economy within the last three decades. However, the following facts can be concluded from the table:

* The GDP has increased dramatically from $5bn in 1970 to $40.2bn in 2004.
* There has been a tendency for a decreasing dependency on oil, down to 18% in 2000 compared to 54% in 1970; which is mainly due to the development of the petrochemical sector and other industries.
* Although the labour force has witnessed significant growth, it remains approximately the same with respect to the total population.
* The current account balance has increased from $900mn in 1970 to more than $2.23bn in 2004. This has been mainly due to increases in oil prices.
* Due to the development of non-oil sectors, particularly the petrochemical sector, there has been a slight change in the structure of exports. For example, in 1970 oil exports represented 100% of merchandise exports, while this percentage declined in 2000 and 2004 respectively. In contrast, the values of imports represented 30% and 60% of those of total exports in 1970 and 2004 respectively.
* The GDP per capita increased from $2500 in 1970 to $6500 in 2000 and $6750 in 2004, which mainly resulted from the rise in the non-oil sectors contribution to the GDP.
* The trade balance recorded a surplus in 1970, 2000, and 2004.

2.2 Employment

According to the Libyan Secretariat of Planning (2004), and shown in Table 2.4, the size of the workforce in Libya reached around 1,325,513 workers in 2003. The Libyan workforce represents 87.0% of the total workforce. The number of workers rose to 1,315,709 in 2000. In 2004, employment was expected to reach 1,481,058 employees.

Table 2.4: The Size of Employment in the Libyan Economy (1995-2004) ('000 of workers)

Year	Number of Employment	Year	Number of Employment
1995	1210.141	**2000**	1315.709
1996	1224.069	**2001**	1310.300
1997	1255.110	**2002**	1314.226
1998	1223.701	**2003**	1325.513
1999	1325.503	**2004**	1481.058

Source: Secretariat of Planning, Tripoli, Libya 2004; Libyan Central Bank, 2003; Central Bank, 2004. It is also stated that it is difficult to estimate the exact total workforce so care should be taken regarding the employment figures (LNAID, 2005).

According to the Libyan Central Bank annual report (2004), analysis of the distribution of the workforce according to economic activities reveals that the number of workers has increased in all economic sectors. Economic sectors such as agriculture, oil, mining, industry, electricity, and construction, employed around 51.1% of the total work force. However, in 2004, other sectoral services employed around 49.9% of the total workforce (Libyan Central Bank, 2004). Agriculture, forestry, and fisheries still remain the biggest sector in terms of employment (see Appendix 2). This sector accounts for around 17.0% of the total workforce, while the construction sector covers 14.7%, and the educational sector represents 14.0% of the total (Libyan Central Bank, 2004).

An important source of economic weaknesses in the Libyan sectors relates to the technical conception of development projects and the difficulties in undertaking their implementation (Libyan Central Bank, 2004). Furthermore, the Libyan economy has a shortage of manpower and it needs all different kind of skills to be productive in the economy. As a result, foreign expertise is needed to transfer required managerial skills and technological advances into Libyan development plans, so as to achieve a healthy economy in the long term (Economic Intelligent Unit, 2004).

2.3 Libyan Foreign Trade

According to the LNAID, (2004), the value of the imports was a total of 1,510.9 mn LD in 1990. The value of exports in the same year was 3,744.9mn LD (LNAID, 2004). This gave a total balance of 2,234mn LD. In 2004, the imports were 5,821.9 mn, and exports were a total of 10,288.0 mn. Therefore, the trade balance reached a total of 4,466.1mn. Table 2.5 shows Libyan imports, exports and trade balance statistics during the period of 1990-2004.

In 2002, the value of exports was 10,177.0 mn LD, compared to 5,394.0 mn LD in 2001. According to the Libyan Central Bank (2004), during 2003, the value of exports and imports indicated a trade surplus of 11,177.0 mn LD. The major commodities values such as crude oil and natural gas have major importance in the Libyan export structure (see Appendix 3).

Table 2.5: Libyan Imports, Exports and Re=Exports, and Trade Balance (1990-2004) in Libyan Million Dinar

Year	Imports	Exports and Re-Exports	Trade Balance
1990	1510.9	3744.9	2234.0
1991	1505.5	3153.7	1648.2
1992	1422.1	3038.8	1616.7
1993	1711.3	2477.6	766.3
1994	1487.9	3117.2	1629.3
1995	1728.5	3222.1	1493.6
1996	1914.8	3578.7	1663.9
1997	2138.6	3455.6	1317.0
1998	2203.8	2374.1	170.3
1999	1928.6	3682.2	1753.6
2000	1911.4	5221.5	3310.1
2001	2660.4	5394.0	2733.6
2002	5585.7	10177.0	4591.3
2003	5851.7	11177.0	5325.3
2004	5821.9	10288.0	4466.1

Source: Libyan Central Bank, (2004), Research and Statistics Department, and Libyan National Authority for Information and Documentation (LNAID), Tripoli, Libya, 2004.

2.3.1 Main Trading Countries

The Libyan Central Bank (2004) has stated that Libya's exports traditionally go to industrial countries especially the European markets. Italy is considered to be the number one partner, followed by Germany, Spain, Switzerland, Turkey, and France which receive small proportions of total Libya exports, as can be seen in Tables 2.6 and 2.7.

Table 2.6: Major Countries Trading with Libya --Main destinations of exports (% of total)

Country	1990	1995	2000	2004
Italy	**41.3**	**40.0**	**37.6**	**39.7**
Germany	**19.2**	**16.2**	**22.3**	**12.8**
Spain	**10.9**	**12.8**	**12.0**	**13.7**
Switzerland	**2.4**	**2.2**	**2.2**	**3.2**
Turkey	**1.6**	**3.2**	**3.0**	**6.7**
France	**5.2**	**3.8**	**5.8**	**6.2**

Source: Libyan National Authority for Information and Documentation (LNAID), Tripoli, Libya 2004; Libyan Central Bank, 2004, Economic Intelligence Unit, 2004.

Tables 2.6 and 2.7 also show the geographical distribution of Libyan imports and exports as follows: Italy is considered to be the main traditional market for Libyan exports and imports. Because of geographical and historical factors, and the nature of Libyan imports, Libya has been importing machinery, equipment, and industrial commodities. There has been a big trade relationship between Libya and Europe in general. As a result, this market has been and will remain the main trade partner with Libya.

Table 2.7: Main origins of imports 1990-2004 (% of total)

Country	1990	1995	2000	2004
Italy	23.0	21.4	23.4	27.5
Germany	15.6	13.6	12.5	9.5
Tunisia	3.9	8.0	7.3	7.7
UK	8.4	n/a	6.8	7.0
South Korea	6.1	6.4	6.4	6.4
France	7.0	4.3	6.5	5.9

Source: Libyan National Authority for Information and Documentation (LNAID), Tripoli, Libya 2004; Libyan Central Bank, 2004; Economic Intelligence Unit, 2004.

According to the Libyan Central Bank (2004), imports from Italy were estimated to represent 27.5% of total imports during 2004. However, Germany's percentage of imports during that year was 9.5%, whereas average Libyan imports from UK and Tunisia were 7.0% and 7.7% respectively (LNAID, 2004).

2.4 Technological Development in Libya

This section focuses on technological developments in modern Libya. A modern and well functioning information telecommunication technology infrastructure and adequate access to hardware, software, and services are basic requirements for e-Commerce technology. As a developing country, Libya is striving to achieve these

basic requirements, in order to develop its Internet infrastructure. The availability of telecommunications equipment in particular, will enhance the capacity of Libya's businesses to participate in e-Commerce technology.

The **LOGCs** can benefit from Internet and e-Commerce in terms of sales of products and services. Libya's oil and gas industry has a comparative advantage which it has not been able to utilize fully because of a lack of technological infrastructure. The present research intends to deepen the understanding of the issues involved in e-Commerce adoption and the development of the Libyan oil and gas industry.

The development of the Internet and e-Commerce business has to be part of general economic debate. If the Libyan government and its oil industry is doubtful about its ability to finance Internet based e-Commerce infrastructure, it should realize that once a critical mass of Internet e-Commerce traffic is reached, users themselves whether domestic or foreign, would start investing in the infrastructure.

A few years ago, Internet technology was not available in Libya, but now many **LOGCs** have set up Internet access in their companies. Furthermore, Libyan managers are changing their attitudes and increasing their business involvement worldwide by establishing an Internet presence. Today, the mood is changing, and the Internet is expected to provide huge returns to their traditional business investments. The Internet has the potential to change the way oil businesses work and the way managers conduct their work (Livesay, 2000; Zhida, 2000).

For Libya, e-Commerce represents a tremendous opportunity, but there is a need to have an adequate technical infrastructure. Successful e-Commerce technology relies on business sense rather than on the complexity of web sites. e-Commerce offers various opportunities, including the elimination of middlemen in trade, reduced transaction costs, and increased trade in global markets.

2.4.1 IT in the Libyan Oil Sector

The **LOGCs** have a great opportunity to undertake Internet and e-Commerce initiatives. As Libya is trying to develop the diversity of its economy, its goals will be best achieved by using the Internet and e-Commerce (Terterov and Wallace, 2002; Arab Advisors Group, 2003). As far as Libya is concerned, the **IT** revolution is needed as the ideal market location for foreign and domestic companies to undertake Internet and e-Commerce ventures, including **B2B**, and **B2C** e-Commerce activities (Economic Intelligent Unit, 1998).

2.4.2 e-Commerce: Real Economic Change

It can be argued that e-Commerce is changing the face of every economy, extending the boundaries of the possible and growing rapidly (Steinfield, 2003; Feldman 2000). One study has suggested that the Internet economy has been growing annually at a high rate (Feldman, 2000). Forrester Research (2001) has predicted that the worldwide Internet economy will reach value of US$6.9 trillion in 2004.[10]

The opportunities for the **LOGCs** are to add business and economic strategies by enhancing their portfolios with **IT**. Moreover, **IT** investment offers new opportunities to the **LOGCs** in the e-Commerce area to expand their global reach. The culture of **LOGCs** is not fully established in terms of a business drive for e-Commerce strategies. By educating **LOGCs** in the subject of e-Commerce and its influence on the economy, there will be more chance of building the demand for products, services and further profits. Therefore, promoting the commercial value of e-Commerce would make more financial sense to the Libyan economy as a whole.

When large organizations have decided to use Internet activities, billions of dollars will be generated and rapidly added to the Internet economy (Feldman, 2000). To achieve results, however organizations need to adopt e-Commerce systems and management approaches that can realise real economic change. However, businesses face issues in relation to basic requirements, especially when dealing with organizational inertia, cultural sensitivities and **IT** capabilities, particularly in the developing countries. Thus, in the case of Libya, these requirements can be very challenging.

2.4.3 Economic Drivers

To understand fully the economic drivers and growth of e-Commerce, a number of ideas have emerged to explain the economic impact of e-Commerce technology. First of all, e-Commerce has a huge affect on marketplaces and the methods organizations use in doing business. As a result, new products and services are developed and

relationships created between businesses. This has an effect on the organization's work in terms of flexibility and adaptability.

Secondly, e-Commerce reforms economic concepts, and it establishes electronic links between global businesses. It increases openness and speed through the Internet. As the role of time changes, so will the structure of all business and economic activities, causing potentially large impacts (World Trade Organization, 1999). However, in examining the economic forces that drive e-Commerce, economic success depends on the supporting structure, so that government policies are relevant to commerce and trade.

2.4.4 Libyan Telecommunications Infrastructure

Telecommunications are a priority for the Libyan government. Libya's Internet technology began in the mid 1990s, with the objective of improving the access of Libyan businesses and citizens alike to the Internet and reducing the digital gap between Libya and the rest of the world (see Appendix 4). e-Commerce technology in Libya is still a difficult proposition even though the telecommunications infrastructure is showing signs of improvement as Libya seeks to increase its teledensity. However, it is believed that an Internet revolution is possible in Libya through networks of content and service providers (MEC International, 2001).

2.4.4.1 Internet Development

Libya has established internet development and infrastructure, in communications and Internet centres which provide telephones, computers and fax services, and Internet and e-mail services. Many users are limited to using e-mails for business and personal purposes. However, in Libya there is a plan to expand the Internet across the country. One major worry is the prospect of the Internet becoming free, as Libya's General Post and Telecommunications Company **(GPTC)** still depends on access charges for its revenues.

In Libya there is a growth in both Internet infrastructure and users (GPTC, 2003). This is a reflection of the development of the telecommunications infrastructure in different parts of Libya. The use of the Internet will increase once competition in Internet services providers **(ISPs)** is allowed, leading to a fall in Internet access charges. Libya Telecom and Technology (2002), stated that the more people are connected to the Internet, the better informed they are likely to be. This will lead to more informed decisions, which in turn will help to build a stronger society. Libya has established Internet services and opened to the public a number of Internet and computer institutions and centres, with quality services provide to all people throughout the country (Libya Telecom and Technology, 2002).

In 1994, the Libyan government granted El-Madar, a public private company in which the General Post and Telecommunications Company **(GPTC)** has a 20% stake, a concession to operate Global System for Mobile Communications **(GSM)** services

using the 900 mhz standard (Uziyel and Kishtainy, 2001). Telecommunications are stated to be a priority within the Libyan government 's investment programme (see Appendix 4). New government mechanism to promote telecommunications development has been set up, but few details have been made public.

The intention is that by 2020, tele-density will increase by 37 per cent. This will require an estimated investment of US$10 billion over the 2000-2005 period (Libya Telecom and Technology, 2002). Foreign investors will provide up to 50 per cent of the total, although there are, as yet, no signs that the sector will be liberalized or the National Telephone Company **(LNTC)** offered full or partial privatization (MEC International, 2001).

The Libyan government is aware of the importance of communications and Information Technology **(IT)**. Private, government and offshore investment will increasingly head into the communications and information technology sector. Telecommunications access to Libya is already difficult because of growing pressure on a limited number of lines. Meanwhile, Libya is committed to building a national backbone network to connect banks, universities and other public sources to the Internet (Terterov and Wallace, 2002; Libya Telecom and Technology, 2002).

2.4.4.2 Libyan Mobile Phones

Libyana, a Libyan state-run mobile phone operator, has signed a $38.5 million mobile phone network deal with China's number two telecoms equipment maker ZTE Corp. A

senior manager at Libyana has disclosed that "The deal will help Libyana expand its network, with a high quality service," (Mena Report, 2005). Libyana is Libya's second-largest mobile phone operator which competes against El-Madar, another state-owned operator. Libyana's subscriber numbers have reached 186,000 since it launched its operations in May, 2004. It seeks to expand the number of subscribers to more than 2.4 million in Tripoli and 45 other cities and towns in the near future. Libyana aims to expand its coverage to 12000 square kilometres to cover Azzawia in the west to Alkhomis in the east. Under the terms of its contract, ZTE will provide Libyana with technical support for three years (Mena Report, 2005).

2.4.4.3 Libyan's Telecoms Investment Plans

According to the General Post and Telecommunications Company (1990), the Libyan government has laid out a plan for the development of telecommunications, covering the period 1993-2020, with the following aims:

- Adoption of modern digital technology and the replacement of old technology.
- Fully automatic telecommunications services.
- Improved connectivity, and services to remote areas.
- Provision of data transmissions such as the Internet.
- Provision of **GSM** services.

The Libyan government is participating in the latter project in a way that will allow it to maximise benefits to its services and operations and its role in decision-making (Terterov and Wallace, 2002). The budget for the plan for 2000-2020 is split between

systems expenditure (subscriber equipment, cable networks, carrier networks) and construction and service centres, transportation, training, consultancy and technical support (Terterov and Wallace, 2002).

2.4.4.4 Libyan Strengths and Weaknesses

The Libyan business sector possesses some advantages with regard to its information technology landscape. Although Libya does not have a thriving hardware and software market in terms of manufacturing and design, it still has the opportunity to be involved in information technology. Massive oil wealth, low costs of labour and an ideal location provide a great opportunity for Internet and e-Commerce in the 21st century.

Although Libya has numerous weaknesses in terms of Information Technology **(IT)**, Libya is and will continue to be an ideal place to locate and adopt **IT** applications such as Internet and e-Commerce technology in its business sector. The market is lucrative and the demand is there. Libyan companies, however, should seriously consider adopting **IT** in their organizations. The following are the primary strengths and weaknesses in Libyan **IT**:

2.4.4.4.1 Strengths

- Its small population makes investments in the infrastructure for technologies possible and cost effective. Furthermore, Libya is situated at the crossroads of Europe, Africa and the Middle East, providing a potential market to millions of people.

- The Libyan government is supportive of the telecommunications industry and infrastructure. Policies are aimed at inviting foreign technology companies to the country.
- Large revenues from oil and gas will increase **GDP** per inhabitant and living standards. This will increase access to modern technology, allowing it to become a mainstay of society. For example, even though access costs are high the majority of the people in Libya can afford it.
- Libya offers a unique regional advantage to its oil and gas businesses, and this is a great incentive for establishing information technology.
- Growth in Arabic software packages in Libya and other Arabic speaking countries for business and other use increases the potential user base of the Internet, and computers in general.
- The major universities and education facilities around the country are offering programmes in telecommunications and information technology. Furthermore, Libya is beginning to make basic computer skills a key curriculum subject in its educational institutions. There are considerable educational opportunities for information technology in Libya.

2.4.4.4.2 Weaknesses

- The General Post and Telecommunications Company **(GPTC)** is a monopoly that controls telecommunications and Internet access. This would limit foreign and local investment in telecommunications and Internet gateways.
- No significant manufacturing of hardware or software locally.

- The cost of Internet access is still high. Although many large business organisations are able to afford modern technologies, other businesses are lagging behind. Until the gap between these business organisations is bridged, Libyan business organisations will not be fully modernised.

2.4.4.4.3 Management and Technology Mismatch

Given this theoretical background, the issues involved in IT relating to companies, with particular emphasis on managerial attitudes can be discussed. Al-Sulimani et al (1994), Bukhari and Meadows (1992), and Atiyyah (1988) and (1989) have found that IT is often hampered by technical, organisational, and human problems. For example, within the Arab world, management has yet to develop successful approaches to IT, computer systems and policy (Ali, 1991; Atiyyah, 1989; Goodman et al., 1992). This may also be the case for Libyan management.

IT appears to be used in most, if not all, governmental agencies, industries and businesses. Also, Libyan businesses use computers and the Internet with a steady growth of utilisation (GPTC Report, 2004). Generally, Libyan management views computers and the Internet as symbols of modernity. IT diffusion in Libyan businesses still remains low, however, reflecting a general slowness in the diffusion of the Internet and e-Commerce technology. Accordingly, computers and technology usage in general is still limited (Libya Telecom and Technology, 2002).

2.5 Technological Infrastructure

This section focuses on a review of the technological infrastructure in modern Libya. Libya's languishing telecommunications sector has received a boost, since a new mobile phone network operator and service provider called Libyana was launched in 2004. Besides, this Libya's state owned General Post and Telecommunications Company **(GPTC)** has contracted with Alcatel of France and Nokia of Finland to enlarge Libya's mobile phone network.

2.5.1 Technology and Telecommunications

According to **GPTC** officials, two networks will be built, which together will provide 2.5m new mobile phone lines. At present there are 195,000 mobile subscribers and 700,000 fixed lines (GPTC Report, 2004). The launch of Libyana promises some competition to El-Madar, which was previously Libya's only mobile phone company. However, the competition will be limited. Like El-Madar, and Libyana are entirely owned by the **GPTC.**

2.5.2 Internet and Online e-Commerce

The Internet in Libya has become a modern and fashionable tool for many Libyans. Table 2.8 shows the number of Internet users in Libya, who see it as a sign of progress and modernity. However, it will be some time before it is used, to strengthen Libya's economic sectors particularly in the oil and gas sector. This needs a management strategy of managing the Internet and e-Commerce technology to be more effective in the Libyan economy. The Libyan business sector also needs to increase their market

reach online. For example, **LOGCs** will have a great advantage to utilize the global information market and capital flows if they adopt Internet and e-Commerce technologies, which offers business opportunities to a broad marketplace.

2.5.2.1 Internet Infrastructure

The Libyan petroleum companies can improve their information, education, local events, workshops, seminars and training facilities with help from the Libyan government. In this respect, the Libyan economy is improving steadily and the political situation is stable, so the Internet and online business can make a great contribution to the global market economy. Accordingly, the Libyan government is creating and expanding Internet connections and infrastructure. Libyans and the business sector have access to working phone lines and the penetration of computer and information technology is increasing.

2.5.2.2 Libyan Telecommunication Company

The Libyan General Post and Telecommunication Company **(LGPTC)**, operates a dial up and leased line Internet hub connected to many cities. [11] In 2001, there were only two Internet companies; but by 2002 the number of Internet Services Providers **(ISPs)** had increased to seven Internet companies. Public access Internet facilities are available in many Libyan cities. Table 2.8 shows the statistics for Internet users in Libya during the period of 1997-2004. Libya's Internet users are growing relative to its small population.

Table 2.8: Internet users in Libya (1997-2004)

Year	Internet Users	Year	Internet Users
1997	300-450	**2001**	45000
1998	660	**2002**	150000
1999	1800	**2003**	350000
2000	10190	**2004**	970,000*

Sources: www.ajeeb.com, www.dit.com Group, Libyan Technology and Telecommunication (LTT), http://www.nua/surveys/how-many-online/africa.html, It is still difficult to maintain exact figures of Internet usage however, the Libyan Telecommunication s and Technology offered this estimates *Estimation by LTT, http://www.lttnet.com/,

The Internet is offered to businesses, government agencies, non-governmental organizations (**NGOs)**, universities, and other professionals. It can help the Libyan business sector in both the private and public sectors by providing access to various international suppliers and global markets.

2.5.3 The Role of Government in e-Commerce

A joint venture between the Libyan government and Libyan business sectors has simulated **B2B** e-Commerce transactions. This provides useful insights for further development of Internet and e-Commerce rules and regulations in Libya. This will create major **B2B** e-Commerce possibilities for all Libyan businesses. It will be owned and operated completely by the Libyan government. In the United Arab Emirates, for example, a **B2B** site was created and it is called Tejari.com.[12] Tejari has become the premier digital marketplace in the Middle East.[13]

2.6 Oil and Gas Sector [14]

This section focuses on the Libyan oil and gas sector. The development of the oil and gas industry in Libya has been amazing during the last four decades. In less than one decade Libya became a major exporter (Metra Consulting, 1981). This oil income transformed Libya into a capital exporter. Oil and gas have and will continue play a major role in the Libyan economic structure and its development plans. According to the National Oil Corporation **(NOC)** official data (2004), the potential of oil reserves is placed at over 100 billion barrels and gas reserves are estimated at 50 trillion cubic feet (see Appendix 8a,b). Thus the development of Libya's economy should flourish. However, good economic policies are needed to achieve economic prosperity.

2.6.1 Oil Production

In 1970, oil production reached a peak of 3.318 mn b/d; this was the highest oil output Libya has ever reached (Gurney, 1996). In the late 1980s, output had dropped to less than a million b/d. Libya's onshore oil production is found mainly in the Sirte basin (Gurney, 1996). The stages of Libyan crude oil production in the period 1970-2005 give a good overview of oil production (see Appendix 7).

Libya's oil and gas industry is run by the state owned National Oil Corporation **(NOC)**, founded in 1970 (Gannous, 1998). Several international oil companies are engaged in Exploration/ Production agreements with the **NOC**. Table 2.9 shows the oil and gas companies operating in Libya during the period 1995-2003, indicating that with the

exception of the American companies which left in 1986, many foreign companies were working in the country.

Table 2.9: Production of Crude Oil by Operating Groups (Mn of Barrels)

Operating Group	During									NOC %
	1995	1996	1997	1998	1999	2000	2001	2002	2003	
Agip	79.3	83.5	78.5	70.3	62.7	64.6	65.4	62.8	65.2	62.5
Arabian Gulf	166.2	177.3	151.1	163.7	149.6	144.3	136.8	134.0	158.1	100.0
Sirte	39.5	44.3	43.3	42.7	41.2	40.5	42.1	38.3	40.5	100.0
Veba	33.9	38.0	35.0	34.6	32.6	32.7	32.6	31.0	36.5	51.0
Waha	145.0	143.4	138.7	132.0	113.6	108.2	107.2	79.4	114.8	51.0
Zuweitina	25.6	27.0	25.6	25.5	24.5	25.4	26.0	23.1	22.0	66.0
Wintershall	33.1	31.2	32.9	42.3	39.4	39.0	39.0	38.3	41.1	51.0
Total Co.	3.6	3.5	3.7	5.1	6.4	6.4	6.5	6.7	7.8	80.0
O.M.V	1.1	1.2	1.1	1.0	0.8	0.6	0.6	0.5	0.4	65.0
Repsol	-	-	-	32.6	56.5	58.1	59.7	59.4	73.6	50.0
Total	**527.3**	**549.4**	**543.2**	**574.7**	**527.3**	**519.8**	**516.8**	**473.5**	**560.0**	

Source: The Libyan National Oil Corporation (NOC), Tripoli, Libya, 2004.

The major operating company in that period was Arabian Gulf with a production capacity of 166.2 million barrels per year representing 31.8% of total production in 1995; and its 158.1 million barrels in 2003, represented 28.2% of the entire production of all the operating companies. The second biggest producer was Waha with 145.0 million barrels in 1995 and 114.8 million barrels in 2003, representing 28% and 20.3% of total production respectively.

2.6.2 Oil Exports

In relation to export distribution according to oil companies operating in Libya, Table 2.9 shows that production by operating groups are distributed among other national oil and joint venture companies (Libyan National Oil Corporation, 2003). According to the **NOC,** Libya produces high quality low sulphur crude oil at very low cost (NOC, 2003). In the past, the U.S.A was the major buyer of Libyan crude oil, estimated at around 35% of Libyan production. Today, the biggest buyer is the European market (Gannous, 1998).

2.6.3 Natural Gas

From the beginning of 1973, great care was taken of natural gas production (Adowa Iktesadia, 2002). Accordingly, great importance was given to the discovery of new reserves, which were regarded as one of the best means of maintaining existing oil and gas supplies (see Appendix 8). Through its completely owned companies or joint ventures, the **NOC** has undertaken numerous activities in the field of discovery in all parts of Libya (al Meshal Oil Journal, 2000).

Gas production remains a high priority for Libya for two main reasons. Firstly, Libya has aimed, with limited success, to use gas instead of oil domestically, freeing up more oil for export (NOC, 2003). Secondly, Libya has vast reserves and is looking to increase its gas exports, particularly to Europe (al Taqa Wa al Hayyat, 2003). Libya's proven natural gas reserves are largely unexploited and unexplored (see Appendix 8). The next chapter, elaborates in detail the **LOGCs** characteristics and key business

drivers. There are great advantages for modernisation of this industry because of its abundant energy resources. The oil industry is the centre of the Libyan economy, and it needs foreign investment and modern technology to enhance its oil exploration, marketing, technological and production operations and capabilities.

2.7 Conclusion

This chapter has examined several issues related to the Libyan economy over the past three decades. It is clear that Libya is a major oil producer and much of its wealth goes towards major planning priorities in order to achieve sustainable development by attracting foreign investment and expertise. During the past three decades, Libya has initiated large development projects in order to diversify its economy. Libya now aims to attract foreign investment and technical expertise into projects in Libya (El-Houderi, 1998).

The economy has undergone a gradual process of liberalization. The chapter has analysed the strengths and weaknesses of the Libyan economy. It has also evaluated Libyan economic growth during the period 1970 to 2004 by highlighting the economic forces prevailing in Libya from 1970 to the present time.

It appears that the Libyan economy needs advanced technologies, management and economic policies to improve its performance. The Libyan petroleum sector has the potential for modernisation and to adopt and use Internet and e-Commerce technologies. In summary, it can be argued that the discovery of oil has been the most

important element in improving and developing the country's economy. Oil has therefore made a major contribution to making the modern Libyan economy one of the most stable in the region. The next chapter will examine some of the literature in relation to the Libyan oil and gas industry.

End Notes

[1] A UN resolution provided for Libyan independence in 1951. Libya became an independent country and part of the United Nations assembly.

[2] In January 1992, the UN Security Council approved Resolution 731 demanding that Libya cooperate with the Pan Am 103 and UTA 772 investigations, and pay compensation. On March 31, 1992, USA imposed sanctions on Libya. As noted, UN sanctions were lifted on September 12, 2003, after Libya fulfilled all remaining UNSCR requirements. On December 19, 2003, Libya announced its intention to rid itself of WMD programmes. Libya re-established its diplomatic presence in Washington with the opening of an Interest Section on July 8, 2004.

[3] Libya is officially the Socialist People's Libyan Arab Jamahiriya, (2004 est. pop. 5,680,000), (1,759,540 sq km), N Africa, bordered by Algeria and Tunisia (West), the Mediterranean Sea (North), Egypt and Sudan (East), and Chad and Niger (South). The capital city is Tripoli.

[4] The ideological basis of Qadhafi's revolution developed during the 1970s from nationalism based on the Nasser model to one based on his own political philosophy, the Third Universal Theory, set out in his Green Book; draws heavily on Islam, socialism and Bedouin traditions.
[5] In November 2000, the Libyan government emphasised that there is nothing in the Libyan economic system, which opposes private business.
[6] The Libyan economy was a mixed economy and there was no private sector of any importance in Libya since 1979. However, there is a large public sector of state organisations and workers committees owned individual companies. The state has implemented new policies toward the private sector based on partnership business structure. Today however, the state is encouraging Libyans to take advantage of developing the private sector to run a long side with the public sector in order to contribute to the local economy.
[7] In 1980s, the state has issued a decree for the Libyanisation of the workforce; Libyan citizens should lead businesses, and industries. Therefore, foreign companies were forced to use local Libyan labour when possible. Every company was pressured and required to train Libyans. In other respects affecting the economy, the new government marked time, except for its policy of "Libyanization" the process of replacing foreigners and foreign-owned firms in trade, government, and related activities with Libyan citizens and firms.

[8] The political climate of Libya in the mid-1980s placed numerous obstacles in the way of private sector development. The 1978 law requiring all enterprises to be run by workers' committees made effective management almost impossible.

[9] Libya seeks foreign investment: During the 'International Conference on Development and Investment in Libya' held in November 2000 in Tripoli, businessmen, bankers, consultants were invited to participate in the development of Libya's run down infrastructure.
[10] In 1951 Libya became one of the first African colonies to gain independence. At the time Libya was one of the poorest countries in the world, with average income per head at less than $50 per year.
[11] The General Post and Telecommunications Company (GPTC) announced that it had agreed a ($244m) contract with Alcatel of France and Nokia of Finland.
[12] Most Internet users in Libya are young Libyan citizens and foreign nationals and their usage for chat rooms, using e-mail services and surfing the net for interest's subjects and personal knowledge. However, there is no online business such as e-Commerce technology ready for Libyans.
[13] The figures are taken from official Statistics published by the various government departments in Libya, by NOC, OPEC and by OAPEC or indicated otherwise.
[14] Libya's oil industry is run by the state owned National Oil Corporation (NOC), along with smaller subsidiary companies, which when combined account for around half of the country's oil output.

CHAPTER III

LIBYA'S OIL AND GAS INDUSTRY: HISTORICAL GROWTH, STRUCTURAL CHANGE, TECHNOLOGICAL READINESS, AND CONTEMPORARY DEVELOPMENTS

3.1 Introduction

The previous chapter examined some of the literature in relation to the Libyan economy and its development. This chapter reviews the oil and gas industry in Libya. The chapter attempts to examine **LOGCs** strategy and infrastructure readiness by highlighting the critical issues with respect to the petroleum industry's context. In order to facilitate an understanding of Libya's oil and gas sector, the chapter includes a detailed focus on the literature concerning Libya's oil and gas industry, its development plans, and the role of technology in the petroleum economy in the 21st century.

The chapter reviews e-Commerce infrastructure highlighting commonalities and gaps with respect to e-Commerce adoption in petroleum companies. It provides examples of international oil and gas organizations that are developing e-Commerce technology. Finally, this chapter provides concluding remarks and comments on the future of Libya's oil and gas industry in relation to information technologies.

3.1.1 Historical Overview

Oil and natural gas are considered to be the country's most important industry, and represent the backbone of Libya's economy (Simons, 1996). Due to the great importance of these industries, Libya has always given them priority and utmost regard (LNAID, 2004; Gannous, 1998). Libya is an important oil and gas exporter, especially to European markets (Libyan Central Bank, 2003). Since Libya has rejoined the international community, international petroleum companies are looking forward to working in Libyan petroleum markets. This allows Libya to buy oil field equipment, oil facilities, and refineries, which were previously banned (Libyan National Oil Corporation, 2003).

3.1.2 Nationalisation of the Libyan Petroleum Industry

In 1973, the state issued a decree nationalising and transferring 51 per cent of all oil operations to the Libyan National Oil Corporation **(NOC)** (Gannous, 1994). The Agip company retained a 50% stake in Agip Libya against the general trend for foreign companies to be left with a 49% holding (Gurney, 1996). Further, all foreign companies operating under Exploration and Production-Sharing Agreements **(EPSA)** must bear all exploration costs regardless of the outcome (Waddams, 1980). From the early 1970s, Libya has dealt with foreign oil companies in the field of production technology since then price reviews and a number of laws, regulations and government decisions were issued to ensure full control over the petroleum industries (Gannous, 1994). As a result of these important laws and regulations, the number of foreign companies which held 100% of contract concessions was reduced, and the national oil

companies were established to own 100% of concessionaire contracts, as well as joint venture companies owning varying percentages (Libyan National Oil Corporation, 2003).

Today, international oil companies, including Americans firms, can deal with Libya because the U.S.A has annulled the sanctions which were imposed on the country. The interest of international oil companies seem willing to invest, and Libya has opened its doors but there is still a cautious approach to foreign investment. The Libyan oil and gas industry has been controlled by **NOC** since 1970; however the **NOC** helped in setting up joint venture exploration projects with foreign oil companies.

3.1.3 Oil Economic Dimensions

Despite all its political decisions, the Libyan government has never lost sight of the fact that foreign assistance is crucial to the development of the oil industry (Amuzegar et al., 1999). In complete contrast to the rest of the economy, there has been huge development of the Libyan oil economy (Allan, 1981). Oil output rose very rapidly as new discoveries were made and developed (Feld, 2003; 2005). In less than one decade Libya became a major exporter, and oil gave the Libyan economy new dimensions (Gannous, 1994). Libyan oil is attractive because of its purity and low cost of extraction (Allan, 1981).

3.1.4 Libyan Petroleum Structure

The National Oil Corporation (**NOC**) was established under Law No. 24 of 1970, in order to replace the General Libyan Petroleum Corporation, which was established under Law No. 13 for 1968 (Gannous, 1994). This enabled the **NOC** to face the massive and rapid development in the oil and gas industry in a more flexible manner and to keep up to date with changes in this international industry.

3.1.4.1 National Oil Corporation (NOC) and Its Affiliated Companies

The **NOC** was reorganized to achieve the goals of the transformation development plans in the oil sector (Waddams, 1980). It was designed to support the national economy, to gain technological experience, and to invest the oil wealth inside and outside Libya through its fully owned companies, or in partnership with others (Gannous, 1994).

3.1.5 The Role of the NOC

The **NOC** performs its duties as listed in the laws and bylaws of its inception, through its fully owned companies which vary in activity from operating and production companies, to refining, domestic processing and international marketing companies, and various service companies (Libyan National Oil Corporation, 2004).

3.1.5.1 The NOC

The **NOC** performs some of its activities through partnership with foreign companies in exploration, production and specialized oil services (Gannous, 1994). In addition to

the Secretariat of Petroleum's technical and regulatory function, the **NOC** is the contractual partner of all foreign firms under the **EPSAs** or any other agreements for the purpose of exploiting Libya's oil resources (Terterov and Wallace, 2002). The **NOC** has the power to negotiate any such agreement and to agree upon its terms, which must be referred to the Libyan government for ratification (Gannous, 1994).

3.1.6 The Role of Foreign Oil Firms

In 1970 Libya negotiated with the twenty foreign oil companies operating in the country, to negotiate an increase in the posted price upon which its oil revenue was calculated (Libyan National Oil Corporation, 2000). Probably its most important function in the oil and gas industry is directing production, correcting prices and protecting oil wealth (Gannous, 1998). A number of international oil companies are involved in exploration/production agreements with the **NOC.**

3.1.6.1 The Former Oil Operators

In 1982, American oil companies Exxon and Mobil withdrew from Libya (Gurney, 1996). Five other American oil companies (Amarada Hess, Grace Petroleum, Occidental, Marathon and Conoco) remained until 1986 (Clyde, 2003). Since 1959, Italy's Agip-ENI had been the major foreign oil producing company operating in Libya (Beschorner and Smith, 1991; Economic Intelligent Unit, 2005). According to Gurney (1996), when the political situation worsened, all US oil companies left Libya.[15] Today, Libya aims to attract foreign oil and gas investment, and particularly, desires the

American companies to return and operate in their old oil fields in Libya (Economist Intelligence Unit, 2005). However, the perennial economic and technological question is how can **NOC** provide the international oil companies with the satisfaction of getting the best fiscal and investment terms in order to attract investors and encourage more foreign oil and gas investors into the Libyan petroleum industry? A related question is can **LOGCs** adopt e-Commerce to reshape the Libyan oil and gas industry?

3.1.7 Libyan Oil Reserves

Presently, Libyan oil reserves have been estimated at 36.5 billion barrels (Libyan Central Bank, 2003). Libya has 12 major oil fields each with reserves of 1 billion barrels or more (Energy Information Administration, 2005). In addition, there are two other fields with a total of 500 million to 1 billion barrels (Energy Information administration, 2004). Libya's oil is mostly concentrated in the Sirte basin area (Al Taqa Wa al Hayyat, 2002). Libya also has a large reserve of oil and gas which has not yet been discovered (Adhowa Iktesadia, 2002).

3.1.7.1 Basin Potentials

To fully exploit Libya's oil potential, attractive fiscal terms are necessary attract foreign oil and gas companies into Libya's oil fields (Bahar and Javan, 2000). Libya's **NOC** main concern is the exploration of new areas in the Sirte, Murzuq, Ghadams and other unexplored areas in Cyrennica and Kufra (Economist Intelligence Unit, 2002). The **NOC** needs to apply modern enhanced oil recovery **(EOR)** techniques in order to increase their production capacity (Bahar and Javan, 2000).

3.1.8 The NOC New Petroleum Law

Libya's current legal framework dates back to a petroleum law enacted in 1955 and the present Exploration and Production Sharing Agreement round **(EPSA IV)**, has been unsuccessful in terms of the scale of discoveries. However, it offered better terms to foreign oil companies than previous **EPSA** rounds. There was also a problem of fiscal terms that were uncompetitive. The general tendency for oil companies is to concentrate on geographic areas; the **NOC**, however, has to compete with foreign investment in other areas (Gurney, 1996).

3.1.8.1 Features of EPSAIV

The **NOC** knows that the fiscal terms are too tough, and that the whole **EPSA IV** round needs to be revised in order to give incentives for more exploration. Nevertheless, international oil and gas companies have had a positive gesture from the **NOC** about the current **EPSA IV** round, and it has promised new and more flexible terms (NOC, 2005).

In 2005, **NOC** held its first round of oil and gas exploration leases since the United States ended sanctions against Libya (Economist Intelligence Unit, 2005). The **NOC** would like to improve transparency and introduce international bidding practices and encourage exploration. Since the lifting of UN sanctions on Libya in 1999, Libya has cautiously approached oil foreign investment, and attitudes toward foreign investment have had mixed reactions (Economist Intelligence Unit, 2004). Libya is eager to attract

foreign investment in its strategic oil and gas sector. However, progress has been relatively slow.

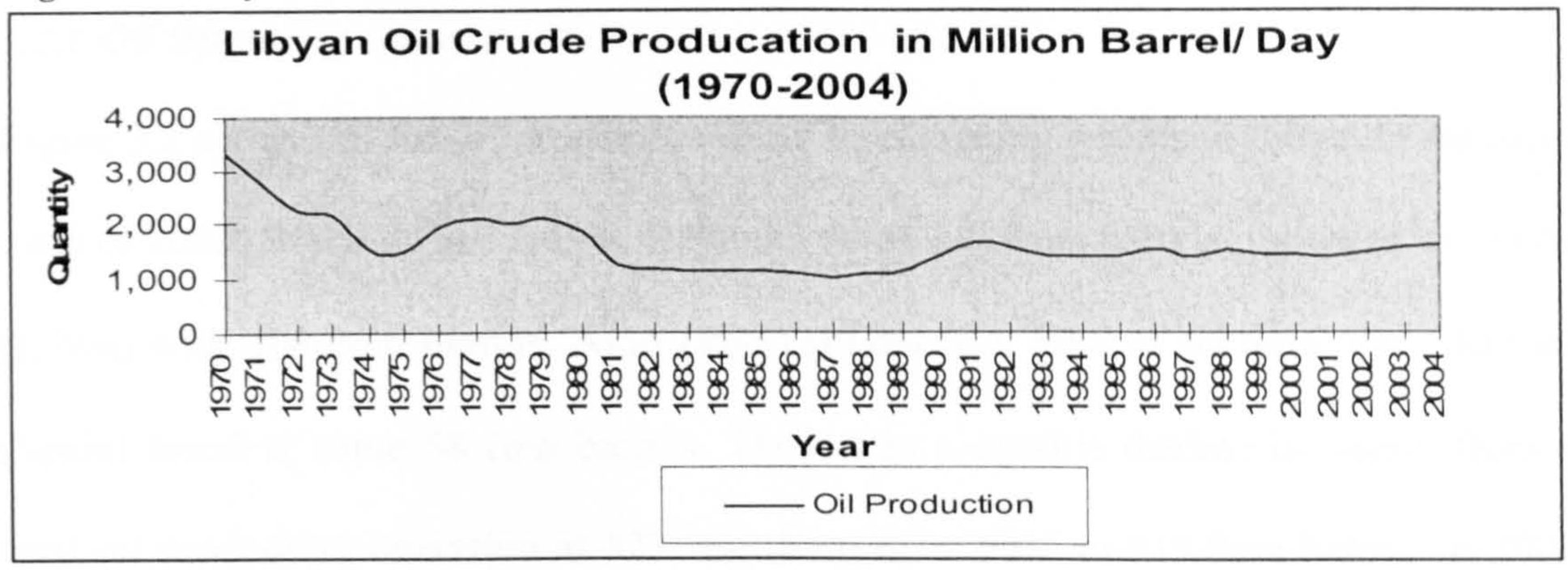
3.2 Oil Production

This section provides a review of the stages of Libyan oil production during the last three decades. The oil and gas industry is central to the Libyan economy, and production was 1.534 million barrels per day in 2004 (National Oil Corporation, 2004). According to the Economic Intelligence Unit (1987), the first commercial exports of Libyan crude were made by Esso in 1961. In that year, Libya joined the Organisation of Petroleum Exporting Countries **(OPEC)** (Gannous, 1998). Libya is also a member of the Organisation of Arab Petroleum Exporting Countries **(OAPEC)** (Gannous, 1998).

Figure 3.1 shows levels of Libyan crude oil production. After commercial oil was discovered in Libya in 1957and by 1970 Libya was 6th in world oil production behind the US, Iran, Saudi Arabia, Indonesia, and Venezuela (Allan, 1981). Since its discovery, Libyan oil has remained an attractive commodity because of its lightness, and purity. For these reasons, most international oil companies found these attributes attractive (Gannous, 1994; 1998). In less than a decade, Libya became a major world exporter along with the Gulf States. Historically, crude oil production reached its peak in 1970 at 3.3 mn b/d. Since then, oil production has tended to fall with a few exceptions (Libyan National Oil Corporation, 2003). Libyan output fell below 2mn b/d in 1970s and stabilised in the 1980s at approximately 1.1mn b/d (see Figure 3.1).

However, during the 1990s and to the present Libya's oil production capacity has been on the rise.

Figure 3.1: Libyan Crude Oil Production, 1970-2004 (mn b/d)



Source: National Oil Corporation, (1990, 1995, 2003, 2004) Tripoli, Libya.

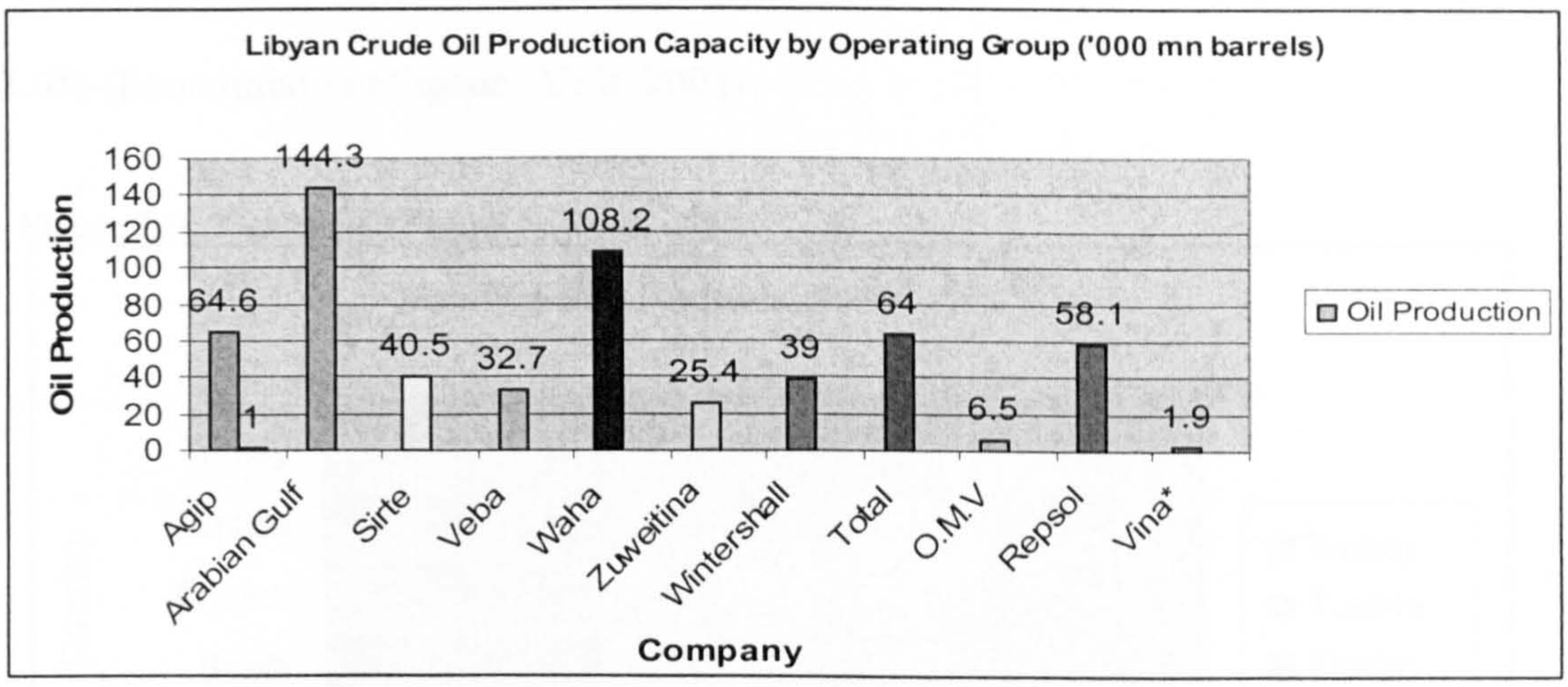
Average production costs for the **NOC** fields are less than $2.50 a barrel (Libyan National Oil Corporation, 2003). The **NOC** is considering opening areas for exploration by foreign oil companies with highly advanced technologies (Terterov and Wallace, 2002). Several prominent international oil and gas companies are active in Libya, such as Italy's Agip, Germany's Wintershall, Austria's OMV, Total and Elf Aquitaine of France, and Canada's Red Sea Oil. Also, Spain's Repsol and the UK's Lasmo and others are working on different basins in Libya (Libyan Central Bank, 2004). Libya currently produces around 1.534m b/d, and the **NOC** has outlined plans to enhance production capacity to about 2m b/d. With new investment, many oil fields could significantly enhance production rates (Libyan Central Bank, 2004). The return of US oil companies is now a high priority and all sources suggest that US oil companies will be in Libya soon. **NOC** officials have stated that US companies are

more than welcome to return and work in their fields. Libya has thus opened its door to them (Economist Intelligence Unit, 2004).

3.2.1 Oil Operating Groups

Figure 3.2 shows the size of production of oil by operating groups in Libya. In the early parts of 2003, Arabian Gulf led the way with some 144.3mn barrels, followed by Waha (Libya) with 108.2mn barrels. Agip (Italy) produced a total of 64.6mn while Repsol (Spain) stood at some 58.1mn barrels. There was a notable decline in output from a total oil production operation at 527.7mn barrels in 2002 to 519.8mn barrels in 2003 (Libyan National Oil Corporation, 2004).

Figure 3.2: Libyan Crude Oil Production by Operating Groups, 1970-2004 **(mn b/d)**



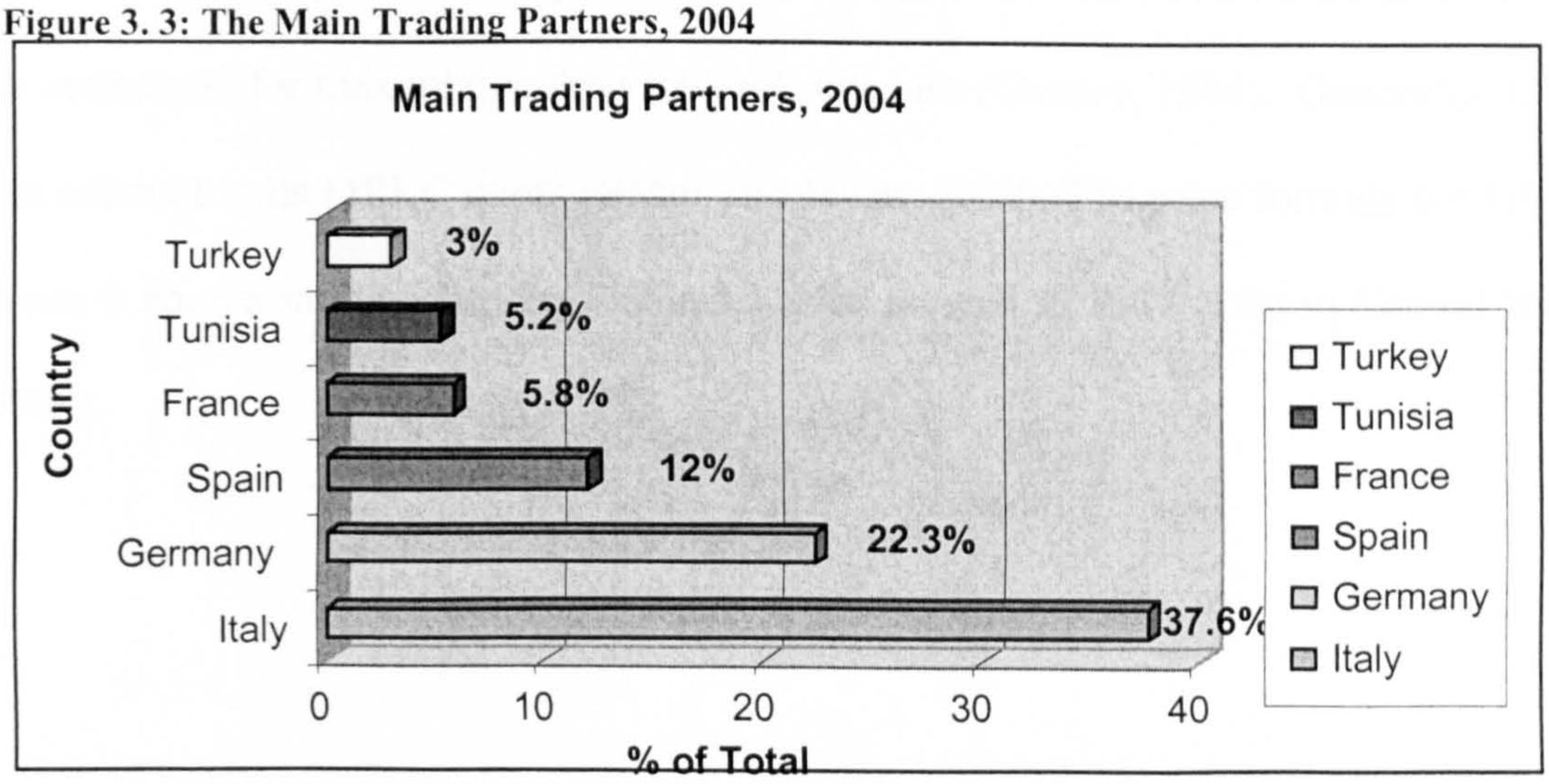
Source: Libyan National Oil Corporation (NOC), Tripoli, Libya, 2004. The Libyan oil companies: Arabian Gulf Co., Sirte Co., Waha Co., Zuweitina Co. The foreign Companies: Wintershall (Germany), Total (France), Repsol (Spain), Agip (Italy), O.M.V (Austria), Veba (Germany).

3.2.2 Crude Oil Exports and Destinations

The European market remains the principal purchaser of Libyan crude oil. As Libya continues to have a competitive position as a big oil supplier to Western Europe, it will have freight advantage compared to the Gulf States. The major customers for Libyan crude are Western countries such as Italy, Germany, Spain, and France. In aggregate, these four countries accounted for 78% of the total in 2003. In 2002 crude oil exports were higher than in 2003 (Libyan Central Bank, 2003).

It can be seen from Figure 3.3 that the main trading partners with Libya are Italy, which remains Libya's principal customer absorbing 37.6% of Libyan crude (about 28% of Italy's requirements). Germany is the second largest customer with 22.3%, followed by Spain at 12.0%. France at 5.8%, Tunisia at 5.2% and finally Turkey at an estimated 3.0% (Economist Intelligence Unit, 2004).

Figure 3. 3: The Main Trading Partners, 2004



Source: IMF, 2003; Direction of Trade Statistics, Central Bank of Libya, Economic Bulletin, 2004

3.2.3 Oil Reserves and Geology

The picture for Libyan oil reserves is encouraging, and it has been recognised since the early 1970s that Libya enjoys huge oil reserves (Libyan National Oil Corporation, 2003). Libya retains large untapped oil in areas covered by agreements with foreign oil companies (see Appendix 8a, b). Libya's proven crude oil reserves have been estimated at 29.5 billion barrels (Middle East Economic Digest, 2003). Currently, according to **NOC** (2004) officials, the El-Bouri offshore field contains an estimated 3.7bn barrels of oil (al Taqa Wa al Hayyat, 2002). Furthermore, recent discoveries have been made in three geological areas: Murzuq, Ghadames and Sirte basins. These give an indication of the huge oil reserves in Libya (Feld, 2003).

3.2.4 Pricing Policies

The Libyan price policy has largely been settled in meetings of **OPEC**, which it joined in 1962. Libyan governments past and present have remained committed to **OPEC** as an instrument for maximizing their total oil revenues (Gurney, 1996). Generally, Libya has adhered to its **OPEC** quota (Bahar and Javan, 2000). The price formula for Libyan crude is shown in the following Table 3.1 as at the end of 2004 (Libyan Central Bank, 2004).

Table 3.1: Average Sale Prices of Libyan Crude Oil (US$/b; (F.O.B)

	2000	2004
Esharara	28.09	28.08
Brega	28.05	28.53
Zueitina	28.12	28.69
Sirtica	28.45	28.40
Es Sider	28.09	28.21
Bouri	28.55	28.70
Bu attifel	28.04	28.33
Amna	27.99	28.26
Sarir	27.61	29.08

Source: Libyan National Oil Corporation, 2004

3.2.5 Oil Refining and Distribution

Libya has five domestic refineries, with a combined capacity of approximately 378,000 bbl/d (Gannous, 1994). The refineries: are the Ras Lanuf export refinery completed in 1984 with a crude oil refining capacity of 220,000 bbl/d; the Zawiya refineries completed in 1974 with crude processing capacity of 120,000bbl/d (Gannous, 1994); Brega, with crude capacity of 10,000; and the Tobruk refinery with crude capacity of 20,000; finally, the el-Sarir refinery has a crude capacity of 10,000 bbl/d (Gannous, 1994).

3.2.5.1 Domestic Oil Refineries

Refinery capacity for the past decade has been well below these levels. (Bahar and Javan, 2000; Economic Intelligent Unit, 2005). The **NOC** is keen to gain access to the equipment necessary to convert refineries to the production of lighter fuels, a

development that should help in reducing Libyan imports of petrol in the longer term (Bahar and Javan, 2000). The **NOC** expects to spend over the next decade some $3bn on refineries and $500m on the upgrading of a petrochemical complex (Libyan National Oil Corporation, 2004).

3.2.5.2 Capacity and Upgrading

In 2004 the **NOC** invited international oil companies to participate in joint ventures designed to upgrade and expand its refining and petrochemical industries, especially at Ras Lanuf on the Gulf of Sirte. This refinery, completed in 1984, has a 200,000b/d crude oil unit and an ethylene plant. Beside this, the **NOC** is planning to upgrade the Azzawiya refinery which has a theoretical capacity of 120,000 b/d of crude (Economist Intelligence Unit, 2004).

3.3 Natural Gas

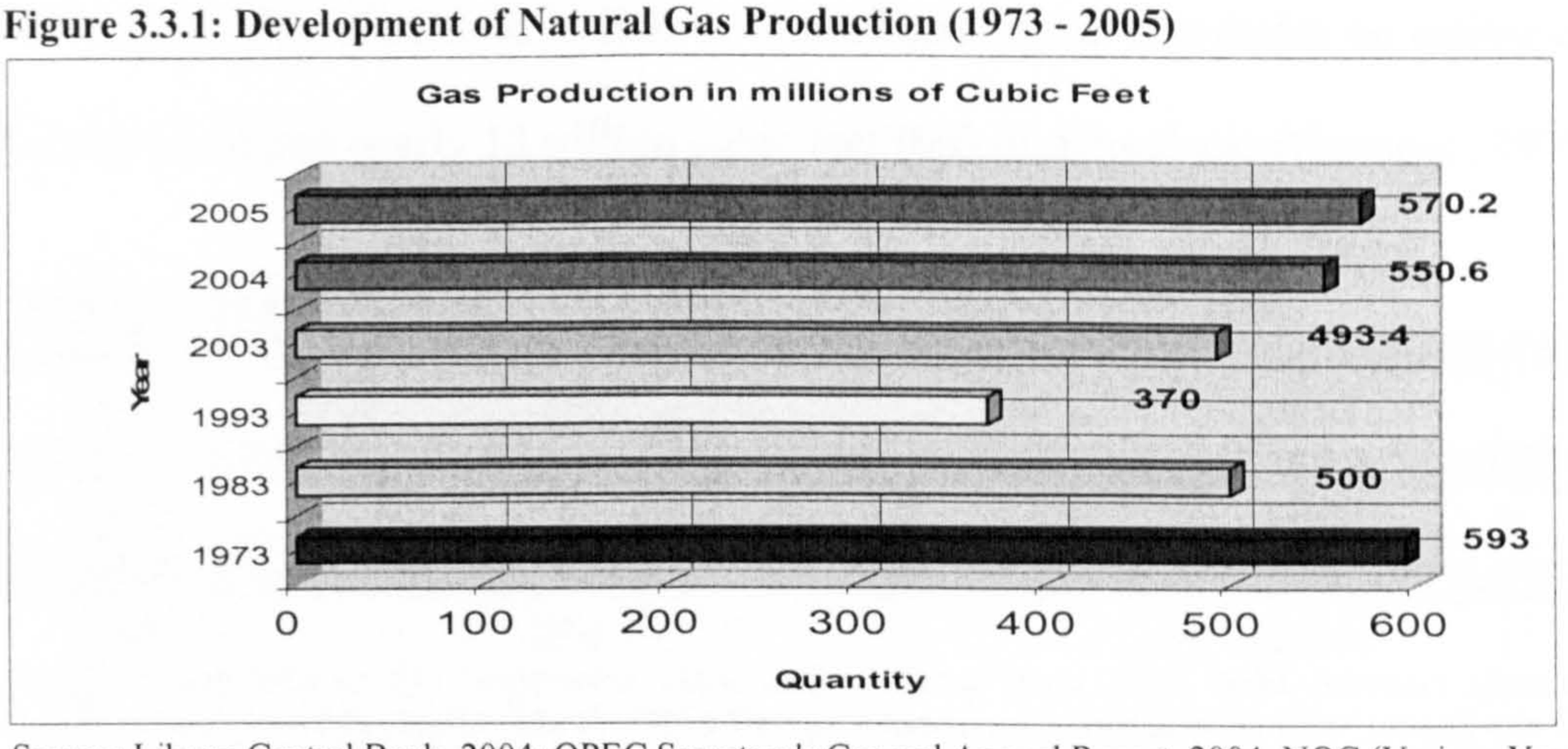
This section discusses the stages of Libyan natural gas development since 1973. Production of natural gas in Libya received a major boost in 1971 when a law was passed requiring oil companies to store and liquefy the natural gas condensate from their oil wells (Waddams, 1980). Natural gas is considered to be one of the country's most important industries, and it is very important to Libya's economy (Gannous, 1998), and care is taken of natural gas production accompanying crude oil production, or in the form of natural gas discovered in gas fields (Gannous, 1994).

3.3.1 Gas Production

Natural gas production has lagged far behind oil because its high costs of transport and liquefaction have made it a less attractive alternative (see Appendix 8). A large liquefaction plant was built at Marsa al-Brega in 1968 (Gurney, 1996). Approximately 70% of Libya's natural gas production is consumed domestically (Gannous, 1994).

It can be seen from Figure 3.3.1 that gas production was accompanied by another closely related activity, namely increasing the size of oil and gas reserves. Accordingly, great importance is accorded to increasing oil and gas reserves (Libyan National Oil Corporation, 2003).

Figure 3.3.1: Development of Natural Gas Production (1973 - 2005)



Source: Libyan Central Bank, 2004; OPEC Secretary's General Annual Report, 2004; NOC (Various Years)

In expanding its gas production, marketing, and distribution, Libya is looking to foreign participation and investment. In recent years large new gas discoveries have been made in different basins. During the mid 1990s, new oil discoveries were made in the Ghadames, Sirte, and Murzq basins (Petroleum Economist, 1999). However, Libya needs technical expertise and high technology in order to extract liquefied petroleum

gas from liquefied natural gas (Economist Intelligence Unit, 2002). The Libyan government know that in order to establish a significant export capacity for its natural gas, it needs foreign capital and expertise. Now, and more than ever, the Libyan oil and gas industry is looking for foreign investment to develop and update its industry.

The **NOC** has begun numerous activities in the field of discovery in all parts of Libya. As a result of these activities, there has been a great increase in the number of oil fields. The most important discovery, not only for Libya, but the whole Mediterranean, was the El-Buri sea oil field (Libyan National Oil Corporation, 2003).

Table 3.2 shows the development of oil and natural gas reserves during the period 1973-2004. The Buri field is rich in oil and gas. Its area contains an estimated 3.7bn barrels of oil and nearly 12 trillion cubic feet **(tcf)** of natural gas (Gannous, 1994).

Table 3.2: The Development of Oil and Natural Gas Reserves (1973 -2004)

Year	Oil Reserves (billion barrel/day)	Natural Gas Reserves (billion $m^{3)}$
1973	25.5	764.2
1983	25.3	650.0
1993	29.2	601.0
2003	29.6	780.0
2004	29.6	890.0

Source: Libyan National Oil Corporation, 2004; Libyan Central Bank, 2003; OPEC-Secretary General's Annual Report; OPEC- Monthly reports (March 1989). Energy Information Administration (2003) stated that Libya's gas reserves are huge and thought by Libyan experts to be around 50-70 trillion cubic feet. Another study by Libyan NOC (2004) suggested that Libyan reserves of natural gas were estimated at 46.4 tcf, but a large area was unexploited. However, the Libyan experts think that gas reserves are higher than 50 tcf.

3.3.2 Development Plans

Libya was among the few countries to export liquefied natural gas **(LNG)** in the early 1970s (Ghanem, 1975). Due to technical difficulties, Libya experienced problems in extracting liquefied petroleum gas **(LPG)** from **(LNG),** which forced the buyers to do

so. Libya's **LNG** plant, at Marsa el-Brega was built by Esso and it has a capacity of 124 **bcf** per year **(bcf/y)**. Due to technical limitations, only about one-third is available for export, mainly to Spain (Bahar and Javan, 2000).

At present, Libya's natural gas development projects are underway in onshore and offshore oilfields. Libya's intention is to increase its gas exports to the European market and it is looking for foreign companies to expand its refineries. In 1999, a joint venture agreement was made between **NOC** and Agip-ENI on gas development projects to export natural gas to Italy (Economist Intelligence Unit, 2002).

3.3.2.1 NOC's Gas Plan

There are an estimated 46,300 million cubic feet **(mcf)** of proven natural gas reserves, but misunderstandings of the gas industry's legal structure is likely to discourage foreign operators from participating in expansion plans (Bahar and Javan, 2000). As early as 1981, the **NOC** approved a general plan for gas utilisation. However, the plan was not applied due to political circumstances that have created many obstacles hindering the normal growth of the industry (Gurney, 1996). The **NOC** has invited international oil companies to participate in the exploration, development and construction of infrastructure, and the marketing of gas both domestically and internationally (Bahar and Javan, 2000).

3.3.2.1.1 Western Libya Gas Project (WLGP)

Mellita is set to become a gas nexus for Libya and a major hub for the Western Libya Gas Project **(WLGP)**. The Mellita plant's processing capacity will be 10 billion cubic metres (Middle East Economic Digest, 2002). Agip-ENI and the **NOC** have a US$5.5 billion joint venture which aims at developing and exporting large volumes (8 billion cubic metres per year) of natural gas to Italy. The **WLGP** involves a 372 mile, 32 inch sub-sea pipeline that will take gas under the Mediterranean to South-eastern Sicily, and then on to the Italian mainland (OAPEC Bulletin, 2003). As part of the overall **WLGP**, Agip-ENI is set to develop huge Libyan gas reserves in offshore Block NC41 in the Gulf of Gabes, as well as in the Wafa onshore gas and oil field on the Algerian border (Bahar and Javan, 2000).

Libyan gas exports to Europe are increasing rapidly, with the **WLGP** and its $6.6 billion "Greenstream" underwater gas pipeline coming online. The **WLGP** is a 50/50 joint venture between Eni and **NOC** which has now expanded these exports to Italy and beyond (Economic Intelligent Unit, 2005). Starting in 2005, approximately 8 billion cubic metres (280 Bcf) per year of natural gas will be exported from a processing facility at Melitah, on the Libyan coast, via an underwater pipeline called Greenstream to south-eastern Sicily (Energy Information Administration, 2005).

3.3.3 Technological Trends

In a developing country such as Libya, introducing e-Commerce to its traditional markets can help to build the oil and gas industry. Internet and e-Commerce can help

the Libyan economy reaching international markets. The **LOGCs** have traditionally found it difficult to reach the global petroleum market abroad, by increasing e-Commerce awareness, **LOGCs** can take advantage of Internet based e-Commerce to market and sell their petroleum products and services abroad.

Evidence from the literature looks at attitudes of business managers, and executives, and highlights the importance of such an argument. So, what are the strategies and polices required in dealing with the economic and managerial implications of e-Commerce? A rich source of literature and debate is available on the topic of e-Commerce technology, the main themes of which will be discussed in the following sections.

3.4 e-Commerce: the New Economy

This section discusses the new economy that confronts the **LOGCs** with this major business problem as they enter 21st century. The internet is a large network made up of a number of smaller computer networks. The internet is a global network of overlapping and interconnected computer networks. The internet is made up of more than 465 million interconnected computers in more than 100 countries covering commercial, academic and government endeavours (Internet World Stats, 2004). Originally developed for the U.S. military, the Internet became widely used for academic and commercial research. Today, the Internet has become commercialized into a worldwide information highway, providing information on every subject known to humankind.

3.4.1 The Basics of the Internet

The internet is a lot of things, but first and foremost, it is a communications medium. There is an often-noted property known as Metcalf's law. It essentially says that every time one additional person is added to a network, the value of the network increases exponentially not linearly. This makes intuitive sense, because each new person on the network can now share information with each of the original members.

3.4.1.1 The Communications: E-mail

At the end of 2000, about 690 million e-mail boxes existed worldwide, almost six times the number in 1995 (Internet World Stats, 2001). U.S. surfers access 334 million of these e-mail boxes (Messaging Online, 2002). But the number of e-mail boxes is tiny compared with the volume of messages. Jupiter Communications estimates that U.S. surfers sent 432 billion e-mail messages in 2003, up from 132 billion in 1999 (The Industry Standard, 2000). These figures are significant for a number of reasons. First, they reflect the advantages of email.

> *I can send out 500 emails more easily than I can complete a similar number of phone calls and faxes. Message can be saved efficiently. A message can be sent to a large number of individuals with each adding their comments. The incremental cost of an email is virtually zero; you can't attach files to faxes or phone calls.* Management Oilfield Capital, 2000.

Some employees and managers within oil and gas companies have not yet begun to use email, or still use the phone and fax for the vast majority of their communications. e-mail is a useful and easy way to begin using the internet to become more productive.

3.5 Impacts of e-Commerce Technology

This section discusses the possible impacts of e-Commerce on business organizations. Evaluating the effects of e-Commerce on shifts in business culture is no easy task (Whinston et al., 1997). e-Commerce saves money and reduces business costs. So what lies at the core of e-Commerce business strategy?

3.5.1 Economic Incentives

Most observers recognize that the impact of e-Commerce occur at both microeconomic and macroeconomic levels. With the adoption of e-Commerce technologies, along with high levels of new business capital that are available for an organization's e-Commerce, the macro level effects are likely to be substantial. These are, however, difficult to measure with today's approaches, although there is much debate (Golden, 1999). Several studies by leading economists have indicated that the prosperity of the 1990s and beyond is directly attributable to **IT**. The use of e-Commerce could transform the Libyan oil market, and allow **LOGCs** to be reached via the Internet.

3.6 Technology in Libyan Petroleum Sector

This section examines the technology used in **LOGCs**. Despite the fact that the **NOC** and its fully owned companies are operating on computers and related Internet technologies, the idea of engagement in e-Commerce technology is not widely understood and it is still in its early stages of development. So it is a difficult proposition for the national oil and gas companies to accept and adopt. As a result, the **NOC** needs to change the attitudes and perceptions of managers concerning Internet

and e-Commerce technology. It is believed that e-Commerce adoption is a great challenge for the future of **LOGCs** to contribute as much as possible to the economic potential of the Libyan oil industry. Therefore, the Internet and e-Commerce can reshape the whole industry.

3.6.1 The Internet and Computers

The Internet and computers represent highly advanced tools that provide the means for upgrading the performance of **LOGCs**. The **LOGCs** have imported highly advanced computers and other technologies from Europe, installed them and started their operations. Training and educating a large number of personnel in the various aspects of Internet and computing technologies such as analysis, design, programming, operation, maintenance and the use of the Internet are essential in all **LOGCs** (al Taqa Wa al Hayyat, 1998). However, certain barriers are holding back the growth of Internet and e-Commerce technology in Libya.

3.7 Technological Tendencies in the Libyan Petroleum Sector

The previous section described the technology used in the oil and gas sector. This section describes the technological tendencies and potential problems in the Libyan petroleum industry. There is a positive attitude among the **LOGCs** towards information technology. There are significant studies confirming that the economic climate is ripe for e-Commerce. These trends in the **LOGCs** are in line with the sweeping changes taking place in global markets where the Internet has emerged as the main medium for conducting business.

The Libayn **NOC** established a modern telecommunications network linking the oil and gas companies to their remote locations. Most of **NOC** and its fully owned companies are connected to the Internet, which makes possible a revolutionary change in the operating mode of the **LOGCs**. Libya is also planning to adopt modern digital technology and to replace the old technology so as to improve connectivity (al Taqa Wa Al Hayyat, 1999).

3.7.1 Access to Information Technology

With the introduction of the Internet and e-Commerce, the traditional structure, business practices and characteristics of the oil and gas industry are set to under go changes over the coming years. Given that the Internet and e-Commerce is in place, the way oil and gas products and services are traded is changing at a fast pace, which is sure to have a deep impact on every area of the industry worldwide (Platts, 2000). Some oil and gas companies have been quick to embrace new "e-strategies" and to incorporate e-Commerce into their corporate business models. Other oil and gas companies have placed the development of e-Commerce high up on their priority lists (Platts, 2000).

The elements for successful oil company operations are the availability of technology, the appropriate scale for economic operations, access to reliable marketing outlets, and capital (Ghadar, 1983). As these elements become available, the **NOC** will encourage the development of its own oil and gas companies to have greater access to advanced technologies. The **NOC** has its own readily accessible market operations. However, it

needs foreign capital and, more significantly, the Internet and information technology (al Meshal, 2002).

3.7.2 Technological Know-How

There is a great need to understand all aspects of how technology such as the Internet and e-Commerce is impacting both the top line and the bottom line of **LOGCs**. The **LOGCs** are currently in the process of developing **IT** infrastructure such as the Internet and e-Commerce. The arrival of the Internet in Libya, followed by the mushrooming of Web based businesses, is leading to Internet and e-Commerce on both the **B2B** and **B2C** sides.

3.7.3 Impacts on and Prospects for the Oil Sector

Libya is one of the most attractive business centres with ideal access to the Mediterranean, Middle East, Europe and Africa. This provides direct trade with all regions, although most of the growth in Libya's economy can be tied to the massive oil and gas reserves found in the country. Developing a strong **ICTs** infrastructure will further encourage the trading growth of the Libyan oil and gas sector. According to Livesay (2000) oil companies readily adopt cutting-edge information technology and replace outdated technologies in order to improve their communications and commerce (Livesay, 2000). Therefore, the Libyan petroleum market has a huge potential to benefit from these business opportunities.

3.7.3.1 Impact on the Petroleum Market

With its ideal location from which to launch expansion into the growing Middle Eastern, European, and African marketplaces, Libya provides excellent trade links. A talented IT labour supply and a strong telecommunications infrastructure, combined with government policies aimed at encouraging foreign investment should draw companies from around the world. Having a telecommunications infrastructure encourages the growth of the Internet and e-Commerce. Many foreign and domestic non-IT businesses have used the Internet as a means of doing business. The number of Internet subscribers in Libya is growing. Furthermore, removal of the U.S.A sanctions against Libya, makes it possible to invite U.S. companies into the Libyan petroleum industry. This allows Libya to develop a huge marketplace, and provides an excellent opportunity for any industry offering goods.

3.7.4 Potential Problems

Cogburn (1999) argued that with the rise of e-Commerce, there is now an opportunity for the global community to participate. However, certain barriers to participation exist in the shape of access limitations, high prices and low usability (Cogburn, 1999). It may seem easy to establish the necessary infrastructure to allow e-Commerce to flourish. However, monopoly has the potential to hinder growth. The Libyan government needs to increase the number of ISPs in order to allow for competition and to encourage rapid technological advancement (Libya Telecom & Technology, 2002).

3.7.4.1 The Digital Gap

e-Commerce obstacles are different for developed and developing countries. There is a digital divide in e-Commerce readiness between developed and developing countries. For instance, the major issues in developing regions are slow speeds, high prices of **ISPs**, and the lack of infrastructure; whereas in developed countries the main issues are privacy and taxes (OECD, 2002). The most important matter for Libya is high Internet access charges resulting from a combination of high telephone call costs and **ISPs** charges (Economist Intelligent Unit, 2003). These high charges are due to the predominance of monopolies in Libya, but it must be cautioned that in some cases the introduction of competition might not solve the problem.

3.8 e-Commerce: A Business Opportunity

This section presents e-Commerce as a business opportunity for **LOGCs**. It is also discusses the technological barriers facing the oil and gas industry. The business in the petroleum industry is divided into two main types of activities: upstream activities including the exploration, production, and procurement of crude oil; and downstream activities include the refining, transportation and sales of petrochemical products such as industrial oils and other products. Both types are currently facing particular challenges. On the upstream side crude oil and gas prices are falling steadily. The reason is that many producers in the Middle East and elsewhere need the revenues from oil for short-term reasons, preventing a significant reduction in supply (Aramco Oil and Gas Company, 2002).

3.8.1 The Internet in the Oil Business

According to Livesay (2000), an executive officer of WellBid Inc. stated that the simple truth about e-Commerce is that it is inevitable, and that it is already changing the way in which business is conducted in the oil industry (Livesay, 2000). The Internet is the next great step in the evolution of business. With the Internet and e-Commerce, oil and gas companies have access to faster, more efficient avenues of communication than any they have previously employed. Whereas fax machine seemed an essential business tool of the 20th century, faxes, along with many other manual actions, are now becoming inefficient business processes that will simply vanish (Livesay, 2000).

3.8.2 Technological Barriers

Barriers to technology include factors such as lack of technical skills, knowledge management, or information technology infrastructure. Lack of understanding and experience of the Internet and e-Commerce are facing the **LOGCs** development and profitability. Therefore, productivity largely depends on the strength of managerial and organisational skills to co-ordinate the industry. As long as technological and managerial skills are not effective, the success of the oil industry's operations remains in doubt (Ghader, 1983). Although **LOGCs** are keen to use the Internet and e-Commerce to improve their services and productivity, they believed that they are being held back by the lack of proper technical support for e-Commerce technology trading, and their inability to set up and manage the required technical infrastructure.

In the case of Libya, the technological barriers mentioned above and other barriers, such as capital investment in oil operations and production, have profound effects on the Libyan oil and gas industry in becoming more profitable. The lack of capital investment is the key for the **NOC** and its oil companies because they need foreign assistance. There is also a need to develop effective marketing as well as management organisation within the Libyan oil industry, in order to successfully reach the world market (al Taqa Wa al Hayyat, 2003). The Libyan oil and gas industry in general feels that the electronic medium is a promising one.

3.9 e-Commerce Benefits in the Petroleum Sector

This section discusses the benefits of e-Commerce in the petroleum industry. The richness in natural resources and industries in sectors such as fuel, petrochemicals, oil, gas, and mining, should be coupled with e-Commerce techniques in sales, procurement, and contracting. Examples from the fuel sector are presented here, together with the potential in other commodity sectors such as oil industry.

3.9.1 E-Sales

Many large and leading companies in the fuel, petroleum, gas, oil, and petrochemical sectors have already introduced advanced e-Commerce systems or are in the process of upgrading their existing sales, procurement, and marketing services on the Internet. For instance, the Saudi Arabian Aramco has introduced Internet Petroleum Products Sales **(IPPS)** for Liquefied Petroleum Gas **(LPG)**. This e-Commerce application automates

the current manual **LPG** tender sales process, and the company can thereby maximize profitability from the sale of propane and butane (see Appendix 9).

IPPS enables the companies' sales and marketing departments to electronically publish **LPG** sales tenders to selected customers, permits the customers to review published tenders and to submit offers and allows the company to notify customers whether their offers were accepted. As a consequence of the opportunities offered by **ICTs** and e-Commerce, most major players in the fuel, petroleum, and gas sector today consider the Internet and Intranet as vital business operations. Information and knowledge-sharing tools are seen as enhancing productivity and efficiency, and the economic effects on sales and contracting are already immense for example Libyan Umm al-Jawaby Oil Services (see Appendix 9).

3.9.2 e-Commerce Deployment

According to a report by Strategy Analytics (2000), selective deployment of e-Commerce solutions will net 9% cost savings in the United States Petroleum industry. Zhida (2000) argues that e-Commerce can bring huge profit to the oil and gas industry, and that the purchase price can be cut by 5-10% through e-Commerce. The segments most likely to succeed are distribution, refining, exploration and production. The Strategy Analytic (2000) report suggested that there is an opportunity for advantages to those oil and gas companies that successfully pursue them. The next few years will surely see the development, improvement, and expansion of oil and gas moving from traditional trading to new business solutions via the Internet (Platts, 2000).

3.9.3 Business Potential in the Oil Industry

According to Zhida (2000), e-Commerce decreases the restrictions of time and space to close the distance of oil and gas companies from the market. Zhida (2000) explains that the Internet and e-Commerce would enforce the internal coordination of oil and gas companies, to increase the speed of decision-making as well as sharpening the competitive edge. Through the Internet and e-Commerce, petroleum companies can also strengthen cooperation and communication (Zhida, 2000).

e-Commerce can result in 20 per cent cost savings in the **E&P** area, and 15 per cent of costs in refining and distribution (Wire Reports, 2002). Trade-Ranger, the industry-backed marketplace formed by Shell, BP and a dozen other leading petroleum companies, is the leading player in the procurement marketplace. Other players include property and asset management sites like Indigopool and NetworkOil and Wellogix.

3.9.3.1 Potential Benefits of e-Commerce

Zhida (2000) and Livesay (2000) argue that the coming of **B2B** will have a great impact on the oil and gas industry, causing revolutionary changes in the operating modes of petroleum companies. Zhida (2000) suggested that **B2B** would become the main means for oil and gas companies to sell their products, greatly saving transaction costs and bringing huge profit to the industry.

3.9.3.2 e-Commerce Across the Petroleum Value Chain

According to Wire Reports (2002) stated that there is an opportunity for companies that successfully pursue e-Commerce technology. Initial response to technological advances in the oil and gas industry has been slow, particularly for the large, established companies, according to an analyst at **S&P** Marketscope (Wire Reports, 2002). In other energy companies, Internet and e-Commerce has quickly become core to their operations, but more traditional oil and gas companies are finding it harder to shift their way of thinking.

> *"e-Commerce technology must provide more services than the traditional way of trading, deliveries must be at least as fast as in the traditional economy and payments must be safe,"according to (Strategy Analytics, 2000).*

3.9.3.3 Oil Producers

Many reports about oil and gas e-Commerce list a large number of general benefits to be derived from the adoption of e-Commerce initiatives. These include lower costs, better knowledge management, and improved customer service. Table 3.3, shows a sample of the many e-Commerce sites that have been established to serve the oil and gas industry.

Table 3.3: e-Commerce Sites Serve the Oil and Gas Industry

E-Commerce Technology Sites	Services
OilfieldCapital.com	Financing
Trade-Ranger.com	Procurement
NetworkOil.com	Procurement / Surplus Equipment
Eoilfield.com	Surplus Equipment
EnergyPortal.com	Procurement
Wellogix.com	Workflow Automation
Oilexchange.com	Property Auctions
PetroleumPlace.com	Property Auctions
IndigoPool.com	Property Sales
Oceanconnect.com	Shipping

Sources: from different oil and gas web sites, www.oilfieldCapital.com, www.Trade-Ranger.com, www.oildex.com , www.theoilauction.com, www.Networkoil.com, www.energyportal.com, www.oilexchange.com, www.petroleumplace.com,

3.9.3.4 Trade-Ranger

Trade-Ranger is the premiere global destination for online procurement in the energy and petrochemical industries, connecting buyers and suppliers in the upstream and downstream sectors. It was launched in 2000 as a joint initiative by fifteen of the world's leading energy and petrochemical companies. Trade-Ranger is the world's largest online marketplace for goods and services traded in the oil and gas and petrochemical industries, and has seen rapid growth, with suppliers who sell goods and services to the energy and petrochemical industries joining the trading platform.

According to Management of Oilfield Capital (2000), 684 suppliers from North America, Europe and Asia have become members of Trade-Ranger. This rapid growth indicates that both buyers and suppliers recognize the value of an independent, neutral, secure trading hub and are ready to embrace the efficiencies of online trading. A number of companies are involved in trading online in the energy sector, such as EnergyPrism.com, eOilfield.com, networkoil.com, oillink.com, oilfielddirect.com,

petrocosm.com, petroleumplace.com, commerceone.com, wellbid.com, and worldoil.com.

Some companies view e-Commerce as the 21st century version of the partnerships that producers previously used to push down the prices of goods and services. However, some segments of oil field services will remain sceptical, unless convinced that e-Commerce can benefit the industry (Oil & Gas Journal, 2000). Schollnberger, vice president of reservoir technology at BP Amoco PLC, argued that there is a future for oil and gas fields' development through smart electronic fields and to adjust these fields to business on line through online connections to the oil and gas markets. The positive energy of e-Commerce might prove a key step in the eventual evolution of electronic fields (Oil & Gas Journal, 2000).

3.9.3.5 Oil Industry and Challenges

Internet and e-Commerce technology presents challenges and opportunities unique to the oil and gas industry. It has the potential to change the balance of power between oil companies and service supply companies. Internet and e-Commerce initiatives are most rewarding where they allow companies to change business processes and secure growing shares of value created by those processes (Tippee, 2000).

3.9.3.6 e-Commerce Strategy

e-Commerce is rapidly penetrating every major industry in the world. Industries influenced by technology, and particularly computers and telecommunications, have

already developed extensive e-Commerce infrastructures. Other industries, including oil and gas, have been somewhat slower to adopt the Internet as a daily business tool for commerce. Many oil and gas companies still view the Internet and electronic transactions as too much of a change from traditional ways of doing business (Livesay, 2000).

Oil and gas companies are investigating issues, problems and opportunities in the new world of e-Commerce. They are looking at every aspect of information technologies, and the growth of the Internet in order to create an e-Commerce plan (Livesay, 2000; Oil and Gas Journal, 2001; Zhida, 2000). Today, many leading oil and gas companies are leveraging their external and internal energy operations by introducing new e-strategies (Hudson, 2000). Every oil and gas company is undergoing essential changes in its ways and means of doing business as it enters the new phase of the new economy. Today, there is rapid growth in the online marketplace, setting new principles and values for productivity, efficiency and growth by having a viable e-Commerce strategy. This enables oil and gas companies to face the energy challenges and to open up new opportunities, new growth and profitability in the 21st century (Hudson, 2000). This focus is crucial to facilitate online decision-making by implementing an overall e-Commerce strategy.

3.9.3.7 The "Inescapable" Shakeout

People throughout the oil and gas industry have predicted a shakeout among the many new e-Commerce companies that were formed in late 1999 and early 2000. Many e-

Commerce companies are planning to offer e-Commerce services to the oil and gas industry. Table 3.4 shows an analysis of e-Commerce trends in the coming years. A major cause of the shakeout, however, is the impact that incumbent brick and mortar companies had on the development of e-Commerce in the oil and gas industry. The new internet companies are seeking to change the commercial and competitive dynamics of an industry. However, time will tell how successful these organizations are in developing e-Commerce exchanges.

Table 3.4: The Changes of e-Commerce Technology in the Oil and Gas Industry

Profile	1990s	2010 and the future
B2B E-Commerce environment	Chaos: a lot of claims, promises, advertising and competing business models	Subdued: "the morning after"
Formation of new dot com companies	Daily	Less frequent
Portals	"portal wars" to establish leading e-Commerce marketplace for oil and gas	Much more focus on niche strategies and markets
Marketing focus	Advertising and press releases	Delivering real solutions

Sources: www.oilfieldCapital.com, www.Trade-Ranger.com, www.oildex.com , and www.theoilauction.com,

3.9.4 Issues, Threats and Challenges

Much of the enthusiasm and high expectations surrounding the potential for **B2B** e-Commerce throughout other major sectors of the economy in recent years were also experienced in the petroleum industry (Management of Oilfield Capital, 2000). This is understandable given the fact that the petroleum industry accounts for $2.5 trillion of annual gross trade revenues, and total annual procurement is approximately $430 billion (Oil and Gas Investor, 2000). Clearly, any dot com company seeking to establish a leadership position in petroleum e-Commerce saw the size of the

opportunity and sought to market its solutions aggressively to capture market share (see Appendix 10).

The development and adoption of technical standards is critical for the success of e-Commerce in the petroleum industry. Imagine if half of the phone companies used a standard for telephone service that was incompatible with the other half. This would dramatically lower the value of the nationwide network (Platts, 2000). The oil industry faces this problem today. Many large organizations use Electronic Data Interchange **EDI** (a method to format information on documents like invoices), while many smaller companies do not (Livesay, 2000). Oil and gas e-Commerce companies are attempting to develop a standard version of Extendible Mark up Language **(XML)** for the industry, which can be seen as critical for the development of e-Commerce technology (see Appendix 10).

3.9.4.1 Resistance to Change

Firms and people do not like to change. This may seem obvious; however, oil and gas e-Commerce companies must realize just how compelling their e-Commerce services will have to be before they will become widely adopted (Livesay, 2000). One of the founders of Kleiner Perkins, one of the USA's most prestigious venture capital firms, has said that they will only invest in technologies that are ten times faster or ten times more convenient for users. An order of magnitude change is sometimes necessary before people will change their habits (Management of Oilfield Capital, 2000).

3.9.4.2 e-Commerce Operations Management

With global e-Commerce expected to reach trillions of dollars, resolving today's inadequate manufacturing techniques and inefficient global logistics market is imperative. Processes that are barely able to handle today's $57 billion in worldwide e-Commerce trade will be paralyzed by the $6.8 trillion expected in 2004 (Forrester Research, 2002). Forrester believes that companies will thrive in the Internet economy by participating in e-Business networks as resilient structures of interdependent players cooperating in real time over the Net. These issues are being addressed today throughout the petroleum e-Commerce market (Zhida, 2000). Some people have focused on the dot coms that have discontinued operations or changed their business strategies and have come to the conclusion that much of the suggested potential for oil and gas e-Commerce technology has been exaggerated (Livesay, 2000; Oil and Gas Journal, 2001; Management of Oilfield Capital, 2000; Platts, 2000). However, according to experts, this has been the very beginning of a 5-15 year process that will profoundly change the petroleum industry (Livesay, 2000).

3.9.4.3 Employees with e-Commerce Experience

The typical oil and gas company tends to have employees that are on average more experienced and somewhat older than comparable companies in other industries. The technology, advertising and investment banking industries, for example, tend to hire many people in their early and late twenties and give them a lot of responsibility relatively early in their careers (Management of Oilfield Capital, 2000).

Petroleum industry engineers and managers require years of experience before moving up through senior management. Therefore, much of the industry tends to be made up of baby boomers who did not grow up with personal computers and the internet rather than people in their early to late 20's (Management of Oilfield Capital, 2000). Given today's environment of tight human resource supplies and the desire of many college graduates to work in high technology, consulting or investment banking, then the oil and gas industry will continue to find it a challenge to recruit e-Commerce talent (Livesay, 2000). There are number of initiatives that oil companies can adopt to hire good e-Commerce people. These include strong senior management commitment to e-Commerce technology.

3.9.4.4 Investment Opportunities

The Libyan **NOC** and its subsidiaries control the oil and gas market in Libya and account for approximately 63% of total hydrocarbons production (Libyan Central Bank, 2002). The current model contract offered by **NOC** is **EPSA IV** whereby the Libyan government retains title of acreage (Economic Intelligence Unit, 2004). During the late 1990s, it was becoming increasingly important for Libya to boost the foreign oil firms participation in exploration, development and production, in order to reverse Libya's declining oil production capacity. This presently stands at an estimated 1.5mn b/d, and the aim is to bring it up to around 2mn b/d (al Hayyat, 2002).

To reverse the decline, the Libyan oil and gas industry needs a major investment in the latest technology, and capital expenditure to enable new discoveries to be made and

brought on line quickly, as well as enhanced oil recovery programmes to be instigated in many key fields (al Hayyat, 2002). It is clearly evident that a framework on a global basis and not just locally is very much required. As e-Commerce defies the traditional restraints of the old economy - the bricks and mortar business framework of location- it is essential to have an e-Commerce framework within a global organization that grants access to world markets. Despite e-Commerce phenomenal growth, it still remains in its infancy. In the Libyan context, the phenomenon of e-Commerce has yet to take off.

3.9.5 Libyan Petroleum Foreign Policy

The **NOC** has announced a new international bidding round for unexplored areas. Thus, the Libyan energy market is wide open for foreign oil companies to invest and do business in Libya. Foreign companies are starting to take a serious look at the Libyan market. While the **NOC** has so far given little away about the details of the improved terms for developing its oil reserves, the Libyan government is aware that it will have to ease contractual conditions to attract investment (Libyan National Oil Corporation, 2003). Hopes of an immediate oil bonanza, therefore, are likely to be limited by Libya's strict adherence to the **OPEC** production quota agreement, which will give only a little room for new developers to increase production (Bahar and Javan, 2000).

3.9.5.1 Libya's Policy in Relation to OPEC

In the early 1970's, Libya had great deal of power in **OPEC** but its influence waned during the 1980s. As its oil output went down to 1 mn / barrel, Libya had little power to influence mainstream **OPEC** policy, but Libya was always opposed to low oil prices

(Gurney, 1996). However, the Libyan position was weak because the country could not produce sufficient volumes of oil to compete for market share with other **OPEC** members whose oil reserves were much larger than Libya's (Beschorner and Smith, 1991). Libya now has an opportunity to enhance production rates in the large oil fields with new investment, and it might regain its influence in **OPEC** affairs (Libyan National Oil Corporation, 2002).

3.9.5.2 The Role and the Future of Libya in OPEC[6]

It is believed that **OPEC** will always try to maintain its benchmark price in the US$30-40 barrel range. If oil prices fell further, **OPEC** would cut production (Libyan Central Bank, 2004). Only around a quarter of Libya's oilfields have been granted to foreign operators. However, the country's oil and gas is likely to be limited to the **OPEC** production quota agreement (Gurney, 1996). Libya has respected its **OPEC** commitments to restrict oil output and this has made it difficult. However, the **NOC** has plans to enhance production capacity by investing $1,500 million over the coming years.

3.10 Summary and Conclusion

This chapter has examined and analysed in detail the characteristics of the Libyan oil and gas industry throughout its past, present and likely future. Since the early 1960s, the development of the oil and gas industry has been remarkable; however in the mid-1980s the effect of sanctions on the downstream sector was great, particularly in the area of spare parts, equipment and technology transfer. Furthermore, because of a lack of well-planned investment, the older fields are badly maintained and are beginning to suffer reduced output. The Libyan **NOC**, however, relies on the participation of European companies, which has increased substantially, and there have been many new oil discoveries.

It is clear that after the UN and USA had lifted their sanctions, Libya has wanted to encourage substantial foreign investment in all aspects of its hydrocarbons sector, but there are difficulties that could restrict the development of Libya's petroleum industry. Libya has been left with a large unexploited oil and gas potential. With the innovations in information and communication technologies, such opportunities are providing more enabling environments for competition on a global scale as well as introducing new business processes, trading communities and creating new revenue streams. For Libya, e-Commerce represents an opportunity to keep pace with the developed world and to leverage its developmental plans; however, there a number of changes that need to take place to transform the above-mentioned challenges into opportunities.

e-Commerce represents a very good opportunity for petroleum companies to gain business value. Many oil and gas companies have invested in computer technology. This must be altered to be internet-ready. However, the key risk related to e-Commerce is that some petroleum companies may fall behind in their use of the internet for e-Commerce and then find it difficult to catch up. The main themes that have come out of this chapter are the key hurdles in achieving the widespread usage and adoption of Internet and e-Commerce throughout the petroleum industry.

This chapter has provided an overview of how emerging technologies can have an impact on Libyan petroleum firms. The **LOGCs** may face various challenges regarding the adoption of e-Commerce due to lack of awareness, organizational inertia, lack of technological skills and technical infrastructure. These are important elements for the adoption of e-Commerce. By increasing e-Commerce awareness, **LOGCs** that traditionally find it difficult to reach global oil and gas markets, may help Libya's petroleum economy overcome this barrier.

The enthusiasm shared by many for the potential of e-Commerce has been replaced with some degree of scepticism, at least among a proportion of oil and gas professionals. However, e-Commerce in the oil and gas industry has barely begun. The investment being made today in advance technologies will significantly impact on the Libyan petroleum economy. This chapter is intended to help the senior management of **LOGCs** to clarify the issues and opportunities related to e-Commerce. There has been

a great deal of change within the e-Commerce petroleum marketplace in the past few years.

It is clearly evident that the global market for e-Commerce technology presents a much larger potential for growth to the **LOGCs**. However, certain barriers are holding back the growth of the Internet and e-Commerce in the **LOGCs**. e-Commerce would require the **LOGCs** to strategically reposition themselves so as to meet challenges of the new economy. Today, Libya's petroleum industry is looking for new sources of investment, and with greater opportunity than ever before with vast petroleum resources, is well positioned to enter the 21st century. The next chapter will examine some of the literature relative to the broad framework of e-Commerce technology adoption, diffusion, technological readiness and development and geographical differences in e-Commerce technology in a strategic context.

End Notes

[1] Sanctions remain a problem, but are likely to soon become a thing of the past. There appears to be a lack of political will within the UN (with the exception of the US) to reimpose the resolutions of the early 1990s, while the US's unilateral embargo ILSA (Iran-Libya Sanctions Act) still poses a threat but is subject to waivers and is becoming increasingly ignored by non-US firms. The NOC has achieved a little success despite sources of frustration imposed on the national oil sector for many years by the American oil companies. American administration has attempted to obstruct progress in this field by imposing an embargo on importing oil spare parts and imposing an embargo on importing tools and modern technology equipment such as computers and related accessories. Furthermore, laws and regulations have been issued for comprehensive sanctions concerning trade with Libya. This prevents American companies from conducting any business in Libya.

[2] The NOC is the holding of the oil and gas sector in Libya and performs its duties through its fully owned companies which vary in activity from operating and producing companies, to refining, processing and domestic and international marketing companies, to various service companies. Moreover, the NOC performs some of its activities through partnership with foreign exploration, production and specialised oil service companies.

[3]According to Economist Intelligence Unit report, 2003 stated that these US oil companies could make a return if U.S.A restrictions (Iran-Libya Sanctions Act) are lifted.

[4]The Petroleum law was enacted in 1955, which precipitated a period of rapid growth in exploration activity. The first concessions were awarded in 1955 and by 1968, 137 concessions agreements had been awarded to 42 different companies.

[5] In the absence of U.S. oil firms, Libya depends heavily on non-American companies, such as: 1) Repsol YPF (mainly at the El Sharara field, plus exploration at blocks NC-186, NC-187, and North-A); 2) Italy's Agip (Bu Attifel, plus exploration on block NC-174 and in the el-Bouri offshore Mediterranean field); 3) Austria's OMV 4) PetroCanada (the Amal field in Block NC-12 and the En Naga block); 5) Wintershall (al-Jurf); and 6) Total (Murzuq). Also, in July 2003, India's ONCG Videsh received approval for a $300 million deal on developing two Libyan exploration blocks along with the Turkish Petroleum Overseas Company and possibly Ukraine's Naftohaz Ukrayiny. Then, in December 2003, Libya reached a $100 million deal with a consortium of Australia's Woodside Petroleum (45% share), Repsol YPF (35%), and Greece's Hellenic Petroleum (20%) to develop several Libyan oil fields. Finally, Libya is reportedly in negotiations with Brazil's Petrobras for an exploration venture in the country.

[6] The Organisation of Petroleum Exporting Countries (OPEC) is a permanent, intergovernmental organisation, created at the Baghdad conference by five members and later increase to eight before two suspended their memberships at their own request. OPEC members meet twice a year to formulate general policy. OPEC's objective is to coordinate and unify petroleum polices among member countries, in order to secure fair and stable prices for petroleum producers; and secondly, securing an efficient economic and regular supply of petroleum to consuming nations.

CHAPTER IV

TECHNOLOGICAL DEVELOPMENT IN LIBYA AND WORLD REGIONAL DIFFERENCES IN E-COMMERCE TECHNOLOGY

4.1 Introduction

The last chapter examined and discussed some of the literature in relation to the Libyan oil and gas industry, its technological readiness and contemporary developments. This chapter discusses e-Commerce technology in the developing world. The Arab countries for example, have implemented or are in the process of designing e-Commerce strategies to promote economic and social development. In order for these efforts to succeed, Arab countries must generate and exploit new economic opportunities through the adoption of e-Commerce practices. This chapter also explains e-Commerce development in terms of the cultural and organizational context.

e-Commerce can create profound changes in the structure of the economy and accelerate social change, but it offers no instant cure for the ills of any economy; excessive expectations about what it can do for development should not be encouraged. However, if huge expectations are turned into general scepticism about the relevance of e-Commerce in the context of the challenges facing Libya and other developing economies, a fundamental point is being missed. The importance of e-Commerce for development lies in the fact that the widespread use of these technologies enables

people and organizations across the whole spectrum of social activities to become much more effective and productive (Steinfield, 2003).

4.1.1 Definition of e-Commerce

e-Commerce encompasses everything related to doing business using the Internet, or any other electronic network. Although the term e-Commerce is relatively new, e-Commerce itself has existed for more than 25 years. The electronic funds transfer **(EFT)** was introduced in the late 1970s. Automatic Teller Machines **(ATMs)**, telephone banking and the acceptance and growth of credit cards in the 1980s are also examples of early e-Commerce. However, electronic data interchange **(EDI)** is probably the most well known forerunner of contemporary e-Commerce (Economic and Social Commission for Western Asia (ESCWA), 2002; Livesay, 2000).

It is likely that e-Commerce will be among the most powerful transmission mechanisms through which technology-induced change will spread across developing countries (UNCTAD Report, 2003). The application of **ICTs** for instance, can certainly contribute to the achievement of basic development objectives and can, in the long term, lead to productivity increases. However, the acceleration of economic growth that the Internet and e-Commerce can bring about might also result in a more immediate and sustainable contribution to the reduction of poverty and economic progress (UNCTAD Report, 2003; Steinfield and Whitten, 2002; Steinfield, 2003).

Addressing the comparatively low levels of productivity in the developing countries, the adoption of e-Commerce in these countries can yield particularly large relative improvements in productivity. In most cases, these gains are not derived directly from the technology itself, but through incremental improvements resulting from organizational changes in the production process that are made possible by the technology. An encouraging factor is that e-Commerce seems to be spreading in the Arab countries faster than was the case with previous technological revolutions (Arab Advisors Group, 2003).

For example, Arab countries can profit from the opportunities provided by e-Commerce by exploiting competitive advantages not achievable in the "old economy". e-Commerce gives firms the ability to access international markets that used to be difficult to enter due to high transaction costs and other market access barriers (Arab Advisors Group, 2003).

The emergence of successful industries, such as oil and gas, in several countries is an example of this. e-Commerce can access better-quality trade-related services (for instance, finance, banking, and business petroleum information). e-Commerce can stimulate growth in developing countries by helping to improve the transparency of the operation of markets and public institutions (UNCTAD Report, 2003). For instance, by simplifying business procedures, e-Commerce not only reduces the costs for businesses of complying with trade-related regulations, but also reduces the cost of corruption, a burden that often affects firms most severely. For all these potential benefits to

materialize, action plans are needed to create an enabling environment for e-Commerce, addressing areas such as infrastructure, applications, availability, payments systems, human resources, and legal frameworks. This chapter now addresses global e-Commerce trends, key e-Commerce indicators, and major e-Commerce drivers and features. The potential of e-Commerce in different regions is also discussed.

4.1.2 Worldwide e-Commerce Statistics

It is estimated that by 2004, the value of worldwide e-Commerce reached US$6.8 trillion.[16] According to Gartner Inc. (2004), the worldwide **B2B** Internet commerce market in 2005 will reach $8.5 trillion, and 63% of **B2B** online transactions will originate outside the USA. Another study by Forrester Research (2001) suggested that **B2B** e-Commerce would grow from $109billion in 1999 to $2.7trillion in 2004 (Deitel et al., 2001). **B2B** Internet commerce sales transactions via the Internet can be seen in Table 4.1.

Table 4.1: Internet Statistics Worldwide

Sales	Year
$433billion	1999
$919billion	2001
$1.9trillion	2002
$3.6trillion	2003
$6.8trillion	2004
$8.5trillion	*2005

Source: www.gartnergroup.com, www.Internetnews.com, Nua Internet Surveys, Internet World Stats, Business: Economic Downturn Slow B2B commerce, March 21, 2001 by Michael Pastone, *Predicted

4.1.3 e-Commerce and Internet Worldwide Statistics

According to a study by international data corporation **(IDC)** of Mountain View, California, total Internet commerce was predicted to soar to more than US$1 trillion in 2003; an increase from an estimated US$40 billion in goods and services sold on the net in 1996. As can be seen in Table 4.2, a report by The Star (IN-TECH 2000) demonstrated that the worldwide Internet economy was worth about US$1 trillion in 2001 and it estimated a value of US$ 3 trillion by 2003.

Table 4.2: Facts and Figures: Worldwide Statistics

Internet users in 1998	142 million
Internet users in 1999	196 million
Internet users in 2003	600 million
Internet users in 2004	800 million
Internet users in 2005*	*888 million
Internet users growth rate	70,000 users per day
e-Commerce spending in 1998	US$50 billion
e-Commerce spending in 2001	US$1 trillion
e-Commerce spending in 2003	US$ 3 trillion
Internet shoppers in 1998	31 million
Internet shoppers in 2003	183 million
Internet shoppers in 2004	250 million

Source: Excellence Success Network, http://members.informak.com/stepbiz/forum.htm, and from Internet World Stats, www.internetworldstats.com, International Telecommunications Union (ITU). *Estimation.

e-Commerce is expected to represent a big business offering tremendous new business opportunities. In many cases experts indicate that the Internet and e-Commerce will have positive effects on traditional business processes (Benjamin et al., 1995; Turban et al., 2004). Because there are fewer opportunities for regional market positions, the successful adoption of e-Commerce could be a great strategy.

4.2 Regional Comparisons in Telecommunication Penetration

This section deals with the regional differences in telecommunication penetration. One of the fundamental arguments is that there is a global **"digital divide"** or a significant gap between wealthy and poor countries in the use of and access to various forms of information and communication technologies. This section begins by explaining why increased access to the Internet and other form of information and **ICTs** are important. It then proceeds to describe barriers to increased Internet and e-Commerce access and use. This section provides data that describe the extent of this gap, including the variations in penetration levels across and between regions.

4.2.1 Rationale: ICT and Development

The convergence of information technology and telecommunications have led to the emergence of what has been described as an information economy, characterized by an increased dependence on digital technology and quick, easy access to a global marketplace (Aggrawal, 1991). The idea that telecommunications infrastructure growth contributes to a country's social and economic development is a well-established tenet of economic theory (Aggrawal, 1991). The Internet, however, is expected to have a much wider impact. Much of the high expectations surrounding the Internet are fuelled not only by the nature and capabilities of the Internet itself, but also by the phenomenal progress that has been made over the past two decades in computer and information technology. There are several ways in which the potential of the Internet can be harnessed by poor countries to achieve developmental goals. These are listed below.

4.2.1.1 e-Commerce as a Medium

Turban (2002) points out that information technology in general, and e-Commerce technology in particular, has become the major facilitator of business activities in the world today. While e-Commerce in its various forms such as (**B2B**, and **B2C**) is routine in developed countries, it is still a growing industry in some developing countries. Nevertheless, the literature provides various examples of firms, in remote places taking advantage of e-Commerce to compare prices and advertise goods and services.

4.2.1.2 ICTs: A Business Opportunity

ICTs provide an opportunity for both small and medium sized enterprises **(SMEs)** and large companies to participate more fully in the global economy. Such enterprises can expand their networking capabilities and create increased opportunities for employment. As is the case in developed countries, the new technologies offer businesses an opportunity to increase productivity. Global connectivity has also allowed developed countries to outsource some aspects of their production to developing countries where labour and other costs are cheaper.

4.3 Determinants of Internet Diffusion

This section discusses the determinants of internet diffusion. One way of looking at the determinants of Internet diffusion is to identify those factors that are barriers to increased Internet usage. Identifying these factors not only pinpoints the constraints, but lays the foundation for determining the policy measures that need to be

implemented to remove the obstacles identified. This section highlights the major barriers to Internet diffusion:

4.3.1 Infrastructure

Connecting to the Internet requires a combination of infrastructure and network applications. These include personal computers, main lines, leased lines, secure Internet servers, Internet Service Providers **(ISPs)**, international backbone and adequate bandwidth. Computers, appropriate software and telephones may be regarded as user interface equipment over which the user has some control about whether or not they have access. Network connection is achieved through **ISPs**. Internet Service Providers **(ISPs)** need secure Internet servers to facilitate Internet traffic. Shortages in any parts of this infrastructure network pose a serious barrier to Internet and e-Commerce growth.

4.3.2 Access Costs

In most developing countries access costs are an important issue. The two most important costs are telephone service charge and price charges by the **ISPs** for connecting to the Internet. The cost of local calls is important, as studies have shown that Internet diffusion spreads faster where there is flat rate pricing. This situation is exacerbated by the fact that most developing countries have to pay high international charges to connect to overseas backbones.

4.3.3 Socio Economic Status

Demand for Internet service will obviously depend not only on the costs of subscription (including hardware, software and access prices) but also on the users' ability to pay for these costs. Likewise, a minimum level of literacy and computer literacy are needed to facilitate access to the Internet. In this respect, demand is usually defined by per capita income (Steinfield, 2003). Countries with higher incomes and a more skilled and educated populace will exceed poorer countries in the use and access to the Internet (Steinfield, 2003; Steinfield and Whitten, 2002).

4.3.4 Language and Content

In the case of Arab countries, and in particular Libya, the issue of language may be a significant constraint to the diffusion of the Internet and e-Commerce, as most content is still in English. According to research conducted by the Internet Society, more than 80 per cent of web pages are in English, although only 54 percent of Internet users have English as their mother tongue (International Telecommunications Union, 1999; 2002). Expanding Internet and e-Commerce access is expected to be less successful in countries where English is not the official language due to the barrier caused by language, lack of appropriate content and other social and cultural variables not catered for by a predominantly Western culture (UNCTAD Report, 2003; Organization for Economic co-operation and development, 2002).

4.4 Overview of the Worldwide Digital Divide

The data presented in this section describes the global distribution of various types of telecommunication infrastructure: fixed lines and mobile phones, and numbers of computers, Internet hosts, Internet users, and secure Internet servers.

4.4.1 Libya and the Arab Divide

This section looks at disparities in access between countries in the Arab world. It uses indicators such as infrastructure penetration and user access. The indication of major trends and disparities are essential to understand the current digital gap among Arab countries (see Appendix 11).

Why is IT in Libya a problem? Recent studies suggest that much of the technology designed and produced in developing countries is ethnocentric, that is, in favour of their own social and cultural surroundings (Aggrawal, 1991). Consequently, any country in the Arab world such as Libya encounters cultural and social obstacles when attempting to transfer technology created abroad into practice at home (Yavas et al., 1992). However, it can be argued that many individuals and companies who have experience with technically advanced societies become technologically ready, and thus more willing to accept and adopt, IT forms such as e-Commerce.

4.4.1.1 Libyan Infrastructure and Technology

Global Internet and e-Commerce technologies depend on a modern, global telecommunications network and on the computers that connect to it. Unfortunately, in

many countries such as Libya, telecommunications policies are hindering the development of advanced digital networks because telecommunications services are often too expensive, bandwidth is too limited, and services are unavailable or unreliable. Likewise, many countries maintain trade barriers to imported information technology, making it hard for both merchants and customers to purchase the computers and **IT** they need to participate in the digital world. As a result, Libya has suffered for years from these kinds of technological barriers.

Major infrastructure questions remain. Assuming that the Internet and e-Commerce will further evolve as the main global information infrastructure, will it remain fundamentally decentralized? Many **LOGCs** are held back by lack of Internet and e-Commerce infrastructure and trading partners. Although **LOGCs**, for example, are keen to use the Internet to improve services, productivity, and global market reach, Libyan petroleum companies believed that they are being held back by the lack of proper management and the inability to set up and manage the required technical infrastructure.

4.4.1.2 IT Transfer in Businesses

IT is becoming prominent in the business environment. Studies indicate that **IT** has a positive effect on businesses in the manufacturing and service sectors (Julien, 1995; Schafer, 1995). Diffusion of technology has been associated with increased productivity, efficiency, company growth, and reduced costs (Cooper et al., 1990; Ray et al., 1994). Implementing **IT** is particularly significant for organisations given the

positive effect on operations and company performance (Julien, 1995; Schafer, 1995; Thong et al., 1995). Organisations throughout the business world experience difficulty, and even failure, in IT defined as a movement of information from creators to users (Cunningham et al., 1994).

4.4.2 Technology in Developing Countries

IT problems are even more acute in developing countries (Antonelli, 1986; Goodman, 1991b; Knight, 1993; Goodman et al., 1992). Although developing countries such as Libya are eager to adopt new technologies such as e-Commerce, the process of adoption has been slow and the current utilisation of IT is far below that achieved in the industrialised world (Arab Advisors Group, 2003; Antonelli, 1986). This disparity in IT use between industrialised and developing countries can be explained in part by the high cost of building IT, but this explanation is not entirely satisfactory on its own. Substantial and descriptive evidence exists for many countries in the Arab world for example; they have historically used far less than the available computing capacity (Atiyyah, 1989; Yavas et al., 1992). As a result, the implementation and use of IT conducted inconsistently throughout the Arab region (Cunningham et al., 1994; El-Sayed Noor, 1981; Goodman et al., 1992).

4.4.2.1 Globalization and Basic Technologies

In the IT area, exposure occurs when people become informed or educated about computer and software applications that can be found in formal education experiences such as seminars, workshops, courses, books, and other related sources (Arbose et al.,

1982). As the globalisation of markets evolves, it is becoming clearer that more research is needed about business organization to assist employees and managers (Cash et al., 1992).

A large survey of information systems company executives (1991) highlighted that more than half of the respondents felt that success in global **IT** was the key to their company's future (Ives and Jarvenpaa, 1991). In order to take advantage of increasing operations in the international arena, companies must be able to exploit the power of **IT** to communicate and co-ordinate activities, both within and across organisations. Hence, it is important for the managers of these companies to learn as much as they can about the adoption and use of **IT** (Couger, 1986).

4.4.2.2 e-Commerce and Globalisation

Internet access in Africa is rising and Internet usage in Africa is estimated at 13,500 million users (Internet World Stats, 2005) but its growth is challenged by regulations and limited infrastructure (Deitel et al., 2001). According to Africa online (2000), Africa has few **ISPs** where Africa Online itself is the only transcontinental service (Yeomans, 2000). In 1996, the African Information Society Initiative was proposed to build national communication standards regarding the regulations limiting the development of communications, the implementation of Internet access, and other initiatives. Jensen (2000) reported that, between 1996 and 2000, the proportion of African countries with Internet access increased from 11% to 51% (see Appendix 12).

4.4.3 The Arab World and e-Commerce

In the Middle East, for example, countries such as Egypt, Kuwait, Jordan and the United Arab Emirates have already begun increasing their web presence (Deitel et al., 2001). Other countries such as Iran, and Saudi Arabia are extending full Internet capabilities to government institutions and educational facilities (Deitel et al., 2001). The estimated Internet usage in the Middle East is presently around 19,370 million users (Internet World Stats, 2005) (see Appendix 11).

Libya, for example, has established Internet access in many government institutions, private and public sector and educational facilities. However, most Internet access in the Middle East is government regulated, although the level of regulation varies from country to country. Thus, people have limited access to Internet resources but the trend is toward expansion in most countries (Deitel et al., 2001). As a result, both challenges to and opportunities for traditional Arab cultural identities may arise. In Libya, for example, the effects of the Internet are largely related to government control over the distribution of information. In some cases, access to sites is restricted and often prohibited.

4.5 Cultural Sensitivity and IT

This section looks at cultural sensitivity and **IT**. First, it must be recognised that transferring any kind of technology from one culture to another involves more than providing instructions about technical aspects of using the equipment (Hofstede, 1980). The intricate relationship between managers and **IT** means that attitudes impact on both

how systems are designed and how they are received (Hofstede, 1980). Obstacles and barriers arise because of a lack of technical skills and technical awareness about **IT**.

Successful **IT** involves understanding, co-operation, and strategy to resist any difficulties to adoption in any company. Factors which are likely to be powerful for those who attempt to implement new technologies such as e-Commerce include attitudes among managers as to how technology should be utilised. If in a business organisation managers, directors, and top administrators are not widely experienced with **IT** in general and particularly in the use of the Internet and e-Commerce, it will be difficult to implement e-Commerce technology.

There are other factors which are also likely to explain why **IT** may be fraught with problems in Libyan firms. The transfer of **IT** from industrialised to developing countries such as Libya generally involves a process of injecting the technology of the industrialised world into a developing country. The adoption and use of the new technological knowledge, however, varies according to organisational context. One approach looks at how the attitudes of managers influence the adoption of new technology such as e-Commerce. Schaniel (1988) has stated that:

> *"...the process of technological adaptation is one where the introduced technology is adapted to the social processes of the adopting society".*

There is a need to show how attitudes, knowledge, and technology variables can predict and influence the outcomes of e-Commerce adoption in business settings. This

integrates understanding of the user's notions of technology with more general knowledge regarding managerial attitudes towards **IT** use. It also reflects the management context of an organisation's policy-making processes that affect the adoption of e-Commerce.

Culture is an organizational factor in the Libyan business setting. Cultural differences that exist between different countries may affect the organisation's ability to adopt and utilise e-Commerce technology (Gatignon et al., 1989). Past studies on the cross-national diffusion of technology have observed that an innovation diffuses differently in different cultures depending on the sociocultural environment (Helsen et al., 1993).

4.6 Global e-Commerce and Culture

This section looks at global e-Commerce technology. Over half of the trade in e-Commerce is done with companies located in the US (Industry Standard, 2001). e-Commerce is a US-centric **IT** that is rapidly expanding into a global platform, crossing national borders and deeply penetrating traditionally isolated societies. There are large disparities in the use of e-Commerce in the USA and elsewhere. For example, 40% of the Web traffic on the popular portal site Yahoo comes from outside the US, but Yahoo's international operations contribute only about 15% of total revenues (Industry Standard, 2001).

The World Bank also notes disparities in the technology infrastructure between and among developed and less developed **(LDC)** nations, evidenced by number of **PCs** and

Web servers, and telecommunications costs (World Development Indicators, 2001; 2002). Some of these disparities are shown in Table 4.3.

Table 4.3: Technological Disparities Among Developed and Less Developed Nations

Nation	PCs per 1,000 pops.	Internet Hosts per 10,000 pops.	Cost of local calls 3 mins in US$
United States	458.6	1,508.7	.09
Singapore	458.4	322.3	.03
Norway	373.4	754.2	.10
Netherlands	317.6	403.5	.09
New Zealand	282.1	476.2	.00
Ireland	271.7	156.6	.17
United Kingdom	263.0	270.6	.20
Japan	237.2	163.7	.08
Lithuania	54	30.5	.05
Greece	52	60	.04
Russia	40.6	13	…
Thailand	21.6	4.5	.07
Nicaragua	7.8	2.2	.10
Vietnam	6.4	0	.10
Libya	…	2.1	.09
Uganda	1.5	0	.18

Source: World Development Indicators, The World Bank, 2001; UNCTAD, 2001, 2002 Reports; Libya Telecom & Technology (2002) Available at: www.lttnet.com/, accessed 5/29/02; Libyan General Post and Communications (2003) *Libya Communications Report*, Tripoli, Libya.

4.6.1 Culture and Information Technology

National cultures and **IT** have been linked in numerous studies. Researchers continually emphasize the importance of culture to the success of **IT** (Ives and Jarvenpaa, 1991; Shore and Venkatachalam, 1995; Deans et al., 1997; Palvia, 1998). Some studies rely upon previous research (Dirksen, 2001), while others base their conclusions on multinational surveys (Hasan and Ditsa, 1999).

Some authors predict a global coming together, a convergence and eventual elimination of distinct national cultures based upon improvements in communications and increases in global trade (Levitt, 1983). However, other studies dispute this using data on structures within the home states of multinational corporations (MNCs). Based upon interviews with 25 senior managers from Fortune 500 companies, Ives and Jarvenpaa (1991) conclude that the convergence of cultures is not happening in IT. Much research is focused upon particular regions and nations. Raman et al. (1997) claim that most IS/IT knowledge is based on North American research which may not be applicable in other cultures. They describe two cases in which culture played a major role in IT, and discuss professional, national and organizational cultures.

Ein-Dor et al. (1993) list the national cultural factors in information systems. These factors include attitudes towards technology and progress, and interpersonal relations. These factors are important but are not included in the research model proposed here. These areas assist more in understanding and describing the differences among nations.

4.6.2 Culture and IT: US-Centric Studies

Hill et al. (1998) conclude from structured interviews with the Arab American business community and within five Arab nations, that socio-cultural factors are powerful. They observe that the highly Americanised Arab businessmen evidenced strong identification with their previous Arab culture.

Other research finds mixed outcomes. Mcleod et al. (1997) note that the effects of culture on IT have not been consistent with Hofstede; they used interviews and a questionnaire to survey Chief Information Officers (CIOs) about their perceptions. The qualitative study tested the dimensions of power distance, uncertainty avoidance and individualism. This study of managers in Korea, Mexico and the US found only mixed support for Hofstede's dimensions.

In studies based upon surveys of computer analysts in Singapore and the US, Couger (1986; 1998) reports that there are more cultural similarities than differences, and that these similarities are very surprising given the demographic differences involved. However, he notes that Singapore is the only South East Asian country where English is the standard commercial language. Language may be a leveller in reducing the impact of culture on technology.

4.6.3 Culture and IT: International Studies

Martinsons et al. (1997) contrast Western and Chinese philosophies, then develop a theory to explain differences in IS use. They conclude that these systems are not immune to cultural impact, and outline the effects of culture on management in China. Hasan and Ditsa (1999) observe that culture is probably the most difficult factor to isolate, define and measure. They contrast West Africa, the Middle East and Australia using Hofstede and Hall's (1990) indices, and conclude that most IT products and projects suit cultures with low power distance, and low uncertainty avoidance.

Following a study of the determinants of process-based **IT** adoption in the Indian manufacturing sector. Dasgupta et al. (1999) conclude that organizational and environmental factors have a significant impact on **IT** adoption decisions. However, they did not find any significant differences between Indian owned companies and companies with some foreign alliance. Kandelin et al. (1998) studied Indonesian managers in a survey and found strong similarities among their attitudes towards computer systems, implying that culture, education and familiarity with technology contribute to the acceptance of **IS/IT.**

Edberg et al. (2001) identify five key issues for global **IS** management. These include language, culture and geography, systems development and support, legal regulations, and level of technology. They note that the Japanese culture has not been entirely receptive to computer technologies; that social and group oriented dynamics of decision making may explain the Japanese preference for fax and e-mail use.

Dirksen (2001) conducted a meta-analysis of previous research and notes that the universal applicability of **IT** is a myth. Finally, Straub et al. (2001) studied the influence of cultural beliefs and values on the transference of **IT** in the Arab world. They develop a cultural influence model of **IT** Transfer **(ITT)** that presupposes the effect of culture and top management support. Surveys and interviews within Jordan, Egypt, Saudi Arabia, Lebanon and the Sudan led to the conclusion that Arab cultural beliefs are very strong predictors of resistance to systems and to **ITT.**

4.6.4 Culture and e-Commerce Technology

e-Commerce technology relies heavily upon IT. The Internet, and specifically the World Wide Web, is receiving increasing attention from businesses. e-Commerce, as a global transaction system, must fall under the same multicultural examination and research as previous IT.

> "Although the last few years have witnessed an explosive growth in electronic commerce activities in many parts of the world, very little is known about the exact nature, dynamics and impact of this phenomenon. There is a certain paucity of systematic investigations reported in the literature" (Lee, 2001).

The success of e-Commerce across national borders is a function of several variables, including national economy, national culture, telecommunications, and technology penetration and acceptance (Tillquist, 1997; Pitkow and Kehoe, 1996).

4.6.5 Culture and e-Commerce: International Studies

Technological skills and acceptability may play major roles in global e-Commerce. In a survey of five Arab nations, Rose and Straub (1998) use the Technology Acceptance Model (TAM) to compare perceived usefulness and actual use of computers across national borders, and conclude that cultural biases play a role in TAM when applied to PC use. Harris and Davison (1999) find considerable differences in PC involvement surveys across users in China, Hong Kong, Malaysia, New Zealand, Tanzania and Thailand, and attribute those differences in part to culture. Al-Khaldi and Wallace

(1999) observe differences in **PC** utilization between Canada and Saudi Arabia. They identify factors influencing **PC** use, and survey 200 knowledge workers. Their findings suggest that, in addition to culture, factors such as differing levels of perception caused by differences in education and in previous use may affect PC use among nations.

4.6.6 Culture and e-Commerce: General Studies

Other research focuses on the status of global e-Commerce technology and its effects upon organizations and users. Senn (1997) lists economic factors that drive businesses to global commerce, and observes that globalisation is making it difficult to distinguish between a domestic and a foreign firm. Senn also notes a tendency for inexperienced managers to view international business as nothing more than local business but on a larger scale. Essentially, he states that business is not a universal practice across national borders.

Stafford and Stafford (2001) identify motivations for the use of commercial Internet sites, including process, content, and socialization. They develop a list of descriptive adjectives for Web use, and rank them based upon survey responses. Their findings support previous research and they conclude that Web developers must understand their users in terms of personal and social contexts. Bingi et al. (2000) develop four challenging areas facing global e-Commerce. These include economic, social, technical and legal factors. The social aspects, including cultural diversity, play a major role in areas such as security, privacy, trust, and global trading methods.

4.6.7 Global e-Commerce Development

e-Commerce technology has become a driving force for the globalization of the world's economy, and countries that do not engage in e-Commerce may put the competitiveness of their enterprises at risk. As a result, many enterprises in developing countries have become integral parts of global networks of production supply chains that increasingly use e-Commerce methods. Through these networks, enterprises in developed countries encourage other enterprises in developing countries to adopt new **IT**, organizational changes, and business practices. As for e-Commerce, Table 4.4 presents three estimates of global online sales. In the most optimistic forecast, e-Commerce technology would represent about 18% of worldwide **B2B** and retail transactions in 2006.

Table 4.4: e-Commerce Technology: Estimates and Forecasts (Billions US$)

Source	2001	2001	2002	2003	2004	2005	2006
Forrester	1,100.50	1,700.00	2,293.50	3,878.80	6,201.10	9,240.60	12,837.30
IDC	354.90	615.30	1,660.90	2,500.00	3,290.00	4,700.00	8,900,00
Emarketer*	278.19	474.32	823.48	1,408.57	2,367.47	5,850.00	9,890.00

Source: Forrester Research, www.forrester.com, International Data Corporation (IDC), www.idc.com, Emarketer, www.emarketer.com,* B2B Only.

4.6.7.1 Regional e-Commerce Forecasting

The share of developing countries in total world e-Commerce is predicted to grow by an impressive 45%, but in absolute terms the share will remain at the current level of 6.7%. The global regional differences are enormous, threatening to deepen the future digital divide between developing and developed countries also in the domain of e-

Commerce, as shown in Table 4.5. The e-Commerce forecast for 2006 also indicates that **B2B** is expected to continue to predominate over **B2C** in 2006 in all major regions.

Table 4.5: Forecast B2B and B2C in 2006 by Region in (Billions US$)

Region	B2B	Percentage	B2C	Percentage	B2B/B2C
North America	7,127	58.1	211	37.5	34
Asia Pacific	2,460	20	185	33	13
Western Europe	2,320	18.9	138	24.6	17
Latin America	216	1.8	16	2.9	13
Eastern Europe	84	0.7	6	1.1	13
Africa & Middle East	69	0.6	5	0.9	13
Total	**12,275**	**100**	**562**	**100**	**22**

UNCTAD: Building up New Business Models for Digital Inclusion; Presentation at ITU/IDSC Regional Seminar on E-business for the Arab Region, Cairo, Egypt, 2002.

4.6.7.2 Internet Usage in Developing Nations

The Internet is the prime medium for conducting e-Commerce. Some 150 million new people began using the Internet from 2001 to 2002, of which developing countries accounted for almost one third, bringing the number of Internet users worldwide to 655 million by the end of year 2002 (UNCTAD, 2002). This means that around 10% of the world was online in 2002, and that the growth of new users continues at a rapid pace. In developing countries such as the Arab nations (see Appendix 21), however, Internet penetration rates remain far below the penetration rate of 50% and above seen in more advanced economies.

4.6.8 e-Commerce Indicators in the Arab Region

To measure e-Commerce development requires a weighted combination of many indicators and parameters, such as those listed in Table 4.6. Based on Table 4.6, the

challenge for Arab countries is to integrate themselves into regional and global supply chains, and to continue their development.

Table 4.6 : e-Commerce Infrastructure Components

Primary "Enterprise" Parameters	Secondary "Country" Parameters
Secure hosting	Infrastructure access and affordability
e-Commerce applications	Internet penetration and availability
e-Payment infrastructure	Computerization
Digital certification	User awareness
Access to security and encryption technology	

Source: UNCTAD: Electronic Commerce Strategies for Development, 2002.

The UAE, Kuwait and Bahrain are advanced countries in the region measured by country e-Commerce parameters, followed by other Gulf countries and nations such as Lebanon, Jordan and Egypt on selected indicators.

Table 4.7: Selected Arab Countries e-Commerce Technology Indicators, 2001

Country	Web Presence Measure	Infrastructure Measure				
		PCs/100	Int Hosts/10000	% of Pop. Online	Tele Lines/100	Mobile Phones/100
Algeria	2	0.58	0.01	1.1	5.60	0.27
Bahrain	3	13.98	0.77	10.1	24.97	30.05
Egypt	3.75	1.20	0.35	1.1	8.64	2.14
Jordan	3	1.39	1.36	4.1	9.29	5.83
Kuwait	3	12.13	17.55	8.1	24.40	24.86
Lebanon	3	4.64	23.00	9.0	19.96	19.38
Libya	**2**	**0.30**	**0.05**	**2.0**	**7.80**	**0.36**
Morocco	2.75	1.08	0.84	0.4	5.03	8.26
Oman	2	2.64	11.46	2.0	8.88	6.48
Qatar	2	13.58	37.68	9.8	26.77	19.96
Saudi Arabia	3	5.74	1.73	2.5	13.72	6.37
Tunisia	2	1.53	0.03	2.9	8.99	0.58
U.A.E	3.5	12.51	176.00	33.0	41.79	58.51
Yemen	3	0.17	0.03	1.1	2.27	0.17
Regional Average	**2.71**	**5.11**	**19.35**	**6.36**	**15.09**	**13.09**

Source: UNDESA/ASPA: Benchmarking E-Government: A Global Perspective, 2001; Libyan General Post and Communications (2003) *Libya Communications Report*, Tripoli, Libya.

Regional e-Commerce readiness statistics among selected Arab states are indicated in Table 4.7. e-Commerce in the Arab region is currently dominant in the Gulf Countries Council (GCC), but there are high disparities among less developed Arab countries.

Dial-up costs in the region are still high compared to other countries, and there is low computerization, low infrastructure availability and affordability. On the positive side, Internet bandwidth is growing, and about 6 million subscribers were connected to the Internet in 2002. This number is expected to reach 25 million by 2006 (UNCTAD, 2002).

4.6.8.1 e-Readiness in Libya and Arab Countries

UN-DESA/ASPA has developed a global e-readiness performance index, which integrates infrastructure measures, Web presence, e-government, and other indicators in a weighted benchmarking (UNDESA/ASPA, 2002). The average Arab index is 1.72, with a range starting at 1.27 (Algeria) and reaching 2.17 (UAE). The index of the Arab states hovers just above the average global index of 1.62. However, as shown in Table 4.8, vast differences occur in the Arab region.

Table 4.8: Performance Index of Selected Arab Countries, 2001

Global Leaders	Index
United Arab Emirates	2.17
Kuwait	2.12
Regional Leaders	
Bahrain	2.04
Lebanon	2.00
Saudi Arabia	1.86
Qatar	1.81
Followers	
Jordan	1.75
Egypt	1.73
Oman	1.64
Libya	***1.57***
Morocco	1.47
Tunisia	1.36
Yemen	1.30
Algeria	1.27

Source: www.unpan.org/e-government; UNDESA/ASPA: Benchmarking e-Government: A Global Perspective, 2001.

Besides the primary and secondary e-Commerce parameters mentioned, other less tangible measures such as business climate, responsiveness to change, and technological innovation potential should be included in the measurement of e-Commerce development in the region. In the following section more e-Commerce potentials and drivers are described.

4.6.9 Potential in the Arab Countries

e-Commerce technology means doing business over the Internet, selling goods and services which are delivered offline as well as products which can be digitized and delivered online such as information, music, video, and software. Business transactions can be either **B2B**, and **B2C**, and **B2G**. Table 4.9 shows the benefits of e-Commerce distributed at different levels of society.

Table 4.9: e-Commerce Benefits Distribution at Different Levels of Society

Primary "Enterprise" Parameters	Secondary "Sector" Parameters
Shift power from sellers to buyers	Penetration of new international markets
Reduce transaction cost of payment	On-line delivery of cheap and labour intensive service
Portals increase the automation, speed and geographical range of markets	Emergence of new industries, such as software development
Improves market transparency	Access to cheaper and better quality trade services
Offers customization, and comparability	Escape local de facto monopolies by combating local market imperfections and broadening market access
Facilitates collaboration between business partner, suppliers and customers	Improve transparency and combat corruption by simplifying business procedures, and regulations
Increase market and customer predictability	Improving productivity and efficiency
Stimulate organizational and managerial changes in production, e.g. decentralization	Facilitates the inclusion of marginalized groups.

Source: UNCTAD: Electronic Commerce Strategies for Development: The Basic Elements of an Enabling Environment for e-Commerce technology, Geneva, 2002.

Mehrtens et al. (2001) and Turban et al. (2004) highlighted that e-Commerce technologies proved to be very important in any company's business processes. Smith (1998) details the benefits of e-Commerce as lower costs of trading, faster business decisions, and the lower importance of geography. Whiteley (1998) stated that it gives companies the competitive advantages. In many cases, researchers indicate that e-Commerce will have significant positive effects on traditional business processes (Benjamin et al., 1995).

In the following breakdown of e-Commerce potential in different business sectors the terminology and classification used and recommended by the Arab Monetary Fund **(AMF)** is applied (Arab Monetary Fund, 2001). In a globalized economy with less opportunities for regional market positions, the adoption and deployment of Internet

technology into an integrated e-Commerce business approach becomes a strategic necessity. e-Commerce possesses a number of distinct features across all sectors, which is of importance for countries in general, and for the business community and consumer society in particular. Table 4.10 shows how different sectors can benefit from e-Commerce technology.

Table 4.10: Selected Commodity, Distributive, and Service Sectors

Commodity Sectors	Distributive Sectors	Service Sectors
Mining, Fuel, Oil and Gas Industries, Quarrying	Commerce, Transport, Communication, Finance, Banking.	Housing, Government service, Other service.

Source: Arab Monetary Fund, http://www.amf.org.ae/vEnglish/default.asp, 2002.

Strategically, the potential of e-Commerce is highest when applied in those sectors where the Arab countries already hold significant competitive advantages, and where e-Commerce can subsequently be used as a tool to strengthen its current stronghold and market position, such as fuel, mining, quarrying, petrochemicals, and the oil and gas sectors as in Table 4.10. Secondly e-Commerce can be used to penetrate new markets and develop new services in sectors currently threatened by competition or leveraged by inefficient public services, such as in certain government services, transportation, and manufacturing. Finally, e-Commerce can be utilized to attract investment and create new business opportunities in sectors, where Arab countries previously have had low or no competitive advantages, but where they possess certain advantages such as language skills and local markets, such as in telemarketing, call centres, and software development.

4.6.9.1 Elements of National e-Commerce Strategies

Table 4.11 shows that initiatives aimed at developing national e-Commerce strategies have been launched in most developed and many developing countries. But what exactly are the key policy areas that have been included in the strategies, and how do they differ across countries? In order to provide an overview of what countries have done so far or are planning to do in the near future, an initial survey of national e-Commerce strategies was carried out by UNCTAD (UNCTAD, 2003).

Table 4.11: Key Elements of National e-Commerce Strategies

Strategy element	Countries including element		
	Number of Countries	Percentage of developing countries	Percentage of Developed countries
1. Awareness Building,	50	70%	64%
Training and Education	27	54%	50%
Awareness building	23	51%	29%
2. Access and Infrastructure	41	68%	36%
Infrastructure	21	43%	36%
Access	16	41%	7%
Telecommunication sector reform	4	11%	0%
3. Legal and Regulatory Issues	37	41%	85%
Legal issues	29	46%	85%
Taxation	8	5%	43%
4. Support for the Enterprise Sector	21	41%	43%
5. Sector Specific Policy	19	32%	29%
Trade and Investment	9	19%	14%
Development of IT and other Sectors	10	19%	21%
6. E-government	16	27%	43%
7. E-Banking and Online Payment	9	24%	0%

Source: UNCTAD: Electronic Commerce Strategies for Development: The Basic Elements of an Enabling Environment for e-Commerce technology, Geneva, 2002/2003.

As a result, 51 countries[4] were identified as having e-Commerce strategies or as being in the process of formulating such strategies; among them Egypt, Lebanon, Jordan,

Oman, and Tunisia. Most e-Commerce strategies contain a number of common elements. Table 4.11 groups these policy priorities and activities into seven different areas and summarizes the priorities that were listed under each of these policies in the countries' strategies.

4.6.10 Evidence from Singapore

In Asia, many prerequisites are necessary before technology adoption or acceptance may be embraced. Roth (1999) notes that in the 1960s and 1970s, the government of Singapore followed a policy of creating an electronic infrastructure for information technology applications; Roth also observed that the government adopted a policy that recognized information technology as the key enabling technology for Singapore to become ready for e-Commerce technology.

4.6.10.1 e-Commerce technology in Singapore

Singapore was among the earliest adopters of e-Commerce technology in the world. A comprehensive range of initiatives and frameworks has been put in place to allow businesses to capitalize on the potential that e-Commerce presents (http://www.singapore-sme.com). In Singapore, **SMEs** generate 30% of the total value added to the economy (Hin and Subramaniam, 2003). By virtue of this large number of firms, they are potentially ideal targets for using e-Commerce initiatives to increase their profit margins and markets reach (Quayle, 2000).

The pervasiveness of the Internet in the new economy is posing challenges for many firms and governments to be responsive to the needs of new businesses. In Singapore, the answer has been the setting up by the government of a mirror site on the web (http://www.egov.sg,). After initiating the site in 1996, Singapore has implemented an advanced digital infrastructure. Since 2001, all services that need to be accessed online by the public and businesses have been in operation. For example, the e-filling of income tax forms, buying, selling and promoting for **B2B** or **B2C** or **G2C** or **G2B**, and e-Government all are working online at all times. Currently, over 200 online services are available in Singapore (Hin and Subramaniam, 2003).

A recent report on the e-Business applications market in Singapore by Frost and Sullivan (2003) predicted that the next wave of e-Commerce technology investment will be driven by **SMEs** which form the supply base of large enterprises. The report mentions that the e-Commerce applications market in Singapore is growing rapidly from US$15.5 million in 2002, a rise of 35% over 2001, to US$31.9million estimated for 2005.

4.6.11 Technology in Selected Developing Regions

This section gives examples from Africa, the Middle East, South America, the Caribbean and Central Europe and describes their levels of use and attitudes toward technology acceptance. For example, less developed regions in Africa, with limited exposure to the information age, they are now looking to information and telecommunications technologies as a means of generating and sustaining economic

growth. In the Sub Saharan region **ICTs** have contributed towards the economic growth of several countries (Carbonell, 1997). Carbonell maintains that telecommunications and information technologies (mainly hard technologies) and the associated infrastructure are prerequisites for economic development.

4.6.11.1 Africa

Herzi (1994) posits that while Africa is the second largest continent in the world, it has emerged as the least served by computers and information technology. Specific barriers such as culture and attitudes must be overcome in Zambia, Ghana, and Ethiopia so that information technological networks may be utilized. Enhanced economic restructuring is necessary so that information technology can become more widely adopted and accepted. Cogburn (1996) theorizes that there is a need for ongoing efforts to restructure national telecommunications infrastructures. African countries have to employ **IT** adoption to enhance their economic growth. However, Al-Tayeb (1982) calls for the formulation of national policy to create a more effective model for technology adoption and acceptance.

4.6.11.2 Evidence from Egypt

Since 1985, Egypt has invested in its information and communications infrastructure, targeting the build up of its national information backbone to become the platform for the development of all sectors based on timely, relevant and accurate information (Kamel, 1995; 1999). In 1997, the Internet Society of Egypt established its e-Commerce committee to promote education and awareness of e-Commerce in Egypt

(Kamel, 2002). This was the start of a number of initiatives taken by the government and the private sector to promote e-Commerce technology. It was followed by a number of seminars, and sub-committee formation in the Ministries of Trade and Communications and Information Technology.

4.6.11.2.1 The Emergence of e-Commerce in Egypt

Internet and e-Commerce technology provides unprecedented opportunities for increasing trade, promoting investment, facilitating business transactions, providing a larger and more varied market and supplying an unparalleled marketing tool. e-Commerce carries strong business and socio-economic implications for Egyptian citizens and firms, and provides many opportunities to access global markets. Moreover, as Egyptian companies learn how to use this amazing new tool, they become more efficient and more profitable (Bell, 1998). By 1998, many companies had followed the trend of e-Commerce and online shopping sites reached over 190 Egyptian commercial sites were already active on the Web (Schmitt, 1999; Heikal, 1998).

4.6.11.2.2 Internet Evolution in Egypt

The Internet started in Egypt in 1993 with 2,000 users (Kamel, 1998). In an attempt to diffuse Internet usage throughout the society, the Cabinet of Egypt Information and Decision Support Centre, in collaboration with the Regional IT and Software Engineering Centre, provided free Internet access on a trial basis to public, private, government and non-government organizations to entice users to venture into the new

technology (Kamel and Hussein, 2002). This was done with the financial support of the Egyptian government, in an attempt to aid in the global exposure of the Egyptian market and to pave the way for the commercialisation of Internet services. The free access was accredited for contributing to boosting in the rate of growth of Internet usage within SMEs and other industries.

4.6.11.3 e-Commerce in Egypt

The role of information and communications technology is increasingly affecting business and soci-economic development plans in Egypt (Kamel, 2002). Since the Web's commercial explosion in 1995, the growing popularity of e-Commerce technology in Egypt has revolutionized the way computer users shop for goods and services (Gentile, 1999). Therefore, in its struggle to raise its developmental process, Egypt has formulated a national plan demonstrating its vision to prepare itself for a more competitive and global market environment enabled by the information age through investing in the build up of a comprehensive e-Commerce infrastructure. It is estimated that e-Commerce will generate around $5.3 trillion dollars of revenue by 2004, presenting a window of opportunity for developing countries such as Egypt (Kamel, 2002).

4.6.11.3.1 e-Commerce Diffusion in Egypt

In late 1999, there has been a clear interest in Egypt in diffusing e-Commerce among the business community, shown by moving to the Internet to market and promote ideas, products and services. Therefore, it is perceived that it is just a matter of time before

every established and emerging company in Egypt has to move partially into an online, real time business environment (Kamel and Hussein, 2002). There are great opportunities for e-Commerce dissemination in Egypt and it will change the way business is done in the banking and financial sector, where recently banks have shown growing interest in online transactions and in supporting online businesses. However, this is still in the early phases (Kamel and Hussein, 2002).

4.6.11.3.2 e-Commerce Challenges in Egypt

For e-Commerce technology to realize its targeted business and socio-economic development objectives, there are a number of challenges that need to be faced relating to a variety of social, technical, financial and legal factors. With respect to social challenges, there is lack of awareness, training, and trust, resistance to change and the language barrier (Kamel, 2001). Awareness is considered a major deterrent and that includes customer and organizational awareness of the benefits of the Internet.

While comparing mobile services in Egypt to Internet usage, it is clear that the number of mobile phone users is increasing remarkably, which proves that affordability is not the problem behind the relatively low Internet usage. In fact Internet access is less costly and more reliable. Lack of training is also a major obstacle where people are not prepared to handle operations in the cyber environment. This creates confusion for those accustomed to traditional systems when they are introduced to innovative techniques. Lack of trust remains another challenge with respect to electronic payment systems, and in doing business with people never seen or met before (Kamel, 2002).

4.6.11.4 Central Europe

Hessel (1981) notes that Poland benefited from large-scale adoption and acceptance of Western technology through the impact of machinery and equipment during the late 1970s. Hessel points out that Poland's economic and political failures following these initial successes came as a result of the government's refusal to develop and implement far-reaching economic and socio-political changes. Poland did not have the appropriate infrastructure in place to carry forward or sustain the initial economic growth. Many Central and Eastern European countries have not kept abreast of technological innovations. These countries have failed to exploit the benefits associated with **ICTs,** and many of these countries are therefore rethinking their approach towards technology transfer (May, 1994).

4.6.11.5 The Caribbean

Stephenson and Yi (2000) posit that many islands throughout the Caribbean have begun to modernize their telecommunications infrastructure with platforms that are capable of accommodating Internet services and e-Commerce. For developing countries, the focus of technology adoption and acceptance may initially centre around hard technologies. However, to accomplish this, it is first necessary to have the appropriate telecommunications infrastructure in place. Confirming Stephenson and Yi's observations, Samuel, Welch and Haynes (2000) also observed that East Caribbean countries are rebuilding their telecommunications infrastructure so that there is a significant increase in available bandwidth within the local loop. This increase in bandwidth provides access to reliable international/long haul carriers, to support global

e-Commerce activities. Other studies (Samuel et al., 2000) coming out of the Caribbean recognize the importance of technology adoption and acceptance as an integral part of nation building.

In summary, while many empirical studies of technology acceptance have focused on technology adoption as a catalyst for economic and development growth, few studies have focused on the relationship between technology acceptance and the electronic infrastructure or e-Commerce readiness of a country. More studies are needed to examine the relationship between technology acceptance, country characteristics and e-Commerce technology readiness in the country.

4.6.11.6 Lessons from South America

South American governments are recognising the economic value of putting business processes online. Many are migrating their own procurement processes to online platforms in order to cut costs and improve transparency. Governments are creating policies and legislation that support e-Commerce development. As it can be seen in Table 4.12, in Mexico (39th), a law on digital signatures was recently passed. The Mexican government also has an ambitious plan called "e-Mexico" that seeks to narrow the technology gap between the rich and poor and to make online government services more accessible.

In Chile (29th), Latin America's most e-ready market, companies are now eligible to start electronic invoicing. Peru's (47th) government is looking to build an e-Commerce

and e-Business platform for its shipping and transport industries. In Brazil (35th), private groups are proactively working to develop the country's e-markets. Acceptance of the Internet in business transactions is growing, and the Brazilian government was the first in the world to allow corporate tax filing online as it can be seen in Table 4.12.

Table 4.12: e-Readiness in South America

Country	Overall Ranking (of 64)	e-Readiness Score (of 10)
Chile	29	6.35
Brazil	35	5.56
Mexico	39	5.33
Peru	47	4.44

Source: Economist Intelligence Unit e-Readiness Rankings, 2004.

4.6.11.7 Lessons from the Middle East and Africa

Table 4.13 shows that e-Commerce and e-Business development in Africa and the Middle East is only inching forward. Strict government control and over-regulation of service providers is hampering development, particularly in Middle East markets such as Saudi Arabia (48th) as it can be seen in Table 4.13. In Sub-Saharan Africa's most e-ready country, South Africa (32nd), ineffective government policing of the liberalisation process has prevented the introduction of a new telecom carrier to compete against the *de facto* state monopoly (Economic Intelligence Unit, 2004).

Weak infrastructure development and high costs are conspiring to keep connectivity rates low. Furthermore lagging infrastructure and poor business environments inhibit African and Middle Eastern markets. Some countries have seized a niche and worked it into a competitive advantage, such as technology development in Israel, (22nd) and

business service processing in South Africa (Economist Intelligence Unit, 2004). In South Africa (32nd), the government spends US$1.2bn annually on its own **IT** infrastructure, much of it supporting e-Government initiatives.

Table 4.13: e-Readiness in the Middle East and Africa

Country	Overall Ranking (of 64)	e-Readiness Score (of 10)
Israel	22	7.06
South Africa	32	5.79
Turkey	45	4.51
Saudi Arabia	48	4.38
Egypt	51	4.08
Iran	57	3.68
Nigeria	58	3.44
Algeria	61	2.63
Libya	**64**	**2.59**

Source: Economist Intelligence Unit e-Readiness Ranking, 2004; UNCTAD, 2003.

The future of e-Readiness in the Arab region will be determined by telecoms liberalisation policies. Uptake of Internet services has been modest due to the high cost and inadequate coverage of high-speed connections, which can be blamed partly on the lack of market competition. e-Commerce in Algeria (61st) and Libya (64th) are continuing to be hindered by poor telecoms infrastructure, as show in Table 4.13. In Saudi Arabia (48th), and some other Arab states, e-Commerce is still in its earliest stages of development (Economist Intelligence Unit, 2004).

The Arab states suffer from relatively poor telecoms, slow Internet access, and high service prices. In some Arab states, all Internet access is routed through government-monitored services, and censorship is dampening development. Table 4.13 shows e-Readiness in the Middle East and Africa. Countries where governments are most actively involved in putting citizens and businesses online tend to have the necessary infrastructure and supporting services, positive business environments, and money spent. In countries where censorship of traditional media has carried over to the Internet, and where the old telecoms monopolies are determining the rollout of new ICTs, e-Commerce is stifled. On the other hand, governments must be intimately involved. They must push through laws protecting online transactions. They must make the Internet accessible to the public, and support education in Internet skills. They must find ways to cooperate with other countries, and with their citizens, industries, and local and global businesses to ensure that the evolving demands of the digital economy are recognised and met.

4.7 Conclusion

This chapter has discussed a number of issues that should be central to the development of e-Commerce strategies. The chapter's goal was to identify and examine selected key elements of e-Commerce development in Libya and world regional differences from a variety of perspectives. The Libyan government is conscious that technology is more important than ever. The data presented in the chapter indicate that the less developed regions lag far behind their developed counterparts. There are also important disparities between developed and developing countries in the penetration and access to IT, and the quantity and pace of diffusion differ significantly across countries. This chapter examined the status of telecommunication penetration and access, with an emphasis on the digital gap between developed and developing countries. In so doing, the barriers to e-Commerce diffusion, such as in infrastructure, awareness, and the cultural impact on IT access and penetration levels, were also examined.

In the debate on national, regional and global e-Commerce, it is necessary to address the issue of e-Commerce strategies. Therefore, experts are encouraged to introduce into the debates their experiences in designing e-Commerce development as well as identifying the successes and failures of specific policies. This chapter has also discussed and provided clear ideas, lessons and evidence from different parts of the world about the recent phenomena of e-Commerce strategies to promote economic and social development in developed and developing economies. The next chapter will examine some of the literature relevant to the theoretical framework of e-Commerce technology adoption and nine relationships will be proposed for investigation.

End Notes:

[1] Forrester Research (2000) "Emarketplace will lead US business e-commerce to $2.7trillion in 2004", URL: http://www.forrester.com/ER/Press/Release/0,1769,243,FF.html.
[2] "African Information Society Initiative", www.bellanet.org/partners/aisi.
[3] Jensen, M., "African Internet Status," www3.sn.apc.org/Africa/afstate.htm, May 2000.
[4] The countries include: Australia, Bangladesh, Belgium, Brazil, Brunei, Canada, China, Costa Rica, Côte d'Ivoire, Cuba, Egypt, Eritrea, France, Ghana, Guatemala, Haiti, India, Ireland, Jamaica, Japan, Jordan, Republic of Korea, Lebanon, Lithuania, Malawi, Malaysia, Malta, Mauritius, Mexico, Nepal, New Zealand, Nigeria, Norway, Oman, Pakistan, Peru, Philippines, Russia, Scotland (UK), Singapore, South Africa, Sri Lanka, Sweden, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Uruguay, Vietnam, and Zimbabwe.

CHAPTER V

THEORETICAL FRAMEWORK: INFLUENTIAL FACTORS IN ADOPTING AND DEVELOPING E-COMMERCE TECHNOLOGY

5.1 Introduction

The previous chapter examined some of the literature in relation to technological developments in Libya and world regional differences in e-Commerce adoption. This chapter presents a review of the theoretical framework based on the relevant literature showing the influential factors in from previous researches in e-Commerce technology adoption.

The past decade has witnessed an overwhelming increase in the use of Internet technologies, and especially the World Wide Web **(Web)**, for business purposes. This has not only reshaped existing firms but has also created tremendous opportunities for new business paradigms. Business organizations, regardless of their size, have applied Internet technological tools in a wide range of activities under the umbrella of e-Commerce technology.

Business organizations are spending heavily in the hope of getting a competitive edge over their competitors. The manifold increase in the user base, and increases in the total Internet revenue of US$40 billion in goods and services in 1996 to over US$1 trillion at

the end of 2003 (Forrester Research, 2003) has provided endless opportunities for e-Commerce to operate in the global market. Worldwide Internet revenue has increased from US$834 million in 2002 to US$993 million in 2003; an increase of 19% (emrkerter.com, 2003).

Furthermore the rapid development of the telecommunications infrastructure in recent years has provided broad network coverage with high quality and fast transmission. This factor has facilitated the development of business organizations through the use of the Internet, and has presented new trends for firms to contribute strongly to national economies. The development of open standards for the Internet has brought e-Commerce to the doorsteps of organizations. This has also helped in reducing the gap between large and small firms. Business organizations today are using the Internet to attract suppliers and customers, reduce costs, and build relationships with suppliers.

5.1.1 Background

While e-Commerce technology has become an important issue within the growth of the Internet, there have been insufficient empirical studies concerning its adoption. Despite the potential benefits of e-Commerce, studies have shown that e-Commerce has not been adopted as rapidly by organizations, as anticipated (Iacovou et al., 1995). Researchers have noticed this slower rate of adoption in organizations across the globe. This is due to several reasons, such as a lack of financial resources, and a lack of management enthusiasm and support (Poon and Swatman, 1998).

The majority of e-Commerce studies are limited to the US, Canada, and Europe. Comparatively less research has been conducted in Asia, the Middle East, and Africa. However, some studies on e-Commerce technology have been conducted in India (Sharma and Gupta, 2003), Iran (Karimi and Baghaei, 2003) and Mauritius (Kardaras and Karakostas, 2001). Sadly, little information is available about e-Commerce adoption in Libya. Research on e-Commerce adoption in organizations of different sizes is negligible in Libya.

In the past some studies on e-Commerce technology adoption in firms have been conducted in different geographical and cultural environments (Seyal and Rahman, 2003). Giving the ongoing importance of e-Commerce, the present research was undertaken in early 2002 to assess current levels of e-Commerce adoption in **LOGCs** and to develop and test a theoretical framework that predicts the key factors contributing toward e-Commerce adoption.

This study investigates the extent of e-Commerce adoption, along with the factors that predict e-Commerce technology adoption among 30 oil and gas firms in Libya. Several organizational factors, such as organizational culture, organizational readiness and top management support in adopting e-Commerce, along with technological, industry and environmental factors are studied. Factors such as perceived benefits, firm size, organizational culture and government support are believed to be significant predictors of e-Commerce adoption.

e-Commerce is rapidly changing the competitive landscape of many industries, and especially the petroleum sector. Accordingly, there is a growing academic and practical literature on the promising prospect of e-Commerce. However, it has also been observed that business firms do not embrace the idea of online trading with an enthusiasm. Even in the same industrial sector, some firms may be more active in adopting, developing, implementing and promoting e-Commerce than others. To some extent this reflects the nature of e-Commerce, which is a complex innovation. Examining different attitudes and decisions in firms toward e-Commerce technology is, therefore, very important.

Technologically, the Internet represents a technology that consists of a series of correlated yet distinguishable technologies (Prescott and Slyke, 1997). Strategically, e-Commerce represents a source of fundamental change for businesses (Elliot and Loebbecke, 2000). It is, therefore, not surprising that many firms see the adoption of e-Commerce as a risky and uncertain way of doing business. e-Commerce becomes an even more serious challenge for existing firms pursuing effective strategies on the Internet (Evans and Wurster, 1999). The rationale for this study is that e-Commerce, like other innovations, is crucial to a firm's ability to remain competitive. Various frameworks have been proposed to explain organizational decisions to adopt innovation. Influential factors such as managerial, organizational, and environmental variables have been identified at different levels of analysis. Some of these factors are firm size, top management support, organizational readiness, organizational culture,

perceived benefits, competitive pressure, critical mass, government support and national infrastructure.

Some of these factors may have positive effects on the adoption of innovation while the others may have negative effects. Given this complexity, it is noted that an innovation adoption framework should deal with specific characteristics of innovation, and the contexts in which adoption decisions are made (Grover, 1993). Ruppel (1998) suggests that a fuller understanding of adoption and diffusion behaviours with respect to specific innovations may be gained by considering those organizational factors which facilitate the adoption and diffusion process.

Following suggestions about identifying context specific determinants of innovation adoption, the present research investigates a sample of Libyan petroleum companies. Drawing upon both existing theories and the findings from other studies, important contextual factors are identified that distinguish potential supporters and sceptics concerning e-Commerce in the oil and gas industry. In particular, the research examines the influences of environmental, organizational, and managerial factors on firms in adopting and developing e-Commerce technology. Accordingly, the research identifies some antecedents to e-Commerce adoption that are applicable to the oil and gas industry.

The firm's willingness to develop e-Commerce was studied in terms of environmental, organizational, and industry factors, which have been suggested in the literature. The

role of top managers, and relevant decision-making is also stressed in the study. Previous studies have shown that top managers and managerial characteristics are crucial in adoption (Premkumar et al., 1997). These characteristics have also been found to be related to organizational outcomes (Child, 1972; Gupta, 1984). Top managers have more discretion to influence organizational outcomes when the firm operates in an uncertain environment (Hambrick and Finkelstein, 1987).

5.1.2 Insights into Technology Adoption in Firms

The problem for technology development in organizations is that they are fragile. Cragg and King (1993) agree that there are more opportunities for business organizations to adopt IT and have further concluded that firms have new opportunities to obtain competitive advantage by using IT effectively. Some argue that IT is an enabler to achieve organizational goals exclusively in large businesses, due to the huge initial costs of setting up IT. Nowadays, with the declining cost of hardware and software, more business organizations are investing in IT. Cragg and King (1993) further agree that more organizations have now shifted the use of IT from conventional use to strategic use by developing e-Commerce. However, there are several barriers to successful adoption faced by organizations.

5.1.3 Pattern of Business Characteristics

Many researchers such as MacGregor et al. (1998) have suggested that medium sized enterprises have the following characteristics: centralized control, lack of specialist staff, lack of control over the business environment, limited market shares, and

reluctance to take risks. Some other studies (Yap et al., 1992; MacGregor et al., 1998) suggest that many firms are lacking in the necessary expertise and avoid sophisticated technologies. Certain characteristics of firms such as their limited resources, often create important challenges for the development of IT (Raymond and Magnenet, 1982). Thong and Yap (1995a) identified characteristics of the firm and characteristics of new technologies adopted along with the attitudes of managers towards technology. Organizations that are likely to adopt IT will normally have top managers with positive attitudes, and who are innovative and knowledgeable about the development and applications of IT (Thong and Yap, 1995b).

Giving the ongoing importance of e-Commerce technology, it is equally important to determine how to improve the e-Commerce adoption rate in business organizations. There is, therefore, a strong need to conduct more studies of technology adoption, especially in the area of e-Commerce, in different regional economies and work environments. Clearly recognizing the factors affecting adoption would further help practitioners to better implement e-Commerce adoption. The following section provides an overview of the business environment and the technology infrastructure in Libya.

5.1.4 Libyan Business Environment and Technology Infrastructure

Libya is a developing country in Africa with a population of approximately 6 million (Libyan Central Bank, 2004). Previously with an agriculture-based economy, the country has invested considerably in its petroleum in the past three decades. It is only

in the new millennium that the country has begun to devote resources to cope with the digital world. Recently the government has set up several dynamic policies to promote digital opportunities.

These initiatives include: attracting foreign investment in the ICTs and petroleum sectors; setting up new technology-based infrastructure; promoting IT education through training programmes; and a number of other important fundamental steps in creating and nurturing ICT-driven development together with economic initiatives that promise to enhance digital opportunities and accelerate the pace of business and industry growth.

The government of Libya believes that ICTs can contribute to the economy. It wishes to enable people and enterprises to capture economic opportunities by increasing process efficiency, promoting participation in economic activities, and creating more opportunities for employment and business. With the use of ICTs, businesses can reduce their marketing costs and transaction costs, resulting in lower prices for goods and services. With the advent of the WWW, ICTs are creating new ways of delivering products and bringing sellers and buyers together and providing a competitive advantage within business organizations (Seyal et al., 2004). Business organizations in Libya can gain potential benefits from the development of the petroleum industries and the ICTs sector.

5.2 Insights From Other e-Commerce Adopters

This section discusses different insights from various e-Commerce adopters. e-Commerce technology promises many benefits, ranging from reduced costs to better communication. Because of these benefits, e-Commerce has been extensively studied. A review of the existing literature on technology adoption reveals that most early studies have focused primarily on the use of traditional IS/IT applications, implementation, user satisfaction, and success with these systems. However, the reliance of business organizations on Internet technology has shifted research effort towards understanding the adoption of e-Commerce technology.

Lederer et al. (1996), Vogel and Gricar (1998), and Poon and Swatman (1998) have investigated e-Commerce in business organizations. Once again, very few studies have focused on e-Commerce technology in the petroleum business. Generally the work of Poon and Swatman (1995) and Barker et al. (1997) has shown that firms can benefit from e-Commerce, but that certain conditions need to be satisfied to achieve these benefits.

5.2.1 Review of Previous Studies

The earliest e-Commerce studies can be traced back to as early as 1994 (Cronin, 1995). As pointed out, most studies on e-Commerce adoption have been undertaken in western countries. There are relatively fewer studies from Asia, Latin Americas, Africa and Eastern Europe which have examined the adoption of e-Commerce technology. The

majority of research looks at the developed world, which is environmentally, economically, and technologically very different from the developing economies.

Barker (1994) provided one of the first surveys on how business organizations used the Internet for business purposes. Cronin (1995) discussed how e-Commerce technology might change the patterns of competitiveness in doing business. Some researchers have studied the pattern of IT adoption in business organizations (Fink, 1998; Poon, 2000). Other researchers, such as Poon and Swatman (1998) and Chong and Bauer (2000), have studied the various organizational, innovation and environmental factors that contribute toward e-Commerce adoption.

5.2.2 Patterns of IT Usage Among Different Economies

Studies on the adoption of information technology diffusion and usage have been conducted that have highlighted the pattern of IT usage within Bruneian business (Hussain, 1995; Seyal et al., 1999). Seyal et al. (2003) studied e-Commerce technology adoption in 115 Bruneian firms and concluded that the size of the business, perceived benefits and management support remained significant predictors of e-Commerce adoption. Several other studies in Singapore, Malaysia and Indonesia have investigated interorganizational influences in the adoption of technology. Most studies however, did not investigate the entire range of factors and chose only a few to include in their research.

5.2.2.1 Insights from Singaporean Firms

In Singapore, early studies were confined to the business use of the Internet. Soh et al. (1997) studied Internet use among Singaporean business organizations and found that Internet use was slow in Singaporean business firms in the early stages. However, factors such as compatibility and governmental support were significant influences comparative to relative advantages that were not perceived by the respondents as an advantage over current business practices. Similarly, most of the respondents did not perceive that innovation required complex skills for implementation.

Tan and Teo (1998) studied the factors influencing the adoption of the Internet and developed a contingency model of Internet adoption. They used organizational factors (technology policy, top management support), technological factors (relative advantage, compatibility) and environmental factors (information intensity, competitive pressure and government support). They concluded that organizational and technological factors play a significant role in Internet adoption. In another study Teo and Tan (2000) studied factors such as technological, governmental and self-efficacy and found that self-efficacy and governmental support had an impact on Internet adoption within businesses. Utomo and Dodgson (2001) studied factors in IT diffusion within Indonesian firms and found that top managers' level of IT knowledge coupled with favourable attitudes increased the level of IT investment. This study further identified IT strategy as the dominant factors that helped business organizations achieving technological change. This analysis of e-Commerce adoption in Singaporean

business organizations shows the significance of the Internet and e-Commerce technology.

5.2.2.2 Insights From Malaysian Firms

Valida et al. (1994) surveyed business organizations in Malaysia to determine IT utilization, and found that it was strongly influenced by the size, nature and type of business. Sulaiman and Hong (1999) studied business use of the Internet in 80 organizations and concluded that 60% were confined to running daily processes (communications and publishing company information). Only 15% were using the Internet for e-Commerce technology purposes.

The factors affecting non-adoption were size of the firm, business type, ownership and location of the firm. Hayne et al. (1998) concluded that small businesses were more likely to have a homepage compared to medium sized or large business. They also concluded that foreign owned companies were the earliest adopters of e-Commerce technology. Mukti et al. (1999) studied the pattern of website characteristics of 60 firms and found that most business organizations were convinced that having an impressive web page was good enough to inform the world about their existence.

It is evident from the above review of studies in different economies with different business sizes that e-Commerce adoption has produced mixed results in the form of benefits achieved and promises that were not fulfilled due to various organizational impediments. These studies also discussed various factors that have helped in achieving

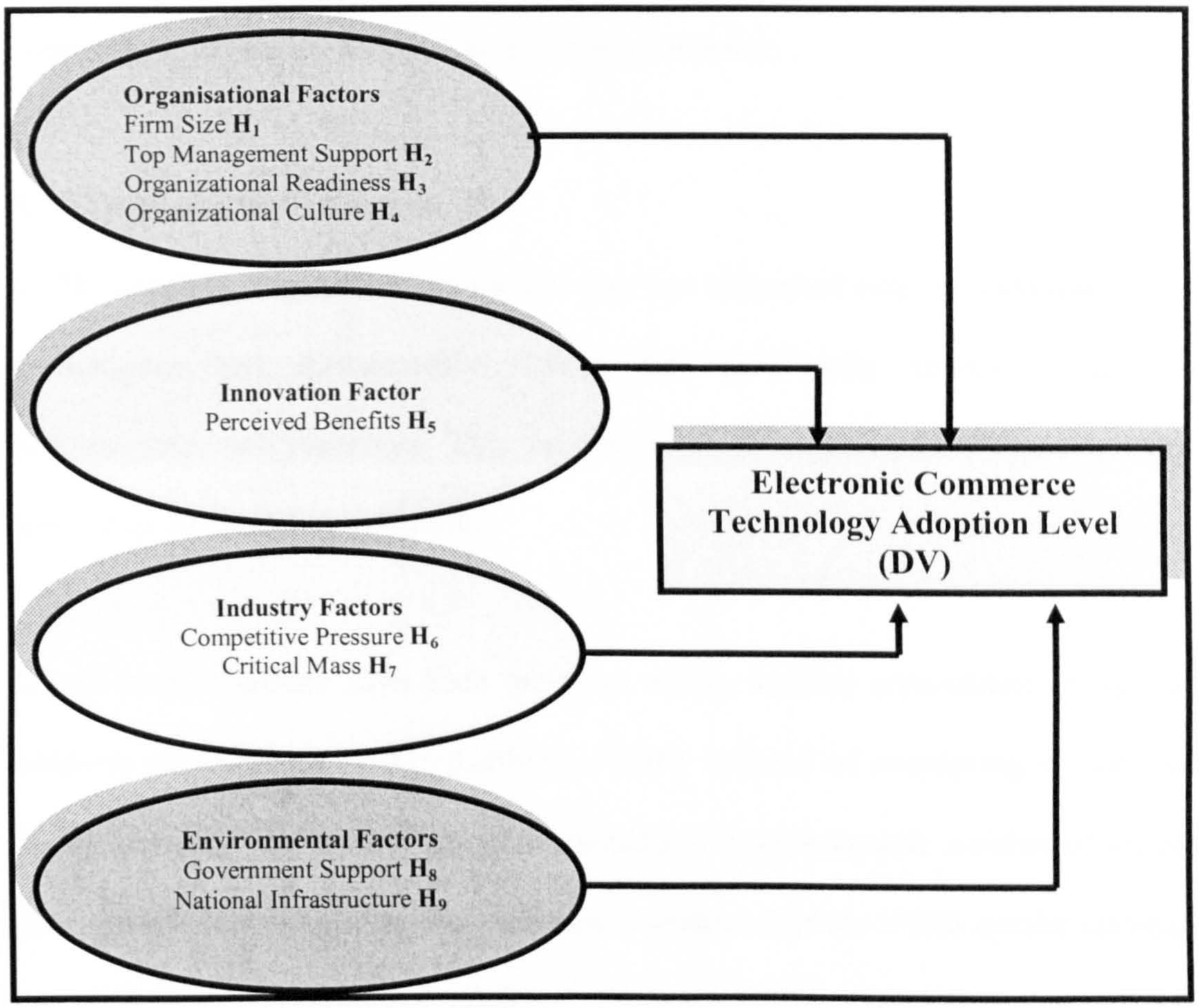
organizational goals. Based upon this reviews, a theoretical framework can be developed which models the various factors that might have a significant contribution to e-Commerce technology adoption.

5.3 Theoretical Framework and Research Variables

This section discusses the theoretical framework and research variables used in this study. The factors identified in the framework are used in the formation of the questionnaire and interview questions for the study. On the basis of existing literature and previous studies on the usage of technology (Seyal et al., 2003; Ling, 2001), a theoretical framework is developed which provides the basis of the present research objectives. This theoretical framework, depicted in Figure 5.1, is a model that relates independent and dependent variables. In this study, e-Commerce adoption level is the dependent variable and there are nine independent variables grouped into four categories. Detailed justification for the inclusion of each independent variable in the framework is given below.

The proposed theoretical framework is rooted in several streams of research investigating organizational characteristics, organization culture, and innovation adoption theory. More importantly, since research studies on e-Commerce adoption have been limited in number and theoretical scope, the present research develops a theoretical framework on the basis of both previous literature and the findings from other studies.

Figure 5.1: Theoretical framework adapted from Ling, C. Y. (2001), Model of Factors Influence of e-Commerce Adoption and Diffusion in business organizations.



Although there are limitations to any theoretical framework, it is still important to see if any of the factors can be used to show the adoption of e-Commerce in the context of this study. Unlike other technological innovations, e-Commerce technology represents a revolutionary business model that requires the adopting firm to radically change its management philosophy and practices. This makes the adoption of e-Commerce a more complex issue for the firm to handle. Internet based e-Commerce applications are often risky and expensive; therefore, the managerial decision concerning adopting e-Commerce early or waiting for the technology to become more established is not trivial

(Santos and Peffers, 1998). On the basis of the prior literature, this study develops a theoretical framework to explain which factors influence a firm in adopting/developing e-Commerce technology in Libyan petroleum industry.

5.3.1 Organizational Factors

In IT adoption, organizational factors play an important role in adoption decisions (Premkumar and Ramamurthy, 1995). For this study several organizational characteristics are examined. This section looks at organizational characteristics in relation to e-Commerce adoption.

Organizational factors have been the most widely studied antecedents of innovation adoption (Damanpour, 1991; Kimberly, 1996). Instead of attempting to construct a "comprehensive" theoretical model containing an unmanageable number of variables, this research focuses on the organizational variables that are worth special attention in the context of e-Commerce adoption. Grover (1993) emphasized that innovation adoption studies need to construct antecedents specific to a single innovation rather than aggregating outcomes across diverse sets of innovations. It is argued here that e-Commerce adoption requires the firm to not only commit financial, technological, and human resources, but also a facilitating strategic context.

5.3.1.1 Firm Size

As Rogers (1995) points out "size is probably a surrogate measure of several dimensions that lead to innovation: total resources, technical expertise of employees,

organizational structure, and so on". Even though large companies that are highly structured may be more resistant to change, big companies also have greater resources available for change; in other words, the size of the firm reflects internal organizational structures and technical factors (De Pietro et al., 1990).

In this study, the influence of internal organizational structure is proposed to be outweighed by other size related factors, such as resources and technical factors, due to the large amount of resources e-Commerce innovation needs and the high technology level it requires. Thus, a positive effect of company size on e-Commerce adoption is anticipated. The bigger a company is, the more products and services they will provide, and the more intensive and extensive information and material flows will be. Therefore, the bigger a company is, the more likely it is that it will adopt e-Commerce technology.

Also, the bigger the company, the more resources it can provide which are necessary for adoption. The number of current employees is used to measure variable company size. Recent research has revealed that organizational size is a strong motivator for e-Commerce adoption. Larger firms are more capable than smaller firms of adopting e-Commerce technologies (Al-Qirim, 2003; Al-Qirim and Corbitt, 2002; Rogers 1995; De Pietro et al., 1990). De Pietro et al. (1990) discussed the context in which innovation takes place as one of the influential factors on the adoption decision.

> *"...Any aggregate index of size (number of employees, and amount of budget, etc.) is correlated with other intraorganizational variables to some degree, but does not reflect directly the degree of vertical hierarchy, the degree of internal complexity, or similar variables, or capture much about the process of internal decision making"* (De Pietro et al., 1990)

Due to its intuitive appeal, size has always been considered one of the company characteristics that impact on a company's adoption decisions. Some empirical studies also have reported that the adoption of e-Commerce technology depends on the size of the business involved, with larger firms more likely to adopt it than smaller ones (Beveren and Thomson, 2002). Hence, this argument leads to the first hypothesis proposed in this study:

H_1: The adoption of e-Commerce technology is positively related to firm size.

5.3.1.2 Top Management Support

Organizational structure is becoming more complex, and with this complexity the focus has shifted to include factors that directly influence the adoption of technology within an organizational context. Among these factors, top management support is a very commonly studied factor. It is further advocated that the success of **IT** within an organization can be determined by considering top management commitment to **IT** in allocating necessary resources (Ang and Pavri, 1994). Thong and Yap (1995a, b) have investigated top managers and **CEO** parameters in their studies and confirmed the importance of this variable.

Fink (1998) concluded that the top management factor could be important for the success of information systems within organizations. Moreover, Tan and Teo (1998) have measured top management support and found it a significant predictor of Internet adoption. In the organizational structure literature, Zaltman, Duncan and Holbek (1973)

found that organizational complexity aided adoption. They defined organizational complexity as the number of occupational specialties among employees.

In this research, the concept of personnel expertise or the necessary technical knowledge for e-Commerce adoption, which is one of the key factors to reduce the knowledge barrier that inhibits diffusion (Fichman and Kemerer, 1997; Turban et al., 2004). Further, the company's current infrastructure level was added as another company characteristic because it is also a necessity for adoption, and its impact on adoption decisions seems inevitable. Based on this reasoning, it is proposed that companies which have the necessary personnel expertise and infrastructure, or who are technologically ready, are more likely to adopt e-Commerce technology. Based upon these arguments, the following hypothesis is therefore proposed:

H_2: Top management support is positively associated with e-Commerce adoption.

5.3.1.3 Technological and Organizational Readiness

e-Commerce technology adoption is a strategic decision that requires both psychological and technological readiness. A well established infrastructure and certain expertise levels help to reduce initial e-Commerce investment, and also reduce the difficulty of adoption by reducing technical training and other procedures (Al-Qirim and Corbitt, 2002). Technology readiness makes e-Commerce adoption more of a one step up behaviour instead of a completely new concept. Although large company size may imply technological readiness, that is not necessarily so.

Further, technology readiness involves all other departments in the company, not just the IT department. Even though the expertise level of IT personnel matters, the general level of e-Commerce knowledge of other personnel plays a more critical role (Al-Qirim and Corbitt, 2002).

A company cannot necessarily require its employees to be competent in e-Commerce technology. It must deal with whatever the general IT expertise level of its employees is. Therefore, technological readiness entails both the company's infrastructure level and the general level of expertise of the company's employees.

A natural outgrowth of technology diffusion is the development of a supportable electronic infrastructure that is able to support and sustain e-Commerce technology. Within the last decade, the business world has witnessed an exceptional growth in the utilization of the Internet. Much of this utilization has been in the form of business transactions. Not only has the Internet facilitated communication between businesses and consumers, and between businesses themselves, it has created a new medium with which to conduct business. This new medium, e-Commerce, is changing relationships in the business world, linking businesses and consumers, and building new business communities (Al-Qirim and Corbitt, 2002).

The successful adoption of e-Commerce requires not only financial commitment but also technical and administrative adaptations in organizations. Case studies have provided evidence that technical issues appear to be the key factor influencing e-

Commerce adoption, especially in its early stages. For example, Elliot and Loebbecke (2000) reported that the initial efforts of a group of Australian organizations' in adopting and implementing smart card systems was focused on the provision of telecommunications based infrastructures in support of Internet oriented services and electronic payment systems.

5.3.1.3.1 IT Resources and Capabilities

Several studies report that **IT** resources were repeatedly mentioned be **CEOs** and top managers as an important factor in e-Commerce development. In general, both the technical base and human skills were emphasized. Therefore, it is suggested that concern about **IT** resources, here defined as a firm's readiness in terms of both technological infrastructure (e.g., computer hardware and software) and human knowledge (e.g., employees' capability to maintain Web sites and complete transactions with the help of computer technologies), might be a determinant of firms' attitude toward e-Commerce technology. Generally speaking, **IT** resources are an enabling base of shared **IT** capabilities that provide the foundation for other business systems. They are:

> *"The base foundation of budgeted for IT capability (both technical and human), shared through the firm in the form of reliable services, and centrally co-ordinated"* (Broadbent, Weill, and Neo, 1999:160).

Researchers of strategic information systems have proposed the concept of **IT** infrastructure capability (Broadbent et al., 1999). **IT** infrastructure refers to not only

sophisticated telecommunication and database facilities (the technical base) but also the human skills and expertise required to operate and update the technical facilities.

5.3.1.3.2 IT Infrastructure Readiness Base

The firm may gain competitive advantage from this combination of human and technical assets because human knowledge embedded in advanced **IT** systems can be seen as a firm-specific resource (Barney, 1991). Obviously, a sufficient **IT** infrastructure provides the base for the firm to catch up with the new developments in **IT**, and hence promotes the use of innovative technologies and strategies (Dewar and Dutton, 1986). **IT** infrastructure has been found to have positive effect on organizational innovation and business process change (e.g., Antonelli, 1985; Davidson and Movizzo, 1996; Johnston and Carrico, 1988).

It is important to understand the concept of **IT** resources in terms of both the technological and human endowments of the firm. McGowan (1998) examined 235 U.S. firms adopting **EDI** and identified three organizational learning factors (technical expertise, level of **EDI** knowledge, and training availability) that influenced the extent of **EDI** implementation. Note that all these learning factors reflected the match between technology and human resource management practices. Many other studies have indicated that, in addition to equipment and software, the technological expertise of both managers and employees plays a significant role in innovation adoption (Attewell, 1992; Rai and Howard, 1993). Again, it is argued here that firms that have established a

strong IT infrastructure readiness base would be more confident in venturing into e-Commerce. So, based on these arguments, the following hypothesis is proposed:

H_3: The adoption of e-Commerce is positively related to organizational readiness.

5.3.1.4 Organizational Culture

Over the past 20 years, Hofstede's (1991) theory of the specific patterns in the values and beliefs that constitute culture has gained significant prominence. One of the most important aspects of Hofstede's work is that he successfully linked his dimensions of culture to management practice. Hofstede describes the central concept of an organizational culture as having a coherent set of beliefs with a set of shared core values.

Subsequent researchers (Schein, 1990; Hussain, 1995) have shown that an organization's culture affects the way it behaves, its values and its basic underlying assumptions about technology diffusion. It is evident that the culture of an organization either facilitates or inhibits the process of technology diffusion. Schein (1990) studied organizational culture and concluded that an analysis of organizational culture helps in developing favourable and unfavourable processes of technology diffusion. He further suggested that for unfavourable cultures, organizations should go through cultural change to adjust technology diffusion.

Hussain (1995) studied cross-cultural technology transfer in Brunei, and suggested the importance of organizational culture as a pre-requisite for technology diffusion and the

management of technology transfer. He suggested a supportive type of corporate culture to achieve success in technology transfer. Veiga et al. (2001) and Ciganek et al. (2003) have discussed the role of culture in the Technology Acceptance Model **(TAM)** of Davis (1989) and in the context of **TAM** with knowledge management systems, and concluded that culturally induced beliefs influence the core variables of the **TAM.**

The use of technology is said to be more effective when it empowers individuals to use information and decide for themselves how to use the technology in support of their duties. However, Harris (1999) studied this variable while researching attitudes of end users but could not find the correlation between support of organizational culture with the attitudes of the end users. Organizational culture has been found to be an important factor in determining e-Commerce technology adoption. The previous findings of Terpsta and David (1991) and Hussain (1995) and Seyal et al. (2004) reinforce the argument about the influence of organizational culture on e-Commerce technology adoption. Seyal et al. (2003) used this variable in earlier work on business organizations within different geographical settings and did not get any support for this organizational culture variable and e-Commerce adoption level. However, the relative importance of this variable in interorganizational decision-making leads to this variable being considered important within different geographical and technological environments. The following hypothesis is proposed:

H_4: The adoption of e-Commerce is positively related to organizational culture.

5.3.1.5 Perceived Benefits

According to Moore and Benbast (1991), the primary characteristics of an innovation are intrinsic to the innovation independent of their perception by potential adopters. The behaviour of individuals, or organizations, is predicted by how they perceive these attributes. Because different adopters might perceive characteristics in different ways, their eventual behaviour might differ (Moore and Benbast, 1991). Hence, the perceived benefits of e-Commerce innovation should be used as a research variable.

5.3.1.5.1 Relative Advantage

Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes (Rogers, 1995). Rogers also provided of relative advantage sub-dimension: the degree of economic profitability, low initial cost, social prestige, and savings in time and effort. This research focuses on those factors relevant to e-Commerce technology adoption.

5.3.1.5.2 Complexity

Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use (Rogers, 1995). Although its developers have tried hard to make e-Commerce technology easy to use, different companies have different perceptions about whether e-Commerce is easy for their employees to understand, accept and use. In addition to the technical aspects of e-Commerce technology solutions, new ways of thinking, doing business, and coordination among many parties are necessary internally and externally.

5.3.1.5.3 Compatibility

According to Rogers (1995), compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experience, and needs of potential adopters. An innovation can be compatible or incompatible with **(1)** social/cultural values, **(2)** previously-introduced ideas, and **(3)** customer needs for the innovation. Study of these social and cultural values is important. Even though e-Commerce technology is very different from previous **IT** technology in terms of the level of technology and the scope of change, it is still based on previous **IT** and Internet based infrastructure, including electronic networks, and databases. From the technical point of view, whether e-Commerce technology is compatible with existing **IT** systems is very important in the adoption decision-making process.

Rogers (1995) identified perceived characteristics that might affect the rate of diffusion of any innovation: *relative advantage*, *compatibility*, and *complexity*. Rogers also established certain relationships between each characteristics and the rate of diffusion. In Tornatzky and Klein's (1982) meta-analysis of innovation characteristic and adoption, they identified ten frequently-studied innovation characteristics, among which only three variables, relative advantage, compatibility, and complexity, were consistently found to be significant. Hence, the perceived benefits are included in e-Commerce adoption frameworks (Sheth, 1981; Ling, 2001).

Perceived benefits are found to be an important predictor for business organizations. The reason for the relative importance of this variable in firms is due to better

management structure and policies. The management of firms consider the perceived benefits as an important pre-requisite to decide on technology adoption. If the benefits are not thought viable they might not decide to adopt the technology. This might be due to the fact that in business organizations the decision making process is always short term (Fink, 1998).

The organizations may pay more attention to viable benefits. Perceived benefits can act as motivators to encourage the adoption of an innovation because direct benefits are more viable and are easier to measure. Moore and Benbasat (1996) and Chwelos et al. (2001) found that perceived benefits are expected to be influential determinants of technology usage.

The adoption of e-Commerce is largely based on perceived benefits. Poon and Swatman (1995) found that perceived benefits are the key reason why organizations adopt and continue to use Internet technology. Perceived benefits are defined by a set of anticipated advantages that innovation can provide to the organization. These benefits can be direct or indirect, as mentioned by Chwelos et al. (2001).

Direct benefits include operational cost savings and improved organizational functioning. On the other hand, indirect benefits are opportunities that are outcomes of the use of innovation, such as improved business services. A numbers of researchers in the technological innovation research field have studied this variable (Premkumar and Ramamurthy, 1995). Moore and Benbasat (1996) have concluded that the compatibility

of the innovation with the existing set of values and perceived benefits were influential determinants of technology usage. Chwelos et al. (2001) have developed an **EDI** adoption model and concluded, in addition to other findings, that higher perceived benefits would lead to greater intent to adopt information technology. Based upon this factor, the following hypothesis is proposed:

H_5: The adoption of e-Commerce is positively related to the perceived benefits.

5.3.1.6 Perceived Competitive Pressure

Firms within the same industry may impose pressure on the firm to turn to e-Commerce technology (Banerjee and Golhar, 1994). This pressure is defined as competitive pressure - pressure on firms arising from the threat of lost competitive advantage (Abrahamson et al., 1990). Competition exerts strong pressure on managers to search for alternatives to current strategies. Previous research has repeatedly demonstrated that competitive pressure has a bearing on the firm's intention to turn to innovations (Grover, 1993; Iacovou et al., 1995; Johnson et al., 1992). Abrahamson et. al (1990) suggested that organizations would join other firms due to the increasing competitive pressure reflected in the increasing number of adopters of a certain innovation. Competitive pressure pushes firms to imitate other firms because they wish to avoid the risk of falling behind.

The effect of competitive pressure on innovation adoption is even stronger if the firm's managers perceive the innovation as an uncertain investment (O'Neil, Pouder, and Buchloltz, 1998). Johnson et al. (1992) found that, in the transportation industry, competitive pressures were the most frequently mentioned reason for adopting **EDI**. In

highly competitive industries, firm managers are constantly faced with pressures from peer firms. Such pressures have an influence on the company's decision to adopt IT (Robertson et al., 1986).

Previous authors support the significance of this variable in new technology diffusion (Pennings et al., 1992). There is a constant need for firms to keep up with technological advances and strategic changes and to adopt them to gain competitive intensity because the Internet gives firms from other industries chances to invade the traditional businesses of the firms. As the competitive arena has expanded into the virtual world, it would be a rational response on the part of a firm's managers to start online business. The criterion becomes "Everyone is doing e-Commerce technology: so must we." Therefore, the following hypothesis is suggested:

H_6: The adoption of e-Commerce is positively related to the firm's competitive pressure.

5.3.1.7 Critical Mass

Critical mass is an important factor for any company trying to adopt new technology to its fullest potential. For example, the usefulness of a personal computer depends on the number of people who use computers and the range of available software. This is also true for e-Commerce technology.

Another significant e-Commerce problem relates to the lack of a critical mass of suppliers and consumers that are e-Commerce enabled and willing to conduct transaction online. The problem of critical mass has been identified by many firms.

Until a critical mass of suppliers and customers are actively using e-Commerce across the supply chain, the potential benefits from e-Commerce is limited (Chau and Turner, 2002). Although technology plays a very important role in e-Commerce, the most important element in the electronic market is still people. An electronic market without sizeable numbers of buyers is not going to succeed. So critical mass is important.

One of the key elements of technology adoption is the influence on organizations of suppliers willing to adopt e-Commerce. But the evidence supports the idea that supplier influence has very little leverage in getting organizations to use some form of web communications. The critical mass of customers and suppliers is an important factor for Libyan petroleum firms which primarily focus their e-Commerce activities at the **B2B** or **B2C** level of e-Commerce. Thus, the following hypothesis is proposed:

H_7: The adoption of e-Commerce is positively related to critical mass.

5.3.1.8 Government Support and National Infrastructure

The impact of government policies and initiatives has been shown to have direct and indirect effects of stimulating the supply of information that produces faster technology. For many organizations, governments have been a source of funding infrastructure (Kettinger, 1994). This study investigates the government's involvement in and support of e-Commerce adoption in **LOGCs**. By establishing a governmental body for information technology and telecommunications, the government of Libya has shown its commitment in providing a positive leadership role in developing the infrastructure to digitise the economy.

The government is in a prime position to directly support those businesses engaging in Internet and e-Commerce technology but also the **ICT** industry plays an essential role in providing services to companies requiring e-Commerce skills and services. The government needs to promote and educate the value of e-Commerce to those companies that are hesitant to incorporate e-Commerce within their businesses (Chau, and Turner, 2002). The influence of government can have a profound impact on firms implementing e-Commerce technology. The government and industry have the power to formulate policies to promote the participation of businesses in adopting e-Commerce technology.

Previous researchers have studied the relative importance of government support augmenting firms' decisions to adopt new technology. Because of its importance, this variable is included in this study. Government incentives and support have been found to be significant in influencing e-Commerce. The greater government incentives as perceived by an organization, the higher is the likelihood of an organization adopting e-Commerce. This is mainly due to the government's policies to develop and promote e-Commerce within the **LOGCs.**

Several researchers in recent years have studied the government's role. Ang and Pavri (1994) found that direct interventions of governments could be considered important in promoting technological innovation, although the degree of influence on firms may vary between countries. Seah and Fjermestad (1997) emphasized that both government and private sector play a vital role in supporting the e-Commerce framework.

Papazafeiropoulou and Pouloudi (2000) argued that government should recognize the unique qualities of the Internet and new e-Commerce environments and should treat the different groups of stakeholders differently according to their specific need.

In their study of **IT** diffusion among Indonesian firms Utomo and Dodgson (2001) further confirmed that government can play an effective role as facilitator in providing assistance to firms that have limited **IT** resources. In several Singaporean based studies, Yap et al. (1994) examined the impact of a government incentive programme on **IT** in 40 business organizations. The evidence showed that governmental incentives, in the form of economic, financial and technological support, lowered barriers to **IT** adoption. A part from environmental factors, other factors that drive technology adoption in the external environment includes national factors. Given the ongoing rapid globalisation of businesses, there is a need to learn how adoption theory applies in other cultures around the world.

The level of national infrastructure and government support are crucial factors in the adoption of e-Commerce. While a nation's infrastructure is defined by its basic communications and transport capacity, many governments have been the source of funding infrastructure projects (Kettinger, 1994). The impact of government policies has direct and indirect effects on the supply of information, which produces faster technology diffusion (Stonemen and David, 1986). In addition, as computers and

telecommunications technology have progressed, many governments are now refocusing their attention from traditional infrastructure development to electronic communications (Joshi et al., 1991).

Goth (1995) suggested that governments could play a leadership role in the diffusion of innovation. Tan and Teo (1998) and Teo and Tan (2000) have discussed the role of government and its support for Internet adoption in their studies. Recently, Scupola (2003) showed that firms desire governmental intervention both in terms of influence and regulation, and such intervention should concentrate on knowledge deployment, subsidies and mobilization. Based upon these arguments the following two hypothesises are proposed:

H_8: Government support is positively associated with e-Commerce adoption.

H_9: National Infrastructure is positively associated with e-Commerce adoption.

5.4 Conclusion

The chapter investigates e-Commerce technology adoption factors proposed in the theoretical framework. The e-Commerce adoption literature has identified e-Commerce adoption factor groups such as organization, innovation, industry and environmental factors which influence the level of e-Commerce adoption; although there are several limitations to this theoretical framework. This chapter has reviewed the theoretical framework literature showing the influential factors for adopting and developing e-Commerce technology. It also investigated the extent of e-Commerce adoption along with the factors that predict e-Commerce among **LOGCs**.

An in depth analysis of the e-Commerce adoption factors in different economies has been given. This has provided insights into the e-Commerce adoption situation in different small, medium and large business organizations. The present research therefore has both theoretical and practical significance. Theoretically, it can provide primary evidence about the typical characteristics of organizations and potential adopters. In a sense the current research contributes to the innovation by highlighting the significance of different factors in developing e-Commerce. In practical, the theoretical framework can help firms to boost their e-Commerce adoption or, conversely to find out what has hindered and inhibited the development of e-Commerce technology in their firms. In conclusion, this chapter has proposed an e-Commerce adoption framework with nine hypotheses to be confirmed or rejected. These will be tested within the **LOGCs** in chapter **VI**. The following chapter discusses and describes the methodology and research design, and examines the instrument used to collect the empirical data for this study.

CHAPTER VI

METHODOLOGY

6.1 Introduction

This research investigates e-Commerce adoption among **LOGCs**. The study provides insights into the perceptions of the Internet and e-Commerce in Libyan petroleum companies that are developing or will develop e-Commerce applications.

The oil and gas industry has always been considered to be low technology, which leads to the false impression that petroleum companies still do not need advanced technology in today's business environment. Thus, the theoretical framework for e-Commerce adoption can assist Libyan petroleum companies that are considering or currently conducting their businesses using the Internet. This study thus attempts to provide an understanding of the Internet and e-Commerce technology in Libya, and its purpose is to identify factors that determine the adoption of e-Commerce technology within **LOGCs.**

6.1.1 Research Question

One main research question is asked in this study: to identify the factors that influence the adoption and development of e-Commerce in **LOGCs**. The objectives can be translated into the following question:

What factors determine the adoption and development of e-Commerce technology in Libyan oil and gas companies?

This study aims to answer the research question based on nine hypothesises. The study provides insights into the adoption of the Internet and e-Commerce in Libyan petroleum companies. The recommendation made in this research may prove invaluable to Libyan petroleum companies when adopting and developing e-Commerce technology.

6.1.2 Research Hypotheses

This research tests the following hypotheses:

H_1: The adoption of e-Commerce technology is positively related to firm size.
H_2: The adoption of e-Commerce is positively related to top management support.
H_3: The adoption of e-Commerce is positively related to organizational readiness.
H_4: The adoption of e-Commerce is positively related to organizational culture.
H_5: The adoption of e-Commerce s positively related to the perceived benefits.
H_6: The adoption of e-Commerce is positively related to competitive pressure.
H_7: The adoption of e-Commerce is positively related to critical mass.
H_8: The adoption of e-Commerce is positively related to government support.
H_9: The adoption of e-Commerce is positively related to national infrastructure.

In order to achieve the research objectives, the following must be accomplished:

- To understand the factors behind the adoption of e-Commerce in **LOGCs**, and to develop a framework of e-Commerce adoption that will assist Libyan petroleum companies considering or currently conducting their businesses using the Internet.
- To gather data related to the characteristics of **LOGCs**, and to examine and analyse of data related to the Libyan economy.
- To critically analyse and evaluate the conclusions drawn and to suggest policy recommendations for the Libyan petroleum industry for adopting e-Commerce technology.

6.1.3 Justification and Significance of the Study

This study is justified by its importance in several areas. First of all, the e-Commerce research area has attracted attention from many researchers. However, very few researchers have looked at the petroleum industry and e-Commerce adoption in developing economies. Secondly, to expand research relevant to e-Commerce adoption from an academic perspective angle and thirdly, to examine the relationship between e-Commerce adoption level and influential factors within the context of **LOGCs**. The present research is looking solely at the **LOGCs**, which are contributing to the Libyan national economy.

This present research ascertains the prospects of the development of e-Commerce technology in developing economies such as Libya. Another justification for the study

is that Libya is in the process of developing and enhancing its telecommunications which will have an affect on the economic and industrial development in Libya. Finally, this study sheds light on attitudes and strategies, so that managers can develop more effective policies that improve e-Commerce adoption and development. The practical implications of the investigation in this area are vast and require additional exploration. However, the body of literature that currently exists in the area is relatively small. This is an area that has yet to be adequately examined. This study, therefore, extends that body of literature and knowledge by examining the level of e-Commerce adoption and usage among **LOGCs** in Libya.

6.1.4 Scope and Limitations of the Study

This study was conducted within the Libyan oil and gas industry, and so the results should not be applied to other industries. The sample for this study was selected from **LOGCs**, and the findings cannot be generalized without caution. This study was conducted at a fixed point in time and only provides a snapshot of e-Commerce adoption at this particular stage.

This study focused on the relationships between selected factors of e-Commerce adoption and e-Commerce adoption level in **LOGCs**. The limitations associated with this study can be summarised as follow:. Firstly, the data was collected using questionnaires and face to face interviews with selected managers of **LOGCs** because it was considered that these companies were more likely than other industries to have Internet capabilities and e-Commerce usage and acceptance. Accordingly no attempts

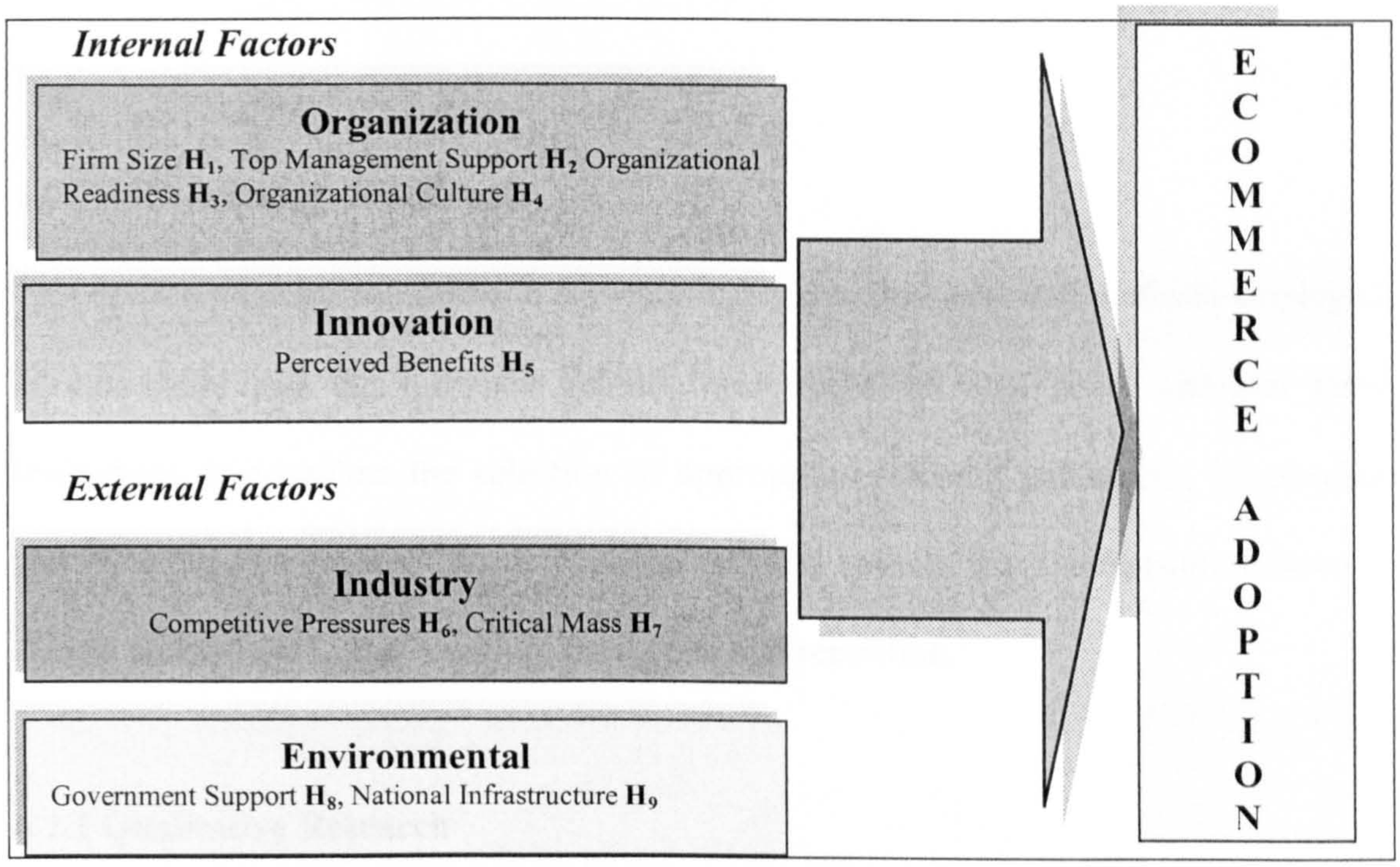
should be made to apply the results to other industries in Libya or in any other countries. Another limitation comes from the constantly changing stages of e-Commerce innovation as a whole in the society. This study only examines e-Commerce adoption at a specific time, and it does not allow other influencing factors to be taken into account. This is important because the nature of the Libyan petroleum environment changes constantly.

6.1.5 Theoretical Framework for e-Commerce Adoption

It is believed that the Internet will eventually be an extremely important vehicle for commercial online trading for **LOGCs**. To date, however, these companies have been very slow to adopt e-Commerce technology. To build an e-Commerce adoption theoretical framework, several factors that influence the adoption need to be identified. In order to successfully identify the factors, managers of Libyan petroleum companies were selected for interview.

This study seeks to explain e-Commerce adoption by examining the factors that may be associated with e-Commerce within Libyan petroleum companies. There are several internal and external factors which have a great influence on e-Commerce adoption by business organizations. The internal factor consists of **organization and innovation factors** and the external factors include **industry** and **environmental factors.** All of these factors are relevant in helping to facilitate or inhibit the adoption of e-Commerce technology. Figure 6.1 shows the proposed e-Commerce adoption framework.

Figure 6.1: The Propose of e-Commerce Technology Adoption Framework for **LOGCs** adapted and modified from Ling, (2001), Model of Factors Influences of Electronic Commerce Adoption and Diffusion.



The theoretical framework consists of one dependent variable and nine independent variables. Although there are limitations to the theoretical framework, it is still important to see if any of these factors can be used to show the adoption of e-Commerce in the context of this study. The factors identified in this framework are used in the formation of the questionnaire and interview questions for the study.

It is argued that e-Commerce technology has technical elements similar to other **IT** innovations, but that e-Commerce has its own interorganizational features that differ from other types of information technology. It is also argued that e-Commerce needs specific study because it is unique and is relevant to the diffusion of innovation theory.

"*Diffusion is the process during which an innovation is communicated through certain channels over time to any members of a social system"* (Rogers, 1983) *"Adoption is a decision to make full use of an innovation as the best course of action"* (Rogers, 1995)

6.2 Methodology Rationale

This section attempts to outline in an analytical manner the research methods employed in this study and the rationale behind their usage, as well as to consider their limitations. It considers the selection of appropriate research techniques. Employing and adhering to a strict set of methodological rules ensures that the research follows a clearly defined path, thus avoiding omissions and repetition.

6.2.1 Qualitative Research

Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena. Examples of qualitative methods are action research and case study research. Qualitative data sources include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions (Bryman, 2001). Qualitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live.

The two general methods of approaching qualitative research are the 'deductive' approach (moving from the general to the specific) and the 'inductive' approach (moving from the specific to the general). According to Cooper/Emory (1995) to

induce is *"To draw a conclusion from one or more particular facts or pieces of evidence"*. When using an inductive approach, the researcher starts out by examining reality and identifying a problem.

6.2.1.1 The Deductive Approach

This includes the development and verification of a theory and is often thought of as scientific research. Bryman (2001) describes the characteristic stages of the logical process of deduction.

(a) Theory

(b) Hypothesis

(c) Data Collection

(d) Findings

(e) Hypotheses confirmed or rejected

(f) Revision of theory

Robson (1993) compiled a comprehensive list of these characteristics. The deductive approach is usually employed in the search to explain causal relationships and involves the development of a hypothesis. In some cases quantitative data are used to test the hypothesis. The methodology followed under such an approach is highly structured, and it facilitates replication and ensures reliability. It is also characterised by 'reductionism' – i.e. the questions sought are reduced to the simplest possible elements for testing.

In the deductive approach the researcher generates hypotheses from a particular theoretical framework and then tests these by observing reality. The goal is to either reject or confirm the hypothesis. The deductive approach calls for a strong theoretical element in the research. The deductive approach is more associated with objectivism and positivism, while the inductive approach is more associated with phenomenology, subjectivism and anti-positivism.

6.2.1.2 The Inductive Approach

Research using an inductive approach is particularly concerned with *the context within which the events are taking place.* As evidence is amassed, the cases that do not agree with the existing framework are evaluated and the framework expanded to accommodate them (Wiersma, 1995). In other words, theory follows the data rather than the other way round. This approach has been developed within the social sciences because it is believed that it is not possible to identify causal links without understanding the ways in which human beings interpret their social surroundings. In contrast with the deductive approach, which is confined to the testing of a single theory, the inductive approach has the advantage of proposing alternative theories.

6.3 Research Methods

Having presented the purpose, objectives, limitations, hypothsises, and research question, the methodology of the study is now described. The first step in conducting primary research is to clarify the exact nature of the problem, which involves identifying issues that are relevant to e-Commerce adoption with a focus on the Libyan

petroleum industry. This study conducts exploratory and explanatory research to determine if the factors proposed in the theoretical framework make key contributions to e-Commerce adoption. The data collection process involves one-to-one conversations with top managers and policy makers in various decision-formulating bodies of the Libyan oil and gas industry.

A questionnaire was prepared to cover issues relevant to e-Commerce adoption and how these issues may affect **LOGCs**. The selection is from the oil and gas sector as a focus of the research. The **LOGCs** selected may or may not have been involved with Internet and e-Commerce activities. Conducting a survey with a sample size of the Libyan oil companies allowed the testing of the theoretical e-Commerce model. The use of questionnaires aimed to capture the information reflecting the perceptions of these adopting e-Commerce in their organizations. In order to gather further information a further examination of **LOGCs** was conducted. This study also includes interviews with key decision makers within selected oil and gas companies in order to confirm the validity of the theoretical e-Commerce framework and to investigate the adoption/development process in some depth.

The general purpose of the research is to discover valuable information and to structure that information, in order to conduct a thorough analysis. Research can be conducted with many different purposes, using a wide variety of methods. In order to decide which methods to use, it is beneficial to categorize the different types of techniques and for what sort of research they are most appropriate. When conducting research, one can

chose between exploratory and conclusive research designs, or a combination of the two. Zikmund (1994) stated that conclusive research could be further divided into descriptive and causal types. The purpose of exploratory research is to investigate a specific problem. Reynolds (1980) mentioned that research is designed to allow an investigator to just look around with respect to a problem, the aim being to develop ideas. Often, exploratory research might help to clarify a problem and identify the information needed for future research. As the name implies, an exploratory approach is often used when the knowledge on the topic and prior research is very limited (Zikmund, 1994).

6.3.1 Exploratory Research

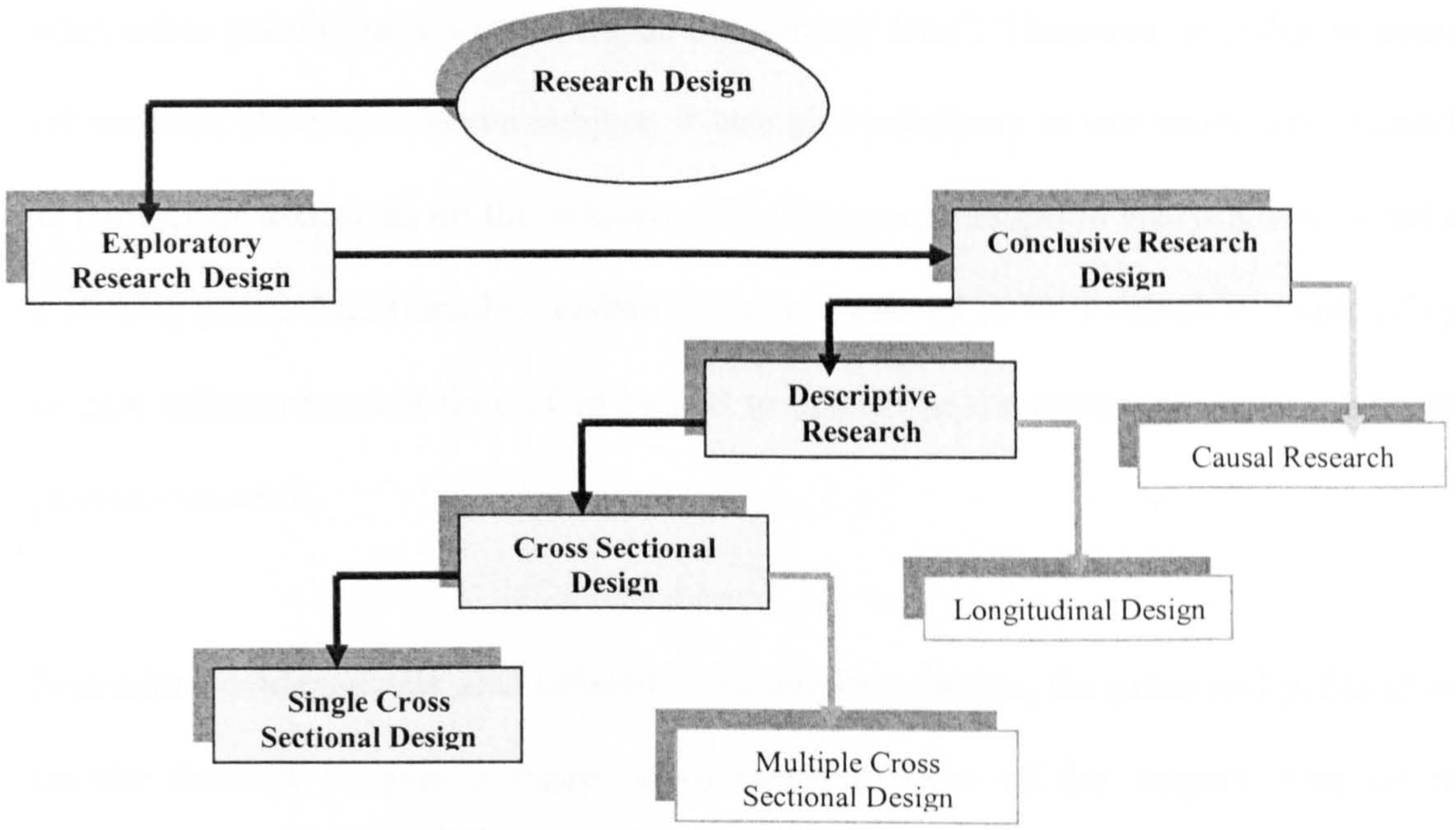
In explorative studies the problem is hard to define and it is difficult to decide on the choice of method, such as interviews or surveys. Exploratory studies are often followed by descriptive studies in order to further examine the results from the initial research.

6.3.2 Descriptive Research

The objective of descriptive research is to develop descriptions or patterns that are identified from exploratory research. Reynolds (1980) mentioned that this could be done when the problem is identified. Descriptive research is usually conducted when the researcher knows what he/she wants to examine without knowing the answers. Many different kinds of statistical methods are used for this type of research (Zikmund, 1994).

6.3.2.1 Classification of Research Designs

Figure 6.3.2.1 Classifications of Research Designs



There are a number of different techniques used when conducting research. The ones most frequently used for descriptive research are surveys and case studies. However, many other techniques are available with different features and purposes. When deciding on the research technique to use, the survey, interview and case study techniques seemed plausible, and for that reason those techniques were considered.

In Yin (1994) it is stated that "Who", "Where" and "What" questions are likely to favour survey strategies. In contrast, "How" and "Why" questions are more explanatory and likely to lead to the use of case studies. The deductive approach was chosen to observe the research a problem more thoroughly.

6.3.3 Investigation of Secondary Data

According to Bell (1993), "An investigation, whatever the scale, will involve reading what other people have written about the subject area". Therefore in order to obtain information about the chosen subject, it was also necessary to use secondary research. A number of textbooks on the subjects of e-Commerce adoption analysis were used as a starting point. Additionally, academic journals proved to be a valuable source of up-to-date information and they often helped to determine the choice of questions for the primary research.

Secondary evidence was also utilised from working papers, the press and publications on the Internet to gain a more comprehensive view of the subject. One of the advantages of secondary data is that it enables the researcher to build upon the experience of numerous other studies, thus maximising the possibility of original findings. According to Saunders (1997), using secondary data is extremely useful for the following reasons:

- Secondary sources help to avoid repeating work which may be previously documented. The originality of the research aims and findings can only be ensured by establishing the extent to which this is possible.
- It is often not economically feasible to collect data from primary sources and secondary sources, may be preferred even if they compromise the research findings.
- Re-analysing secondary data can also lead to unforeseen or unexpected new discoveries.

However, at the same time, the challenges of integrity and cohesiveness arise, as sources must be selected that are reliable and it must be determined whether or not the assumptions of studies used are fundamentally compatible to those of the present study (Bell, 1993). Drawing heavily upon secondary sources, may have the following implications:

- Some sources may be unreliable; special care should be taken to selectively utilise reputable sources, where possible subject to peer review.
- Since they are based on the work of other researchers, their assumptions and conclusions may not be valid in the context of the present study.
- Some information is outdated.
- The originality of the research is compromised simply due to the fact that many of the assumptions and predispositions of other researchers may be irrelevant to the context of the present study and may lead to predetermined conclusions.

It is important, therefore, that a careful balance between utilising useful information and maintaining the integrity of the project is achieved. The challenge is to adopt meaningful knowledge that will add to the content and assist the validity of the study while avoiding being influenced or biased by the styles of other studies. Every effort has been taken in the present study to adhere to these principles, which were made integral to the research philosophy (Saunders, 1997).

6.3.4 Primary Data

The obvious advantage of using primary data is that they constitute an up-to-date account of the situation in the area of interest. Primary data can also be selected to best suit the needs of the research and their collection often adds to knowledge by revealing concepts and relationships which have not been observed before. Thus, this ensures the originality of a research project's findings.

Primary data are usually collected by means of questionnaires or case studies. Its purpose is to validate previous assumptions and, at the same time, seek new data on popular perceptions, personal experiences and conceptual relationships. A case study is often thought of as the development of detailed knowledge about a specific case or a small number of related cases (Robson, 1993). A case study is also known as an attempt to understand the 'whole' by looking into one of its 'parts'. It allows the researcher to gain an understanding of the context of the research and the processes taking place. One of the major shortcomings of primary data resulting from questionnaires is that structured questions may imply or 'direct' the respondents to select certain answers and therefore produce the results that the researcher is expecting. Particularly when quantitative data is sought, primary research is limited in flexibility and in the amount of input the respondents are allowed to make.

6.3.5 Quality Research Measurement

Whichever design is chosen for the research, the investigator has to maximise the quality of the design by ensuring validity, reliability, and practicality (Cooper and

Emory, 1995). Validity is said to be the most important, since a method can be reliable without being valid, but not the other way around (Cooper and Emory, 1995). Practicality is concerned with measures such as economy and convenience, which have to some extent influenced the chosen path of this research. Validity and reliability are explained below.

6.3.5.1 Validity

This is often divided into external and internal validity (Cooper and Emory, 1995). External validity can be described as "establishing the domain to which a study's findings can be generalized" (Yin, 1994). Internal validity is described as the instrument's ability to measure what it is intended to measure (Cooper and Emory, 1995). The key to external validity is how the sample used in the survey was chosen and to what degree it can be generalized to the population as a whole. Also, the response rate of the survey is considered vital. Internal validity is further divided into content and construct validity. Content validity is achieved if the topic under study is adequately covered. Feedback from respondents in this study has led to confidence that its content validity is high. Construct validity answers questions concerning "what accounts for the variance in the measure. When examining construct validity, one attempts to identify the underlying constructs being measured and determine how well the test represents them (Cooper and Emory, 1995).

6.3.5.2 Reliability

The main focus of reliability is to minimise errors and biases in the study (Yin, 1994). Reliability can in part be achieved by repeatability, in demonstrating that another researcher would achieve the same results by repeating the operations of the study such as the data collection procedures (Yin, 1994). There is no way to guarantee reliability. One way to make repeatability of the research possible is to provide a maximum of transparency. This can be achieved by displaying all of the information that has been used to come to the conclusions in the study, and to describe thoroughly how the research was conducted.

6.4 Research Questionnaire

The research questionnaire consisted of four sections. The first section contained instructions. It also sought information on the company and its background details and organizational characteristics. The second section addressed the current and future planned usage of Internet applications, e-Commerce adoption and **ICTs** in general. The third section dealt with the manager's opinions, attitudes towards the Internet and e-Commerce adoption in the industry and its business environment. The fourth section addressed the organisation's management philosophy regarding the development of e-Commerce adoption, policy initiatives and the future of e-Commerce in their firms. The questionnaire was delivered to 30 **LOGCs.** A good response rate was achieved. Most the questionnaire items were structured so as to gain five-point Likert scale responses.

6.4.1 Design

The research adopted a cross-sectional survey design. The questionnaire was delivered in many ways, such as in person, sent by fax, email, and by conventional mail. A list of firms belonging to the Libyan oil and gas industry had been obtained from the Libyan National Oil Corporation (**NOC**) directory, http://www.noclibya.com, and from the Libyan Yellow Pages http://www.yellowpages.ly, which is part of the Libyaonline.com Network, an official partner of the Federation of the Libyan Chamber of Commerce. The oil and gas companies were invited to participate in the research by completing the questionnaire.

6.4.2 Pre test (Pilot Study)

The developed questionnaire was distributed to 11 top level managers from **LOGCs** in Tripoli, Libya, including one from the Umm al-Jawaby firm based in London. In the pilot study, nine of the eleven pre-tests were conducted in person at the managers' offices, and the other two questionnaires were e-mailed. Instructions on completing the questionnaire, the questions, as well as feedback were discussed over the phone. When the feedback had been collected, it was analysed, changes made to the questionnaire, to the final version designed (see Appendix 13). The pilot study was conducted to validate the instrument used for the study, and to test the administrative procedures for gathering adequate data.

6.4.3 Sampling Frame and Sample Size

The sample was drawn from a wide variety of Libyan petroleum companies covering the oil and gas sector of Libya. The survey respondents were all from the oil and gas industry. The sampling frame was defined as someone in a decision making position in their organisation. Thus, the individuals targeted by this survey had the knowledge and the qualifications to answer very specific questions. This research looked solely at **LOGCs**, and these oil and gas companies were the focus of this study.

6.4.4 Sample and Participation

The participants came from 30 **LOGCs** in the Libyan petroleum sector. The sample included a wide range of **LOGCs**, Libyan as well as joint venture (Libyan/foreign partnership) companies participated in the research. However, the focus was mainly on **LOGCs**. A total of 211 usable responses were obtained from a total of 650 questionnaires distributed, giving a response rate of 32.4%. This is higher than the typical 10-12% response rate most surveys achieve. The sample size of this study **(n=211)** is desirable to test e-Commerce model, which includes 9 constructs (hypotheses) consisting of 42 items. It is possible that the length of the survey questionnaire could have affected participation.

6.4.5 Data Collection

The collection of appropriate information to be used in research is a process that requires careful planning and may often take longer than expected. It is an essential part of the research that reinforces the originality of the conclusions reached. The

methodology of data collection is very important too, since adherence to procedural norms ensures that the results are comparable to those of other studies and that the conclusions reached are useful. This study adopted a questionnaire and interview approach to data collection for hypothesis testing.

6.4.5.1 Data Collection Procedure

The data collection procedure was in person, by fax, by e-mail, and by conventional mail. Participation was voluntary. A covering letter, signed by the research supervisor, was included to encourage potential respondents to respond. The researcher included an additional cover letter in order to provide further encouragement and instructions. No monetary or non-monetary rewards were offered for completing of the survey. The present researcher administered data collection, and respondents were guaranteed anonymity in the process.

6.4.5.2 Data Coding Techniques

Data coding was conducted in accordance with the criteria established by the researcher. The analysis was performed using SPSS 12.0 for Windows. The researcher also used Microsoft Excel to group companies by type, and size, and to generate charts and tables and compare data. Personal interviews were conducted with several top managers of the **LOGCs** operating in Libya. These in-depth interviews were conducted on a one-to-one basis with senior personnel, managers, and senior decision-makers. These interviews were based on qualifications criteria. The researcher used multiple methods to collect and analyse the data such as descriptive statistics, correlation and

regression analysis. All analysis was performed using the Statistical Package for Social Sciences. The general purpose of the research questionnaire was to study the prospects of e-Commerce adoption in **LOGCs**. The study tries to answer the research question concerning the level of e-Commerce adoption among **LOGCs**.

6.4.5.3 Interview Procedure

The interview is one of the most important sources of case study information. Interviews may take several forms. Most commonly, case study interviews are of an open-ended nature, in which an investigator can ask key respondents for the facts of a matter as well as for the respondent's opinions about events (Gillham, 2000; Gubrium et al., 2002; Bryman, 2001). Semi-structured interviews were designed which focused on the central aims and objectives of the present research. The semi-structured interview was adopted in order to explore new topics, and sensitive issues of e-Commerce development and adoption. Personal interviews were conducted by the present researcher with 11 interviewees in early January 2004. The interviewees were top managers (decision makers) of selected **LOGCs**. The sample was selected for the purpose of obtaining various opinions and comments from different sources. Typically, each interview lasted 50-60 minutes. Some interviews were tape-recorded with the consent of the interviewee. The researcher drafted the survey questionnaire based on the responses to the interview questions. Most concerned several well-established dimensions of e-Commerce adoption. At the end of each interview, the researcher asked the interviewee to give suggestions, comments, feedback and discussions on the subject matter (see Appendix 14).

6.4.5.4 Interview Sample Selection and Data Collection

The data were collected through a questionnaire survey on **LOGCs**. The questions were presented to the top managers and **CEOs** interviewed and later refined based on their suggestions. The survey was begun in early January 2003. The sample was drawn from the Libyan oil and gas sector directory. The sampling framework is appropriate for the purpose of this study because **LOGCs** have the potential to pursue Internet and e-Commerce technology. Thirty **LOGCs** were randomly selected, only 9 firms had interviewed extensively and were included in the sample for the survey. In order to increase the response rate, some questionnaires were delivered personally to the top managers and **CEOs** during a field trip to Libya.

6.5 Conclusion

This research methodology was designed to investigate e-Commerce adoption factors in **LOGCs**. A theoretical framework of e-Commerce adoption was developed to investigate the factors that potentially influence the adoption of e-Commerce by testing hypotheses generated from the proposed model. This chapter provides an outline of the methodology and rationale employed in this research as well as its limitations. It explains the appropriate research techniques and follows the logical path of the research methodology rationale. The next chapter analyses the empirical findings, and interprets results in relation to the theoretical framework of e-Commerce technology adoption in **LOGCs**.

CHAPTER VII

EMPIRICAL FINDINGS: ANALYSIS OF DATA, AND INTERPRETATION

7.1 Introduction

As has been established previously, this study is limited to the context of **LOGCs**. This chapter presents the research results and findings. The main objective of the study is to determine the factors that influencing the adoption of e-Commerce technology in **LOGCs**. The research results suggested are the first set of **ICT** data related to **LOGCs** to be reported.

7.1.1 Sampling and Questionnaire Results

The sampling procedure identified 211 individuals as potential respondents. All of the sample work for 30 **LOGCs**, some from the same company but in different divisions. The survey was administered using conventional printed questionnaires developed utilizing the prior literature. They were completed and returned by August 2003, resulting in a total response rate of 32.4%. Of these 650 questionnaires distributed, the 211 respondents came from the Libyan oil and gas industry directory, as shown in Table 7.1. The sampling framework was appropriate for the purpose of this study because Libya petroleum companies have the potential to adopt and develop Internet and e-Commerce applications. The results were processed and analysed using SPSS ver.12.0. The results and findings are presented below:

Table 7.1: Industry Type

N=211; Mean=3.18; Std. Deviation=2.80

Industry	Frequency (N)	Questionnaire Percentage
Oil & Gas*	211	32.4%
Total of Respondents	**211**	**32.4%**

* Participation of 30 oil and gas companies

A questionnaire was conducted into the use of Internet and e-Commerce technology by the major **LOGCs**. Table 7.1, shows that the respondents represent 30 different **LOGCs**. The return rate was 32.4%, and this facilitates the drawing of a good cross-sectional picture of the status of Information Technology **(IT)**, such as Internet and e-Commerce technologies, in **LOGCs**.

Table 7.2: Distribution of Ownership of the Organizations

N=211; Mean=1.29; Std. Deviation=.54

		Frequency	Valid Percentage
Valid	Libyan Company	161	76.4%
	Libyan/Foreign Company (Joint Venture)	50	23.6%
	Total	**211**	**100.0%**

From Table 7.2, it can be seen that the respondents worked for **LOGCs**, and joint venture companies. Approximately, 76.4% of the companies participating in this research were Libyan owned companies. The respondents from either Libyan/ Foreign companies (Joint venture), constituted 23.6%. The figures are representative of current trends in Libya, where many oil and gas companies were established with Libyan ownership. This sample allows a good description to be achieved of the current and future use of the Internet and e-Commerce scenario in Libyan petroleum companies.

Table 7.3: Distribution of Departments in the Company

N=211; Mean=5.44; Std. Deviation=2.53

		Frequency	Percentage
Valid	Marketing	20	9.5%
	Operations	27	12.8%
	Materials/Maintenance	12	5.7%
	Administration	32	15.2%
	Information Technology	33	15.7%
	Purchasing/Procurement	18	8.5%
	Project Management	22	10.4%
	Management	47	22.2%
	Total	**211**	**100.0%**

From Table 7.3, it can be seen that participants came from 30 different companies in the Libyan petroleum economy. The sample includes a wide range of departments, which can yield a clear idea about information technologies such as Internet and e-Commerce applications. Respondents in these departments cited the Internet and e-Commerce as crucial to their organization's strategy. From the above table, management departments had the highest percentage of 22.2% respondents. The figures reflect that the majority of participants in these departments seem to be knowledgeable about the Internet, e-Commerce and other **IT** related issues. The respondents in these departments clearly see the Internet and e-Commerce as being strategic tools to gain business advantages and global market reach. However, these departments were varied in terms of information technology, infrastructure capabilities and technical expertise. Thus, this could be a major potential barrier to the effective adoption of e-Commerce in their organizations.

7.1.2 Characteristics of Participating Libyan Petroleum Companies

Table 7.4 contains information regarding company size. The intention was to include companies with more than 200 employees on the assumption that e-Commerce adoption requires a certain level of resources that could only be provided by large oil and gas firms. However, more than 2% of the firms had fewer than 50 employees. The criterion for company size was arbitrarily set at the early proposed stage, so the companies that reported fewer than 50 employees were still used in the data analysis.

Table 7.4: Distribution of Company Size by Employees

N=211; Mean=4.19; Std. Deviation=1.92

		Frequency	Valid Percentage
Valid	1-50	6	2.8%
	51-100	8	3.7%
	101-200	23	10.9%
	201-500	29	13.7%
	501-1000	37	17.6%
	1001-5000	74	35.2%
	>5000	34	16.1%
	Total	**211**	**100.0%**

Considering the nature of Libyan petroleum industry, this sample can be considered representative of the Libyan oil and gas sector because the survey was designed to include comparatively large firms. From Table 7.4, it can be seen that among the respondents, 16.1% have more than 5000 employees, while only 13.7% had between 200 and 500 employees. 17.6% of companies had numbers of employees between 500 and 1000. This shows that most of the companies had large number of employees, as the scale of business operations is large.

The profile of number of employees of the organization may have a positive effect on the adoption of e-Commerce technology. Thus, it may give an indication that measuring the size of participating organisations reflects important e-Commerce adoption factors. From Table 7.4, it can be seen that there is a wide range of employment sizes (1-50 to over 5000 employees). The vast majority of companies fall in the medium to large category by Libyan standards. As mentioned in the literature review, one of the major internal organizational factors that facilitates the adoption of e-Commerce is firm size. This has been supported by various empirical studies (Aiken and Hage, 1971; Beveren and Thomson, 2002; De Pietro et al., 1990; Rogers, 1995; Al-Qirim, 2003; Al-Qirim and Corbitt, 2002)

7.1.3 Characteristics of Respondents

The questionnaire developed in this study included a wide range of questions about company background, and the use of information communications technologies (include the Internet and e-Commerce). It was expected that only persons at certain management levels would have the necessary knowledge to complete the questionnaire. Further, since many companies are developing or planning to develop e-Commerce systems for their companies and for particular divisions, different persons from various different divisions with the same company might give different answers to the same questions. Considering this factor, the respondent's job title was very important for this research. Table 7.5 shows that 35.5% of the respondents were General Managers. Information Technology and Purchasing Managers both accounted for 27.9% of the sample.

From Table 7.5, it can also be seen that among the respondents, most participants held high positions in their organisations. Operations Managers constituted 10.9%. VP-Administration constituted 9.5%, these two managerial positions were titles mentioned in the study questionnaire as well.

Table 7.5: Distribution of Respondents' Position within the Organization
N= 211; Mean= 4.69; Std. Deviation=2.03

	Frequency	Percentage
Operations Manager	23	10.9%
VP-Administration	20	9.5%
IT Manager	33	15.6%
Purchasing Manager	26	12.3%
General Manager	75	35.5%
Chairman/President	11	5.2%
Administrative Manager	23	11.0%
Total	**211**	**100.0%**

The high expertise level of the participants in organisations was important to ensure thorough and complete answers to the questions. Chairman/Presidents and Administrative Managers who participated, both accounted for 16.2%. The job title of participants does give some assurance that they intimately understood the issues raised in the research questionnaire. These figures reflect that top management, and managerial positions on the aspects of **IT**, and especially the Internet and e-Commerce scenario in **LOGCs**. This could be an important factor in adopting e-Commerce (Turban et al., 2004; Kalakota and Whinston, 1997; Tabak, 1999; Burgess, 2002; Walsh, 1995; Damanpour, 2001; Finkelstein and Hambrick, 1996; Thong and Yap, 1995a, b).

7.1.3.1 Distribution of Managerial Experience

From Table 7.6, it can be seen that the managers' experience is diverse. Less than one-third of participants' had between 11 to 19 years experience. This is important because it suggests that managerial perceptions and work experience could facilitate the adoption of e-Commerce technology in their organizations as suggested by empirical studies (such as Sagi, 2003; Rogers, 2003 and 1995; Tabak, 1999; Turban et al., 2000; Tan and Teo, 1998; Fichman and Kemerer, 1997; Nelson, 1990; Harrison and Rainer, 1992; Howell et al., 1990).

Table 7.6: Distribution of Managerial Experience

N=211; Mean =2.45; Std. Deviation=1.07

Years of Experience	Frequency	Percentage
1-5	50	23.7%
6-10	55	26.1%
11-19	69	32.7%
20-29	34	16.1%
>30	3	1.4%
Total	**211**	**100.0%**

7.1.3.2 Distribution of Respondent Nationality

Table 7.7 shows that a total of 84.8% of participants were Libyan nationals, whereas 15.2% were non-Libyans managers. The figures reflect that the respondents' nationality who participated in the study.

Table 7.7: Distribution of Respondent's Nationality

N=211; Mean=1.15; Std. Deviation=.36

		Frequency	Percentage
	Libyan	179	84.8%
	Non-Libyan	32	15.2%
	Total	**211**	**100.0%**

7.1.3.3 Distribution of Employees

From Table 7.8, it can be seen that, departments with greater than 20 employees have the highest percentage, which constitute 40.8%. This are again reflects that these companies are relatively large. The second highest was departments which employed less than 20 employees, with a percentage of 28.9%. Other departments employed less than 10 employees. The figures are broadly representative of different size of department's in Libyan petroleum companies.

Table 7.8: Distribution of Employees in the Departments

N=211; Mean=3.92; Std. Deviation=1.16

		Frequency	Valid Percentage
Valid	1-3	9	4.3%
	4-6	21	10.0%
	7-10	34	16.1%
	11-20	61	28.9%
	>20	86	40.8%
	Total	**211**	**100.0%**

7.1.3.4 Distribution of Organizational Location

Table 7.9 shows that most of the sample of respondents worked for companies in the major Libyan cities. Also, some of the sample worked for Libyan companies outside Libya. This survey shows that companies outside Libya are better off regarding

information technology infrastructure capabilities, technical expertise and e-Commerce knowledge.

Table 7.9: Distribution of Organizational Location

	N=211; Mean=5.54; Std. Deviation=1.60	**Frequency**	**Valid Percentage**
Valid	Sebha	4	1.9%
	Musrata	6	2.8%
	Brega	10	4.7%
	Italy*	8	3.8%
	Tripoli	134	63.5%
	Germany**	10	4.7%
	London***	9	4.3%
	Benghazi	29	13.7%
	Total	**211**	**100.0%**

* Libyan Tamoil Co.; **Libyan Mediterranean Oil Services Co.;
***Libyan Umm al-Jawaby Co.; and Teknica (UK) Ltd.

The majority of firms participating in this survey were located in the capital of Libya, Tripoli, with a percentage of 63.5%. From Table 7.9, it can be seen that among the respondents, 13.7% were from Benghazi. The research survey found that those companies had less technology infrastructure, less technical expertise and less Internet and e-Commerce knowledge. The figures reflect differences in the population size and number of companies in different locations.

7.1.3.5 Distribution of Websites

From Table 7.10, it can be seen that 40.8% of respondents indicated that their companies did not have a company website. The reason for this could be lack of expertise in their companies. However, 27.0% of respondents indicated that they have

had had a website for 1-2 years. The figures showed that most of companies are still developing corporate websites in their companies. Most **LOGCs** still operated in the conventional style, where a corporate website was not a priority in promoting their business on line.

Table 7.10: Distribution of Websites in the Organizations
N=211; Mean=3.49; Std. Deviation=1.46

		Frequency	Percentage
Valid	< 1 Year	18	8.5%
	1-2 Years	57	27.0%
	2-3 Years	25	11.8%
	> 3 Years	24	11.4%
	Do not have a website	86	40.8%
	Total	**210**	**99.5%**
Missing	**System**	**1**	**.5%**
Total		**211**	**100.0%**

The reasons could be lack of expertise and inadequate **IT** infrastructure in the organizations. This has been suggested in many empirical studies (Zwass, 2001; McGowan, 1998; Hall, 1995; Mukti, 2000; Jennex et al., 2004; Sukovskis, 2002; Barry and Milner, 2002; Dedrick and Kraemer, 2001; Cloete and Courtney, 2002; Sachs et al., 2001).

7.1.4 Competitive Intensity in the Organization

From Table 7.11, it can be seen that a total of 91.9% of respondents said that their companies were not competitive, whereas a total of 8.1% of respondents said that their companies had a competitive intensity.

This result is not surprising because most Libyan petroleum companies are government owned. The figures reflect the fact that most **LOGCs** are domestically owned. For that reason competition in general is quite limited. Thus, there is no competitive pressure facing the industry. This can be a major barrier for the adoption of e-Commerce in **LOGCs**, as suggested in recent studies (Evan and Wuster 1999; Abrahamson et al., 1990; Grover, 1993; Iacovou et al., 1995; Johnson et al., 1992; Cragg and King, 1993).

Table 7.11: Competitive intensity in the Organisation

N=211; Mean=2.94; Std. Deviation=1.08

		Frequency	Valid Percentage
Valid	Not Competitive	194	91.9%
	Competitive	17	8.1%
	Total	**211**	**100.0%**

7.1.5 Profile of Respondents' Knowledge of e-Commerce

Table 7.12 shows most respondents felt that they did not possess a great deal of knowledge or expertise in this field. A total of 72.5% of respondents indicated very low knowledge or expertise and a lack of understanding of Internet applications and e-Commerce, whereas 27.5% of respondents had a significant knowledge of e-Commerce. The figures strongly suggest that most oil and gas companies in Libya have a relatively low knowledge of e-Commerce. This could be a major barrier for the adoption of e-Commerce. The fact that managers consider themselves to have low knowledge in e-Commerce could be a major impediment to the adoption of e-Commerce technology. This has been documented by some recent studies (Scupola,

2003; Cloete and Courtney, 2002; Sharma, 2003; McGowan, 1998; Hall, 2002; Beal, 2000; and Turpin, 2000).

Table 7.12: Distribution of e-Commerce Knowledge

N=211; Mean=1.88; Std. Deviation=1.09

		Frequency	Valid Percentage
Valid	Not Knowledgeable	153	72.5%
	Knowledgeable	58	27.5%
	Total	**211**	**100.0%**

Most respondents were keen to learn about and use e-Commerce to improve their organization's services and productivity. Respondents believed that they were being held back by a lack of proper technical support for e-Commerce technology. Respondents cited that a lack of knowledge and low e-Commerce awareness were a major barrier to adoption. However, whilst most respondents agreed that the Internet and e-Commerce technology had many benefits to offer, they recognised that a lack of adequate knowledge and skills prevented them from utilising the advantages being offered. This has been supported by Dodgson (2001) and Bhatnagar et al. (2000).

7.1.6 Profile of e-Commerce Education and Training

In this segment of the survey questionnaire, respondents were asked to specifically indicate their level of learning about e-Commerce technology regarding the need for training and education. The respondents indicated a high degree of consensus that there was a need for training in e-Commerce. The fact that managers, in general, do not see

themselves as very knowledgeable in e-Commerce could to impede the adoption of e-Commerce in their organizations.

This reflects the fact that most oil and gas companies in Libya do not use e-Commerce applications; as such they do not have any e-Commerce education or e-Commerce training programmes. This could be a reason for failure to adopt e-Commerce technology. This has been supported by a report from UNCTAD (2003), and recent studies by McGowan (1998), Kamel (2002), Papazafeiropoulou et al. (2002), Hall (2002), and APEC (2002). The respondents strongly felt that there is a recognised need for systematic training.

Table 7.13: Distribution of Learning e-Commerce Technology

N=211; N Valid= 207, Mean=3.47; Std. Deviation=.85

		Frequency	Percentage	Valid Percentage
Valid	Conferences/Seminars	8	3.8%	3.9%
	Courses	25	11.8%	12.1%
	Books	36	17.1%	17.4%
	Other (Newspaper, Radio, TV, Magazine, Internet, etc…	138	65.4%	66.7%
	Total	207	98.1%	100.0%
Missing	System	4	1.9%	
Total		**211**	**100.0%**	

Internet and e-Commerce awareness is needed at various levels of business organizations. Thus, the survey respondents suggested that more seminars, courses, and conferences could play a major role in training and educating managers in Internet and e-Commerce technology. The respondents needed e-Commerce training, and the figure

in Table 7.13 reflect the need for such training through seminars, courses and other training workshops. This has been supported by a report from UNCTAD (2003) and a recent study by McGowan (1998).

7.1.7 Profile of IT Capabilities

Information technology **(IT)** infrastructure is the most important factor to enable the e-Commerce environment. From Table 7.14, it can be seen that a total of 41.9% of participants indicated that information technology capabilities in their organisations are satisfactory.

This lack of appropriate and improper technology is likely to be a barrier to adopting e-Commerce. **LOGCs** are considering which modern information technology facilities should be made available in their organisations and they are reviewing their plans based on changes in technology and infrastructure. It is recommended that organizations should have a holistic and balanced view of technology infrastructure readiness for the optimum performance of business processes. This argument has been supported by various empirical studies (Davidson and Movizzo, 1996; McGowan, 1998; Elliot and Loebbecke, 2000; al-Qirim and Corbitt, 2002; Zwass, 2001; Jennex et al., 2004; Sukovskis, 2002; Yap et al., 1994; Broadbent et al., 1999).

Table 7.14: Distribution of Organization's IT capabilities

N=211; N Valid=210; Mean=2.81; Std. Deviation=.91

		Frequency	Percentage	Valid Percentage
Valid	Very poor	16	7.6%	7.6%
	Poor	59	28.0%	28.1%
	Satisfactory	88	41.7%	41.9%
	Good	43	20.4%	20.5%
	Excellent	4	1.9%	1.9%
	Total	210	99.5%	100.0%
Missing	System	1	.5%	
Total		**211**	**100.0%**	

Currently, Libyan petroleum firms are not investing in the implementation of e-Commerce sites. Besides this, they do not have immediate plans to introduce e-Commerce services. This can be done by Libyan government involvement and **LOGCs** management to support and facilitate the e-Commerce environment based on awareness, education, competition, privacy, the fostering of transparency and support for commercial transactions.

7.2 Section Two:

This section investigates the distribution of current and future plans regarding Internet and e-Commerce technology applications used by **LOGCs**. It also presents the current status of the modern **ICTs** among the Libyan petroleum companies.

7.2.1 Distribution of Current and Future Internet and e-Commerce Plans

In section two of the questionnaire, respondents were asked to indicate if they currently used specific Internet applications or if they planned to in the future. The results are

summarized in Table 7.15. The results confirm much of what was anticipated. Respondents were asked about their current and intended future use of **IT** in their organisations, if they currently used **ICTs** such as Internet applications and e-Commerce technology or if they planned to use it in the near future.

Table 7.15 shows their current and future plans regarding e-Commerce technology. **LOGCs** are in a very slow process of developing e-Commerce technology. However, the arrival of the Internet allows **LOGCs** to join global business markets. The figures in Table 7.15 are quite representative of the current situation in the Libyan petroleum sector regarding current and future plans for Internet and e-Commerce technology.

Table 7.15: Distribution of Current and Future ICTs Plans

e-Commerce Technologies	Mean	Yes	NO, but we intend to implement this	NO, we don't intend to implement this
Organization uses Internet	.99	85.8%	11.4%	2.8%
Organization has policies to adopt IT	.94	50.5%	42.9%	6.7%
Organization has modern IT infrastructure	.92	47.1%	50.0%	2.9%
Organization has access to Internet	.86	87.2%	11.8%	.9%
Organization currently has website	.47	53.1%	40.7%	6.2%
Organization uses e-mail as a business communication	.31	37.1%	56.7%	6.2%
Organization uses Internet online for purchasing	.73	9.5%	54.5%	36.0%
Organization uses Internet for making payment online	.19	1.4%	16.3%	82.2%
Organizations uses Web catalogues	.62	15.0%	38.8%	46.2%
Organization uses EDI	.55	12.3%	30.8%	55.9%
Organization track orders through Internet	.57	10.3%	30.7%	59.0%
Organization has e-Commerce site to sell products/Services	.19	1.4%	15.9%	82.7%
Organization has a corporate Intranet	.60	11.1%	28.0%	60.9%
We have Extranet connecting with suppliers	.45	8.7%	28.1%	63.3%
We use EFT or e-Payment	.28	4.9%	12.1%	83.0%
We have access to e-Catalogues of suppliers	.91	16.6%	40.0%	43.4%
We use e-Catalogues to purchase products	.72	13.3%	43.8%	42.4%

A total of 85.8% of respondents said that their firms did use the Internet. This showed that the Internet is used in **LOGCs** and it has emerged as a medium in which to conduct their business operations. It was found that the vast majority of respondents, (87.2%), had access to the Internet in their organizations.

These are new findings on the Internet usage in **LOGCs**. This question did not address the issue of frequency of usage, which means that respondents may have used the Internet only occasionally to search for information. Only 50.5% of firms had established policies to implement **IT** in their organizations. Approximately 47.1% of companies have stated that modern **IT** infrastructure had been set up in their organizations. However, the present research has found that **LOGCs** located outside Libya had more technical advantage and better technological infrastructure.

The survey results indicated that more than half of the companies (53.1%) did have websites. Internet access and e-mail were the most widespread technologies used in the companies. Among the **LOGCs** that responded to the survey, 12.3% currently used Electronic Data Interchange **(EDI)**, whereas 55.9% did not intend to implement it. It seems that a sizeable number of companies had not invested in the networks and technology required to implement **EDI**. It was evident from the findings that there is a large, unutilised potential for **B2B** e-Commerce. This has been supported by empirical studies (Chwelos et al., 2001; UNCTAD, 2003; Quayle, 2002; Iacovou et al., 1995; Fink, 1998; Poon, 2000; and Roberts and Wood, 2002).

In terms of the Internet and e-Commerce applications currently in use, 37.1% of **LOGCs** had a Web site and used e-mail for contacting with suppliers. About 11.1% had an Intranet, and 16.6% had direct access to the electronic catalogues of major suppliers. Only 1.4% of Libyan petroleum firms were selling their products and services directly through the e-Commerce Website. Clearly, this indicates that e-Commerce is not fully adopted. 15.9% of **LOGCs** were intending to implement e-Commerce applications such as an e-Commerce site to sell products and services. The vast majority (82.7%) of **LOGCs** are not in the process of gearing up for e-Commerce technology. This is a significant finding in terms of e-Commerce trends usage in **LOGCs**.

In terms of payment methods on the Internet or Electronic Funds Transfer **(EFT)**, 83.0% of companies did not plan to implement it in the near future whereas only 1.4% used the Internet for making payments online. Those companies are located outside Libya. At this early stage in the development of electronic payment in Libya, the commercial and technological environment is changing rapidly, and therefore it is essential to protect customer interests at any cost. If Internet users do not have confidence that their communications and data are safe, they will be unlikely to use the Internet on a routine basis for commerce. This line of argument has been documented and supported by Hall (2002); Turban et al. (2004); UNCTAD (2003); and APEC (2002).

The security of online financial transactions is still a concern for the vast majority of respondents. This concern is apparent in the low usage of online payment methods. This is not surprising. The security of the Internet is a major concern to oil and gas businesses. The survey results showed that 83.0% of respondents indicated that they did not intend to implement any type of Electronic Payments in their organizations. It is clearly evident that there is a lack of standard payment infrastructure, security and financial infrastructure and a lack of knowledge and understanding among **LOGCs** when it comes to e-Commerce and e-Business issues. This may hinder and hold back the process of adopting e-Commerce technology in their organizations. This has been documented and supported by studies such as Sachs (2001); APEC (2002); UNCTAD (2003); Turpin (2000); Hall (2002); Hoffman et al. (1999); and Rowley (1996).

16.6% of Libyan oil and gas firms sampled had access to the electronic catalogues of major suppliers. 15.0% of **LOGCs** used Web catalogues to identify products and services. This is one of the most popular applications of the Internet in oil and gas firms. Even if these oil and gas companies are not using e-Commerce systems, they still can use Web catalogues to perform their jobs more efficiently. It is clear that electronic channels are forcing **LOGCs** to rethink major aspects of the way they are organized and do business.

The Internet and e-Commerce raise major strategic issues and are accelerating developments in areas such as market reach, globalisation, customer service, and supply chain management. From Table 7.15, it can be summarized that the majority of

LOGCs currently do not have e-Commerce applications. The figures reflect that most **LOGCs** still operate in the conventional manner where **IT** is not a top priority. The reasons for this could be lack of e-Commerce awareness, management support, and expertise, capital constraints and technology infrastructure. However, there are other environmental factors that may determine the adoption of e-Commerce. Respondents were asked to rate their use of the Internet and e-Commerce business technologies, and the results in Table 7.15 show that firms had explored various **ITCs**. These results support the previous findings of Gani (1992); Goodhue and Thompson (1995); Harris (1999) and Seyal (2004).

7.3 Sections Three and Four

These questionnaire sections looked at the influential factors proposed in the theoretical framework. The characteristics of Libyan petroleum firms such as size and technical infrastructure readiness were chosen for investigation. Organization, innovation, technical readiness, industry and environmental factors were measured and the responses recorded in a five-point Likert scales indicating strong disagreement to strong agreement.

7.3.1 Analysis of e-Commerce Adoption Theoretical Model

The present research has proposed 9 constructs which were used to measure e-Commerce technology adoption level in **LOGCs**. Accordingly, it investigates nine factors that could influence the level of e-Commerce adoption.

7.3.2 Factors Influencing the Level of Adoption

It follows that the hypotheses tested in this study assess the impact of possible factors on the adoption of e-Commerce. The level of adoption of e-Commerce technology is influenced by factors relating to the organization, innovation, the industry, and the environment.

7.3.2.1 Dependent Variable (DV)

The dependent variable (DV) – Level of adoption of e-Commerce technology - was measured with 2 items on the questionnaire. The Cronbach's alpha coefficient was (α=0.78).

7.3.2.2 Hypothesis Testing

This study proposes that e-Commerce adoption factors would affect the adoption of e-Commerce level in certain ways. The entire 9 hypothesises were tested by using regression analysis, which was deemed most effective for testing the relationships between the variables. Regression analysis was used to test each of the relationships between dependent variable (e-Commerce technology adoption level), and each independent variables proposed in the theoretical framework. Before testing the hypotheses, it is important to evaluate the validity and reliability of the measures used in this study.

7.3.2.3 Reliability of Measurement

The sample size of the study (**n=211**) is appropriate for the proposed e-Commerce theoretical model which included 9 hypothesises and consisted of 42 items (see Appendix 15).

7.4 e-Commerce Technology Adoption Level

7.4.1 Effects of Organization Characteristics on e-Commerce Adoption.

7.4.1.1 Testing Hypotheses 1, 2, 3, and 4

In this study, four independent variables concerned the organization's internal factors: firm's size (H_1), top management support (H_2), organizational readiness (H_3), organizational culture (H_4), and e-Commerce technology adoption level **(DV)**. As shown in Table 7.16, only three hypotheses were supported, and were significant in explaining e-Commerce adoption. These internal factors are important in facilitating and determining the adoption of e-Commerce within the firm.

The hypotheses are written as:

H_1: The adoption of e-Commerce technology is positively related to firm size.

H_0: Firm size has no association with e-Commerce technology adoption.
H_1: Firm size has associated with e-Commerce technology adoption.

Firm size was measured with 2 items focusing on the influence of number of employees in the organization and the department (α=0.84).

H_2: The adoption of e-Commerce is positively related to top management support.

H_0: Top management support has no association with e-Commerce adoption.
H_1: Top management support has associated with e-Commerce adoption.

Top management support was measured with 5 items (α=0.79).

H_3: The adoption of e-Commerce is positively related to organizational readiness.

H_0: Organizational readiness has no association with e-Commerce adoption.
H_1: Organizational readiness has associated with e-Commerce adoption.

Organizational readiness was measured with 5 items (α=0.88).

H_4: The adoption of e-Commerce is positively related to organizational culture.

H_0: Organizational culture has no association with e-Commerce adoption.
H_1: Organizational culture has associated with e-Commerce adoption.
Organizational culture was measured with 5 items (α=0.77).

Table 7.16: Effects of Organizational Factors on e-Commerce Technology Adoption

Independent Variables	Hypothesis Number	Predicted Sign	Parameter Estimate	t-Value	P-Value	R-Square	Adj. R - Square
Firm Size	H_1	+	.104	2.591	0.010	.131	.126
Top Management Support	H_2	+	-.263	-2.576	0.011	.411	.389
Organization Readiness	H_3	+	.328	3.632	0.001	.285	.282
Organization Culture	H_4	+	.304	-1.105	0.270*	.518	.504

Statistically significant at the 0.05 level. *P-Value >0.05
Dependent Variable: e-Commerce technology adoption level

It was confirmed that organization size was positively related to e-Commerce adoption (β=.104, t=2.591, P=0.010). Hence, (H_1) was supported. Looking at the t-ratio, or more usefully the p-value, for firm size, implies that the variable in the model is significant at the 5% significance level. As stated in the literature review, firm size has always had intuitive appeal as a variable with regard to innovation. This has been supported by recent empirical findings (De Pietro et al., 1990; Rogers, 1995 and 2003; al-Qirim and Corbitt, 2002; al-Qirim, 2003; Poon, 2000; Beveren and Thomson, 2002), but its power of explanation in innovation research is uncertain because of the contradictory factors this variable may indirectly represent.

This study also proposed that top management support (H_2) and organizational readiness (H_3), were related to the adoption of e-Commerce. The results presented in Table 7.16 shows that both hypotheses (H_2), (β= -.263, t= -2.576, P=0.011) and (H_3),

(β=.328, t=3.632, P=0.001) were supported. This means that companies with low top management support or basic organizational readiness might hinder and show less adoption of e-Commerce technology (Tornatzky and Klein, 1982; Ang and Pavri, 1994; Tornatzky, et al., 1990; Premkumar and Ramamurthy, 1995; Thong and Yap, 1995a, b; Fink, 1998, Tan and Teo, 1998; and Turban et al., 2004).

As shown in Table 7.16, organizational culture (H_4), (β=.304, t=-1.105, P=0.270) appears not to be significantly associated with e-Commerce adoption. There is no significant relationship between organizational culture and e-Commerce adoption. Thus (H_4) is not supported because its p-value is 0.270 (>0.05). Clearly this implies that the independent variable of organizational culture has no significant effect on the dependent variable of e-Commerce technology adoption level at this early stage. This has been supported by some empirical studies (Mayer-Guell, 2001; Schein, 1990; Terppsta and David, 1991; Hussain, 1995; Veiga et al., 2001; Ciganek et al., 2003; Harris, 1999; Seyal et al., 2003; and Tyayeb, 1988).

7.4.2 Effects of the Innovation Factor on e-Commerce Adoption Level

7.4.2.1 Testing Hypothesis 5

One hypothesis was used to test the relationship between the perceived benefits of e-Commerce tools and the general level of e-Commerce adoption. The result of this one regression analysis is shown in Table 7.17. The hypothesis concerning perceived benefits (H_5), (β= -.168, t=-1.109, P=0.270) was rejected. The implication is that perceived benefits variable was not significant in the model at the 5% significance level.

The findings concerning this variable support those of some empirical studies (Roberts and Wood, 2002; Barry and Milner, 2002; Abell and Limm, 1996; Poon and Swatman, 1997 and 1995; Tappey and Tappet, 2001; Quayle, 2002; Tetteh and Burn, 2001; Lee, 2001; Seyal et al., 2003; Soh et al., 1997; Hair et al., 1979). The results in this study do not support the prior studies of Moore and Benbasat (1996) and Chwelos et al. (2001) that perceived benefits were the most influential determinants of technology usage. The study does however support the findings of Gani (1992), Goodhue and Thompson (1995) and Harris (1999).

The hypothesis is written as:

H_5: The adoption of e-Commerce is positively related to the perceived benefits.
H_0: Perceived benefits have no association with e-Commerce adoption.
H_1: Perceived benefits have association with e-Commerce technology adoption.
Perceived benefits pressure was measured with 5 items (α=0.73).

Table: 7.17 Effects of Innovation Factor on e-Commerce Technology

Independent Variables	Hypothesis Number	Predicted Sign	Parameter Estimate	t-Value	P-Value	R-Square	Adj. R - Square
Perceived Benefits	H_5	-	-.168	-1.109	0.270*	410	406

Statistically significant at the 0.05 level. *P-Value >0.05
Dependent Variable: e-Commerce technology adoption level.

7.4.3 Effects of Industry Factors on e-Commerce Adoption Level

7.4.3.1 Testing Hypotheses 6 and 7

Table 7.18 shows that competitive pressure (H_6) (β=-.235, t= -1.542, P=.126) and Critical Mass--customer/suppliers pressure (H_7) (β=.134, t=1.865, P=0.064) were not found to influence the **LOGCs** e-Commerce adoption. This was probably because they had limited customers and suppliers and not enough competition to influence the company's e-Commerce adoption decision making. As proposed, competitive pressure

and critical mass of customers and suppliers were important factors in explaining e-Commerce adoption.

This result strengthened the point that customers and suppliers and competitive pressure did not have as important an impact on e-Commerce adoption level as anticipated. Therefore, (H_6) and (H_7) were rejected at the 0.05 significance level. This study does not support the empirical findings of other studies that competitive pressure has a significant effect on e-Commerce adoption levels (Banerjee and Golhar, 1994; Abrahamson et al., 1990; Grover, 1993; Iacovou et al., 1995; Johnson, 1992; and O'Neil et al., 1998). Competitive pressure and critical mass did not have significant relationships with the adoption of e-Commerce technology; whereas some other independent variables (**IVs)** do have significant effect on the **DV**.

The hypotheses are written as:

H_6: The adoption of e-Commerce is positively related to competitive pressure.
H_0: Competitive pressure has no association with e-Commerce adoption.
H_1: Competitive pressure has associated with e-Commerce adoption.
Competitive pressure was measured with 3 items (α=0.73).

H_7: The adoption of e-Commerce technology is positively related to critical mass.
H_0: Critical mass has no association with e-Commerce technology adoption.
H_1: Critical mass has associated with e-Commerce technology adoption.
Critical mass was measured with 4 items (α=0.77).

Table: 7.18 Effects of Industry Factors on e-Commerce Adoption.

Independent Variables	Hypothesis Number	Predicted Sign	Parameter Estimate	t-Value	P-Value	R-Square	Adj. R - Square
Competitive pressure	H_6	+	-.235	-1.542	0.126*	.228	.224
Critical Mass	H_7	+	.134	1.865	0.064*	.408	.404

Statistically significant at the 0.05 level. *P-Value >0.05
Dependent Variable: e-Commerce technology adoption level

7.4.4 Effects of Environmental Factors on e-Commerce Adoption Level

7.4.4.1 Testing Hypotheses 8 and 9

The results presented in Table 7.19 shows that both hypothesis H_8, (β=.285, t= 3.933, P=.001) and H_9 (β=.330, t=4.550, P=0.000) were supported. This means that the high involvement of national governments supports firms in adopting e-Commerce, so that it is a significant indication that firms will adopt e-Commerce. Another factor which might facilitate the adoption of e-Commerce technology is national infrastructure (H_9), as suggested by empirical studies (Teo and Tan, 2000; Scupola, 2003; Papazafeiropoulou and Pouloudi, 2000; Seah and Fjermestad, 1997; Utomo and Dodgson, 2001; Goth, 1995; Chau and Turner, 2002; Sukovskis 2002; and Hair et al., 1979).

The hypotheses are written as:

H_8: The adoption of e-Commerce is positively related to government support.

H_0: Government support has no association with e-Commerce adoption.

H_1: Government support has associated with e-Commerce adoption.

Government support was measured with 4 items (α=0.89).

H_9: The adoption of e-Commerce is positively related to national infrastructure.

H_0: National infrastructure has no association with e-Commerce adoption.

H_1: National infrastructure has associated with e-Commerce adoption.

National infrastructure was measured with 7 items (α=0.80).

Table: 7.19 Effects of Environmental Factors on e-Commerce Adoption Level

Independent Variables	Hypothesis Number	Predicted Sign	Parameter Estimate	t-Value	P-Value	R-Square	Adj. R - Square
Government Support	H_8	+	.285	3.933	0.001	.430	.427
National Infrastructure	H_9	+	.330	4.550	0.000	.667	.666

Statistically significant at the 0.05 level.

Dependent Variable: e-Commerce technology adoption.

Once again, the outcome of the regression analysis confirmed that there are highly significant association between government support **(**H_8) national infrastructure (H_9) and e-Commerce adoption level over all (p-values=0.001, 0.000 respectively), however with the lowest r^2 (adj) of .427 and .666 respectively, the model is a asonably fit. However, the regression model is not the best it could be—there are clearly other factors that could influence and determine the adoption of e-Commerce predictions. This needs to be investigated more thoroughly to assess whether the linear relationship is valid in these circumstances. The findings support prior studies by Yap et al. (1994), Tan and Teo (1998); Teo and Tan (2000); and Seyal et al. (2004).

7.4.5 Descriptive Statistics

The descriptive statistics in Table 7.20 show the calculated means, standard deviations, and sample sizes for all 9 independent variables and the dependent variable used in the e-Commerce adoption theoretical model.

Table: 7.20 Descriptive Statistics **N=211**

	Variables	Mean	Std. Deviation	N
1	Firm Size **(FS)**	4.19	1.915	211
2	Top Management Support **(TMS)**	3.42	1.174	209
3	Organizational Culture **(OC)**	3.48	1.127	211
4	Perceived Benefits **(PB)**	3.33	1.097	211
5	Government Support **(GS)**	3.59	1.026	211
6	Organizational Readiness **(OR)**	3.05	1.077	211
7	Competitive Pressure **(CP)**	2.16	1.035	210
8	Critical Mass **(CM)**	3.27	1.180	210
9	National Infrastructure **(NI)**	3.51	1.094	208
10	e-Commerce Technology Adoption **(ECAL)***	1.02	1.127	211

* Dependent variable

From the correlation results (see Appendix 16), there is a reasonably significant association between the dependent variable and each of the independent variables, with

firm size, government support, and national infrastructure being the stronger of the variables. This result is borne out by the correlation analysis findings. From the correlation analysis it is confirmed that firm size **(FS)**, government support **(GS)**, national infrastructure **(NI)**, top management support **(TMS)**, and organization readiness **(OR)** are significantly associated with e-Commerce technology adoption (DV) at the 0.01 and the 0.05 levels (see Appendix 16).

7.4.6 Regression

7.4.6.1 Performing the ENTER Method Procedure

It can be seen in Table 7.21, that all nine independent applied to the module using the ENTER method. (A 5% significant level is tested throughout)

Table: 7.21 Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	FS, TMS, OC, PB, OR, GS, CP, CM, NI[a]	.	Enter

a. All requested variables entered.
b. Dependent Variable: ECA

Before accepting the model in Table 7.22, just as with simple linear regression, various tests of significance are performed. Firstly, a reasonably good r^2 (adjusted) value is noted at 63.1% from the model summary output.

Table: 7.22 Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.836[a]	.699	.631	.696

a. Predictor: (Constant), FS, TMS, OC, PB, OR, GS, CP, CM, NI
b. Dependent Variable: ECAL

The ANOVA results in Table 7.23 show a significant result (i.e. p-value=0.000) implying that at least one of the independent variables has a significant effect on the e-Commerce technology adoption level (DV). From the SPSS output in Table 7.23, the F ratio is F=10.220 with a corresponding p-value of 0.000. Therefore, the regression is significant.

Table: 7.23 ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	123.685	25	4.947	10.220	.000[a]
	Residual	53.249	110	.484		
	Total	176.934	135			

a. Predictor: (Constant), FS, TMS, OC, PB, OR, GS, CP, CM, NI
b. Dependent Variable: ECAL

From the coefficients in Table 7.24, three independent variables, Perceived Benefits **(PB)**, Competitive Pressure **(CP)**, and Critical Mass **(CM)** appear to be non-significant since their p-values > 0.05.

Table: 7.24 Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.801	.432		2.852	.067*
	FS	.146	.143	.177	2.073	.028
	TMS	-.357	.105	-.234	-3.402	.101*
	OC	.299	.109	.281	2.754	.207*
	PB	-.157	.152	-.138	-1.038	.302*
	GS	.124	.111	.115	2.111	.026
	OR	.245	.126	.232	2.949	.057*
	CP	-.153	.100	-.122	-1.525	.130*
	CM	.165	.127	.152	.512	.609*
	NI	.257	.117	.232	2.203	.030

a. Dependent Variable: ECAL *p-value > 0.05

Table 7.25, shows the model with the nine independent variables. It is important to check that these variables are not correlated with each other. If they are, then the model has collinearity (in the case of two independent variables) or multicollinearity (in the case of more than two independent variables). From the results in Table 7.25, he Variance Inflationary Factor **(VIF)** shows that all of the independent variables (IVs) are less than ten, therefore, they are not correlated or collinear, thus there is no real cause for concern (Pallant, 2005). Similarly, the **VIF** confirms there is nothing wrong with the coefficients.

Table: 7.25 Coefficient[a]

Model		Collinearity Statistics	
		Tolerance	**VIF**
1	(Constant)		
	FS	.836	1.196
	TMS	.350	2.857
	OC	.519	1.928
	PB	.311	3.217
	GS	.426	2.349
	OR	.411	2.431
	CP	.626	1.597
	CM	.438	2.282
	NI	.675	1.482

a. Dependent Variable: ECAL

7.4.7 Regression

7.4.7.1 Performing the STEPWISE Procedure

Fitting all nine independent variables using the STEPWISE method, all of the e-Commerce variables (IVs) and e-Commerce adoption level (DV) are entered/removed (see Appendix 17). From the model summary output, Table 7.26 shows that r^2 (adjusted) has a reasonable fit. Given that the regression is significant with r^2 (adj)

values, there is a good deal of confidence in the model in making predictions of likely adoption.

Table 7.26 Model Summary[i]

Mode l	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.871[a]	.758	.756	.573
2	.879[b]	.773	.770	.557
3	.885[c]	.784	.779	.546
4	.890[d]	.792	.786	.537
5	.896[e]	.803	.795	.526

a Predictors: (Constant), NI
b Predictors: (Constant), NI, FS
c Predictors: (Constant), NI, FS, GS
d Predictors: (Constant), NI, FS, GS, TMS
e Predictors: (Constant), NI, FS, GS, TMS, OR
i Dependent Variable: ECAL

7.4.7.1.1 Results of ANOVA

The ANOVA results in Table 7.27 show a significant result (i.e. a p-value = 0.000) implying that at least one of the independent variables has a significant effect on the dependent variable of e-Commerce adoption. From Table 7.27, the p-value suggests that the null hypothesis can be rejected since the p-value <0.05. The F-ratio is large with a corresponding p-value of 0.000. Thus, the regression is significant. Looking at the t-ratio as a rough rule, if t >2 the regression coefficient is significant, so the null hypothesis is rejected (see Appendix 18).

Table7.27 ANOVA[i]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	129.607	1	129.607	394.827	.000[a]
	Residual	41.361	126	.328		
	Total	170.969	127			
2	Regression	132.226	2	66.113	213.310	.000[b]
	Residual	38.742	125	.310		
	Total	170.969	127			
3	Regression	134.027	3	44.676	149.961	.000[c]
	Residual	36.942	124	.298		
	Total	170.969	127			
4	Regression	135.477	4	33.869	117.376	.000[d]
	Residual	35.492	123	.289		
	Total	170.969	127			
5	Regression	137.264	5	27.453	99.370	.000[e]
	Residual	33.705	122	.276		
	Total	170.969	127			

a Predictors: (Constant), NI
b Predictors: (Constant), NI, FS
c Predictors: (Constant), NI, FS, GS
d Predictors: (Constant), NI, FS, GS, TMS
e Predictors: (Constant), NI, FS, GS, TMS, OR
i Dependent Variable: ECAL

7.5 Interview Findings

The following sections describe the procedure and findings of the interviews, which consists of 11 semi-structured personal interviews with top managers of **LOGCs**.

7.5.1 Profile of Libyan Oil and Gas Companies

One of the objectives of the study was to seek the interviewees' suggestions on an early draft of the questionnaire. Experts' and practitioners' opinions were sought about the wording of the questions, and the items selected or developed from the literature review. This work was seen as an important step in the instrument validation procedure.

Some of the data collection for the present research was designed as a semi structured interview. An interview instrument was used for this purpose (see Appendix 14). The interviews instrument covered some general questions about the firm's current situation with Internet and e-Commerce technology and **ICTs** in general, the competitive conditions facing the firm, the firm's technological and management policies, the role of the government and the industrial setting, the development of e-Commerce, and so on.

7.6 Major Interview Findings

The notes and transcriptions from the interviews provided rich information about the operations of the selected **LOGCs**. However, it is not possible to report all of the details here due to limited space. No computerised methods were used to analyse the interview data because of the relatively small sample size. Rather, the raw data was read and examined carefully and the comments of different interviewees were compared in terms of some major themes. Some of the major findings are reported in the following paragraphs. Many interviewee comments are quoted in order to add to the richness of the analysis. As will be discussed in the next paragraphs, these findings offer support for the theoretical framework of the study.

The first theme that came out of the interviews is that the interviewees did have different views on the feasibility and prospects of e-Commerce technology. Some top managers and **CEOs** were sceptical about e-Commerce for different reasons. But these top managers seemed to agree that oil and gas companies would not benefit much from

online transactions at this early stage. The idea of e-Commerce being difficult can be seen from the following remarks:

> "I believe that so called e-Commerce and dealing online is definitely a difficult proposition. There are many obstacles facing Libyan oil and gas companies in developing e-Commerce technology. Buying and selling on the net still has a way to go. If you are talking about trading and doing business over the Internet this has not been adopted yet".

> "Obviously, there are many issues involved in e-Commerce adoption and development. First awareness and education is a crucial barrier to the implementation of e-Commerce technology. I mean consumer awareness and corporate awareness. Second, there is the problem of Internet and e-Commerce technology infrastructure, financial services infrastructure, telecommunications infrastructure and market size. These can be major deterrents to e-Commerce development and adoption".

> "In my opinion, many factors face **LOGCs** in implementing and adopting the e-Commerce or online business: the cost factor; legal and regulatory environment; skilled people are needed to facilitate the adoption. I think suppliers are important and the market base to do online trading is like an e-marketplace".

> "I think there is a gap...you know. Digital gap...or what they call it...digital divide between our companies and international companies in terms of technological know how and infrastructure. There are many deterrents to the use of information and communication technologies in general".

> "Our firm experienced problems with the level of services and skills. Our firm has poor level of **IT** services provided which emerged as one of the problems for e-Commerce adoption".

> "Primarily, the lack of **IT** access, and connection to online and **IT** services, are still problems in providing a good level of services".

"This was particularly evident amongst firms with limited IT skills and experience... I think that many Libyan oil and gas firms suffer from a lack of IT knowledge and technical knowledge. A few may have it...but they do not have the commercial knowledge to use the Internet and e-Commerce technology"

"A lack of knowledge and experience by our managers and employees is an obstacle to us... I am talking about our company here...This factor can hinder the adoption of e-Commerce in the Libyan petroleum industry".

In contrast, there were optimistic views about how far e-Commerce technology could go. As other managers, **CEOs** and decision making top managers stated:

"In my opinion, if you look at the statistics, you can see that the number of consumers, suppliers and petroleum companies trading online is huge. I think the Internet and e-Commerce is growing and we need to take this tool seriously to reach global markets".

"I believe that the internet and e-Commerce technology is a new way to do business...we need to use it with our traditional business...we can access our suppliers...we can do business electronically and more efficiently".

"Accessing the Internet increases the number of customers and suppliers...dealing online is a great idea...it is cheaper, quicker and more reliable".

"It is time to do business online. e-Commerce technology is a trend and we must pursue this technology and adopt and implement it in our company...it is a global commerce tool".

"e-Commerce should go hand in hand with our traditional business...we have to follow modernization...we need to compete with other international oil and gas companies. ...Otherwise we will fall behind".

These Libyan petroleum company officials provided additional background information about the development of the Internet and e-Commerce in Libya. When asked about the current status of e-Commerce, one of the officials indicated that the Internet and e-Commerce had been developing slowly because most **LOGCs** are new to advanced technologies. His prediction was that e-Commerce adoption would take off slowly.

As to what factors had caused the development and adoption of e-Commerce, one of the managers interviewed explained how regional differences in terms of technical infrastructure and even institutional frameworks might boost e-Commerce adoption in one region but inhibit it in another. Another cited hindrance factors related to credit card payments and banking infrastructure (Jennex et al., 2004). This is obviously hindering the adoption and development of e-Commerce technology, as suggested in recent studies (Turban et al., 2004; Zwass, 2001; McGowan, 1998; Sharma and Wickramasinghe, 2004; Kamel and Hussein, 2002).

In term of the resources a firm must obtain in order to develop e-Commerce, many top managers and **CEOs** commented on the significance of technical talent and computer-competent employees in enabling the smooth operation of e-Commerce adoption. According to one interviewee, "we must have a strategy to adopt and implement e-Commerce technology...IT talent, experts, and so on". It seems that many managers are not satisfied with the technological conditions facing the **LOGCs**. Some advanced technologies have not yet been used or adopted.

Another significant e-Commerce problem relates to the lack of **IT** infrastructure and lack of a critical mass of suppliers and consumers who are e-Commerce enabled and willing to conduct transactions online. The problem of critical mass was identified by many firms. One interviewee commented that:

> "The problem we have is that we don't have the advanced technology online to run our operations with suppliers... and to create a strong base for critical mass online. Our firms are still in the developing stage of online trading. Critical mass of customers and suppliers are an important factor for those firms that primarily focus their e-Commerce activities at **B2B** or **B2C** e-Commerce"

Until a critical mass of suppliers actively using e-Commerce exists across the supply chain, the potential for e-Commerce benefits is limited (UNCTAD, 2003). This argument has been supported by some major studies and confirmed by many recent reports (Hall 2002; Beal, 2000; Turpin, 2000; APEC, 2002; and Chau and Turner, 2002).

The interviewees explained how they obtained information about the petroleum market and the competitive situation in the industry. Many interviewees mentioned that competition is not strong due to the fact that **LOGCs** are government-owned and thus competition is quite limited.

The interviewees indicated that Libyan managers as well as employees understood that technology is a more convenient way of sourcing information, particularly about global markets. However, managers and employees feel that the process would have some

inadequacies unless combined with some form of high level technical expertise. The interviewees also mentioned that there is a fear among Libyan oil and gas firms that the basic level of IT knowledge that they have might affect the adoption of e-Commerce. There tended to be an underlying concern that if managers are going to learn IT, they need to be able to understand basic IT based training programmes. Thus, there is an assumption that the electronic support mechanisms are too technical for those with low IT skills (Piper et al., 2000b).

From the interviews this is an attitude that is shared by a large proportion of the **LOGCs**. Again, there is a reluctance to use the Internet or e-Commerce for training in a number of the Libyan oil and gas companies, but these companies can foresee the potential benefits of future training being undertaken. Therefore, if Internet e-Commerce training is to be used successfully, then the approach taken in the future needs not only to be adapted to suit the needs of Libyan petroleum companies, but also to be at a level with which the **LOGCs** would be comfortable.

7.7 Conclusions

This chapter has established that the research design was adequate to answer the research question and that the most appropriate techniques were chosen. It describes the precautions that were taken to ensure that the results obtained were consistent with the precepts of the chosen methodology. This chapter has analysed the data obtained from **LOGCs** and has examined a number of potential factors that were thought to influence and determine the adoption of e-Commerce technology. The data were recorded and analysed by using different statistical techniques such as descriptive statistics, correlation, and multiple regression to try to explain the key factors that determined e-Commerce technology adoption. The proposed theoretical framework has some limitations, and therefore; care should be taken when interpreting the results and findings.

The interview findings laid part of the foundation for the study. From them broad knowledge was gained about the current status of **LOGCs**. The interviews findings are believed to support the theoretical framework proposed (see Appendix 20). However, based on the study findings, there may be some sceptics and enthusiasts regarding e-Commerce development and adoption in **LOGCs**. The next chapter provides a detailed discussion and the conclusions of the study.

CHAPTER VIII

DISCUSSION AND CONCLUSIONS

8.1 Introduction

The last chapter presented the testing of the hypotheses and analysed the results in the light of the research question asked. This chapter presents a general discussion of the study's results. This study has presented a research question investigating the factors determining the adoption of e-Commerce technology in **LOGCs**. The research began by justifying the need for such a study, describing the digital divide situation of Libya, and the unique potential of e-Commerce in helping **LOGCs** with their development. It must be admitted that the empirical study suffers from a number of limitations. Firstly, the data was collected from a single industry and in specific time period. However, it is noted that future research should obtain data from different sources. Second, the research is cross sectional in nature and care should be taken in interpreting the findings.

It should be noted that generalization may be a concern when the findings from the study are interpreted, because the data was collected from a single industry. Although the use of a single industry, as mentioned before, is more manageable and helps in controlling for difficult effects and allows in-depth and context specific information to be obtained, the current study may be challenged for its ability to generate conclusions applicable to other industries. Therefore, care should be taken when interpreting the

research findings. It is suggested that a refined design should explore issues related to e-Commerce adoption in wider contexts.

8.1.1 Summary of Organizational Level Findings

As established previously, this study proposes a theoretical framework about the factors influencing a firm to develop/adopt e-Commerce. The research framework is rooted in several streams of literature. The hypotheses were tested with a sample of 30 Libyan petroleum companies, which produced 211 respondents from **LOGCs**. This study presents a theoretical framework to explain the determinants of e-Commerce technology adoption in **LOGCs**.

The empirical findings revealed that both environmental and organizational factors had significant effects on a firm's adoption and development of e-Commerce. Consistent with the hypotheses, firm size (H_1), top management support (H_2), organizational readiness (H_3), government support (H_8), national infrastructure (H_9) all appeared to be positively associated with the firm's intention to develop e-Commerce. Thus Hypotheses 1, 2, 3, 8, and 9 were empirically supported. However, less significant relationships were found between organizational culture (H_4), perceived benefits (H_5), competitive pressure (H_6), and critical mass (H_7), and the firm's adoption and development of e-Commerce level. Therefore, Hypotheses 4, 5, 6, and 7 were not empirically supported.

These inconsistencies may be explained as follows. In the first place, organizational culture and competitive pressure appear to have little effect on firms in developing and adopting e-Commerce technology. This result is inconsistent with other studies in innovation adoption. Two explanations may be offered regarding this inconsistency. First, it may be speculated that competitive pressure influences the firm's decision making via diverse channels. Outside groups such as governmental bodies, trade organizations, and other businesses and industries should be the major sources of pressure. However, these forces may not be so powerful in the present research context. To clarify this issue, the follow up interviews were conducted with selected top managers who responded to the survey. It was revealed that most treated those organizations as merely symbolic bodies that could exert little influence over individual firms' business operations.

Nevertheless, another possible explanation about the lack of an effect of competition is that competitive pressure and the critical mass of supplier/customers are in reality, weak in the Libyan petroleum industry. Since e-Commerce is still in its early development in Libya, it is possible that competitive pressure has not gained momentum because the number of firms adopting e-Commerce applications is limited. It can be suggested that competitive pressure might not be an influential force on the adoption patterns of firms at the current stage of e-Commerce technology.

The perceived benefits were negatively related to the adoption/development of e-Commerce, which was contrary to (H_5). The questionnaire and interview data provide a

possible explanation for this inconsistency. With their low levels of understanding and awareness of the benefits of e-Commerce technology and a lack of financial resources, the managers of **LOGCs** were discouraged from trying innovative strategies more aggressively. It is argued that financial resources may reinforce enhance the managers' persistence with existing strategy, which would hence have a negative effect on the firm's adoption of e-Commerce technology.

Finally, the relationships between the top management support and the firm in developing /adopting e-Commerce was statistically significant, this consistency shows the important role of top-level management in decision making processes within a firm (Turban et al., 2004).

Since e-Commerce adoption is a highly important strategic issue, it was expected that the decision about whether or not to develop e-Commerce would be made collectively by the top level managers in most firms. In these circumstances, the **CEO**'s personal characteristics may affect the nature of the firm's decision. Another speculation is that the impact of top managers' characteristics on the firm's strategic action may be dependent on contextual factors. For example firm size and industry norms may moderate the relationship between managerial characteristics and organizational outcomes. This line of thinking is worth exploring in the future. The following discussion aims to clarify the linkage between the theoretical framework proposed in the study and the organizational level of e-Commerce adoption.

8.1.2 Organizational Development and Adoption of e-Commerce

The theoretical framework illustrated in Figure 6.1 showed a multi level of factors such as environmental, industry, innovation and organizational factors groups. These factors explained a firm's adoption/development of e-Commerce. Nevertheless, to apply the logic of innovation adoption theory it is not necessarily to measure all of the variables listed in Roger's (1995) original work. For example, the proposed theoretical model does not include the so called innovation variables such as complexity, compatibility, and relative advantage.

As explained fully in chapter V, two major considerations account for this modification. Innovation characteristics focus on such concerns as whether or not a new technology would be compatible with old technologies already used in the organization (compatibility) or whether or not the new technology is perceived as more advantageous than old technologies (relative advantage). The new e-Commerce technology, in the light of these conceptualisations, is interpreted as something complicated and not known to the organization. However, as emphasized throughout this thesis, the decision about adopting e-Commerce goes beyond technological concerns.

For most oil and gas companies, e-Commerce has introduced new challenges into the industrial and competitive landscape mainly in terms of business philosophies and strategic changes rather than in terms of technological upgrading. In other words, the variability among organizations in developing e-Commerce may be better explained by

the variations in business related issues rather than in technology related issues. Technological infrastructure is a concern, but not the only concern. Second, the above statements were supported by the empirical findings from the questionnaire responses and interviews. Therefore, as mentioned in Chapter five, the variables in the organizational level were selected on the basis of both the literature review and the findings from other studies surveyed.

Given the observed complexity in e-Commerce development, the theoretical framework proposed in the study drew upon relevant literature on the subject matter. This research is relevant because it emphasizes on the important role of intangible resources and managerial characteristics in a firm's decision to adopt an innovation. In a sense these theoretical perspectives, mainly from the management literature, complement the innovation adoption literature. They call for more attention to the strategic importance of technologies and therefore provide new perspectives for innovation adoption research.

The literature stresses the need for businesses of all sizes to fully develop market strategies before adopting e-Commerce technology (Giaglis et al., 1998; Pollard and Hayne, 1998; Turban et al., 2004). The findings from this study show that e-Commerce can be adopted by firms when a strategy is in place. It has been found that firms with fewer employees were less likely to adopt e-Commerce than larger firms Hawkins et al., 1995; Hyland and Matlat, 1997; Beveren and Thomson, 2002; DePietro et al., 1990;

Rogers, 1995; Al-Qirim, 2003; Al-Qirim and Corbitt, 2002). The data from this study support this view.

One of the objectives of this study was to investigate the factors of e-Commerce adoption within **LOGCs**. On a five point Likert scale the mean adoption is low (1.02), which shows a gloomy picture of e-Commerce adoption among **LOGCs** but consist with similar research in the developing countries of Asia, Africa, and Asia Pacific (see Appendix 15). As mentioned previously, 12.3% of organizations surveyed have adopted some kind of e-Commerce technology applications. It is further revealed that there is significant difference of business use of the Internet among firms. Although 85.8% of businesses have an Internet account, the accounts are used mainly for e-mail purposes. The findings revealed that only 1.4% of **LOGCs** use the Internet for making payments online. The study has showed that a homepage has been developed by 53.1% of the organizations, and 15.0% of the organizations either have Web servers or have the use of vendor supported Web catalogues.

The oil and gas firms that adopt e-Commerce technology will make huge gains from the global petroleum markets (Livesay, 2000; Zhida, 2000). New technologies may be harnessed by business organizations to help them to achieve competitive advantage; to transform relationships with customers, suppliers and business partners; and to redesign their industries through innovating their organizations. In short, e-Commerce can result in fundamental changes to current business practice for Libyan petroleum firms.

8.1.2.1 Organizational Factors

Organizational culture (H_4) was not a particularly significant factor in determining e-Commerce adoption. This is a unique finding emerging from this study, as it is believed that most firms lack the proper organizational structure and inertia due to the strong influence of top managers on the business firms. The findings do not provide empirical support for the previous findings of Terpsta and David (1991) and Hussain (1995) and Seyal et al. (2004). It can be suggested that this factor needs further examination to reinforce the argument about the influence of organizational culture on e-Commerce adoption levels.

One possible explanation is that in this study adopters possessed the necessary resources and ignored the influence of organizational culture in adopting innovation. Early adopters (although not directly measured) in the study could be regarded as e-Commerce initiators and could be assumed to be more active in adopting e-Commerce due to their resources and knowledge. Therefore, when adopting e-Commerce little consideration was given to organizational culture. Another reason could be that few organizations had adopted e-Commerce as an early adopter and so organizational culture could not be a viable factor at the early stage.

Another organizational factor, top management support (H_2) was found to be significant in e-Commerce adoption. The result is in contrast with the findings of Ang and Pavri (1994), Thong and Yap (1995 a, b), Seyal et al. (1999), Tan and Teo (1998),

and Seyal et al. (2003). The respondents admitted that management has a good understanding of the importance of e-Commerce, and so the responses were positive.

8.1.2.2 Environmental Factors

Previous researchers have studied the relative importance of government support (H_8) and national infrastructure (H_9) in augmenting firms' decisions to adopt new technology. Because of their importance, these factors were included in this study. Government incentives, national infrastructure and support were found to be highly significant and positively influenced e-Commerce adoption levels. The greater government incentive as perceived by an organization, the higher is the likelihood of it adopting e-Commerce. This is mainly due to dynamic governmental policies to develop and promote e-Commerce within **LOGCs**. It is obvious that **LOGCs** consider governmental involvement and infrastructure as important factors for e-Commerce adoption (see Appendices 16 and 19). These findings support those of prior studies by Yap et al. (1994), Tan and Teo (1998), Teo and Tan (2000), and Seyal et al. (2004).

The goal of the Libyan government is to encourage investment in different sectors. Introducing new advanced technologies can help the Libyan petroleum sector to gain huge economic gains. The Libyan business sector needs to increase its market reach online. For example, by adopting e-Commerce **LOGCs** would have great advantages in utilizing the global information market and capital flows, which offer business opportunities to a broad marketplace. The use of the Internet and e-Commerce opens up a universe of new business to exchange information, goods, and services.

8.1.2.3 Technological (Innovation) Factor

Perceived benefits (H_5) are not found to be an important predictor for **LOGCs**. A plausible reason for the irrelevance of this variable in firms is the lack of e-Commerce awareness and understanding. The managements of these firms do not consider the perceived benefits as an important factor in deciding on technology adoption. If the benefits are not thought to be viable they might not adopt technology. This might be due to the fact that in business organizations the decision making process is always short term (Fink, 1998). So this study does not support and follow the prior studies of Moore and Benbasat (1996) and Chwelos et al. (2001), in which perceived benefits were the most influential determinants of technology usage.

8.1.2.4 Interview Comments and Discussion

One major barrier to the adoption of e-Commerce is the lack of infrastructure to support a highly technological environment. The telecommunications infrastructure which could be used to help **LOGCs** is inadequate. Therefore, the **LOGCs** are slow to take advantage of new technologies and the potential benefits offered by e-Commerce. However, the majority of **LOGCs** are interested in the benefits of the Internet and e-Commerce, but are lacking in the necessary skills to benefit positively from the technology. This may lead to oil and gas businesses being left behind in today's Internet age.

According to the interview survey, the Internet and e-Commerce is very important to **LOGCs'** business strategy. The major potential benefits are improved services, and

reduce costs, global market reach and improved productivity. Respondents believed these to be the principal benefits of Internet e-Commerce. The present study has identified the relative advantages of e-Commerce technology compared with traditional methods of communications, such as telephones and faxes, which are used by most Libyan petroleum companies. However, to improve business communication for example, an Internet web site could reached the entire business world.

Based on the interviews conducted, the majority of **LOGCs** who participated believed that they would gain economic benefits from using the Internet and e-Commerce web sites. These **LOGCs** recognized that they could improve their services through the Internet. In the Libyan petroleum sector, for example, some of the **LOGCs** believed that e-Commerce is a competitive necessity. As a result, only a few **LOGCs** have developed an Internet web site to improve the quality of their services. These **LOGCs** have not yet adopted and implemented a good level of services using e-Commerce.

It was also found that most of the **LOGCs** are not using their web sites as a new channel to promote their products and services, but it is worth mentioning that the **LOGCs** believed that this new method is complementary to their traditional methods. The majority of the **LOGCs** are willing to engage in and implement a good level of services by using the Internet and e-Commerce. The majority of the Libyan petroleum companies felt that web sites would give the advantage of establishing electronic business with major international petroleum companies, to promote their products and services via their web sites.

The Libyan managers of most of the **LOGCs** are willing to adopt e-Commerce applications and to increase their web site usage. Beside this, they have encouraged all employees to collaborate in reading the objectives of their companies in which they support the adoption of e-Commerce. Furthermore, the managers believed that using the Internet and e-Commerce is a competitive strategy and that it is the key to achieving the strategic objectives of their companies.

Few of the **LOGCs** have a high level of **IT** knowledge. Companies have some **IT** personnel who have a good knowledge of the Internet and related technologies, and some of the companies have employees and managers who are interested in **IT** and e-Commerce. Thus, managers are encouraging the implementation of the Internet and web sites in their companies.

8.1.2.5 Other General Issues in e-Commerce

All of the companies felt that they had to present a good technological image. The **LOGCs** considered that the Internet web site is very critical to their business because of the Libyan petroleum markets position in the world, and keeping pace with the new economy is also important.

Another key element in adopting e-Commerce is to reach a global market, and thus global scope is a perceived benefit in adopting e-Commerce. Some of the **LOGCs** know that Internet technology has changed the shape of business processes, and **LOGCs** management believe that e-Commerce is a global phenomena. Global scope

can provide tremendous business opportunities to their companies. The strategy is based on the recognition that Internet applications and e-Commerce are essentially global and that the Libyan government, Libyan business organizations and industries should work together to influence the adoption of e-Commerce technology.

The study suggests that **LOGCs**, lack an innovation culture but they are interested in new technologies. The managers of the **LOGCs** are pursuing technological ideas for their companies. Because of their leadership, these managers are trying to establish cultures of innovation in their companies. Beside this, they are trying to provide technical education and awareness by using the Internet. One of the organizational elements in adopting e-Commerce is the technical knowledge within the organization. It is expected, therefore, e-Commerce adoption within an organization requires a high knowledge of technology.

The managers of the Libyan petroleum companies mentioned that financial resources are a fundamental issue in adopting and implementing e-Commerce. Financial resources may become an important issue for the **LOGCs** considering the adoption of e-Commerce web sites in their companies.

To be successful, electronic transactions must be secure. The need was also recognized for securing the transactions of other types of systems and applications such as computers, databases, secure networks, communication channels and e-mails. These facilities need to have high security standards. For **LOGCs** to be successful, they ought

to recruit a well-motivated and skilled workforce in the modern petroleum economy. The actions of managers and employees will have a major impact on the skills that they develop, on productivity in the business organizations and the whole economy. The Libyan government must encourage the fact that e-Commerce technology must take place in all Libyan petroleum organizations if they are to be successful and compete effectively.

It has emerged from the survey that there are few dynamic **LOGCs** keen to exploit all that **IT** has to offer. Although many petroleum firms use computers and are connected to the Internet, the **LOGCs** are concerned that **IT** skills level are poor and that this would be a major barrier to using **IT** based courses, workshops and seminar training. There is also a lack of awareness of the full potential that Internet, e-Commerce technology and **IT** in general can offer to company high performance. In summary, the interview findings laid part of the foundation for the study, and support the theoretical framework proposed.

In summary, e-Commerce initiatives in Libya have a good chance of succeeding. The necessary infrastructure and policy framework need to be put in place for business. The telecommunications infrastructure as well as the regulatory, and policy framework for the support of e-Commerce in Libya are of a low standard. There is still quite some way to go for Libyan petroleum firms to embrace e-Commerce paradigms. In many cases, market developments will generate competitive pressure to adopt e-Commerce practices. Getting **LOGCs** to adopt e-Commerce practices is crucial for their

competitiveness internationally in the digital economy. However, the focus must be on getting **LOGCs** which have the potential to grow to be e-enabled for business.

To sum up, there are a number of obstacles deterring the uptake of e-Commerce technology in **LOGCs**:

1. Lack of awareness of e-Commerce capabilities

Many Libyan petroleum firms are not cognizant of the enabling dimension that can be conferred by e-Commerce initiatives. The **LOGCs** operations are more of a brick and mortar nature, which again are not conducive for e-Commerce initiatives.

2. Lack of skill levels of the workforce

Many **LOGCs** do not have a highly enough educated workforce to support e-Commerce adoption initiatives. The technological expertise and skills are insufficient to allow **LOGCs** to move to e-Commerce adoption level. This is real obstacle to embracing e-Commerce in their firms.

3. Structure of LOGCs

The structure of Libyan petroleum firms is such that many are brick and mortar companies. Only a small percentage are technology oriented enough to embark upon e-Commerce initiatives. This is a major impediment in promoting e-Commerce among **LOGCs**.

8.2 Summary and Conclusions

In conclusion, this study has proposed an e-Commerce adoption theoretical framework based on the innovation adoption literature with four influential factor groups: organizational, innovation, industry, and environmental factors. This framework generated nine hypothesises which were tested within the **LOGCs** context. The results confirmed the explanatory power of environmental and organizational variables affecting e-Commerce adoption levels in **LOGCs.**

The study focused on the adoption of e-Commerce technology in the Libyan petroleum industry. For various reasons the **LOGCs** have yet not utilized the Internet and e-Commerce technology. This research was designed to investigate some of the reasons for this phenomenon. Based on the innovation adoption framework from previous innovation studies, an e-Commerce adoption theoretical framework was proposed, which includes internal factors concerned with the organization, and innovation, and external factors which include industry and environmental factors.

IT is starting to revolutionize the way business is being conducted. However, many of the **LOGCs** are slow to take advantage of these new technologies. Ironically, it is through the effective use of **IT** that the **LOGCs** could be given the opportunity to compete at the same level as international companies. In the same way that **IT** can enhance the way a company conducts its business, it can also be viewed as a great medium for introducing the latest technologies to the **LOGCs.** Some of the key Libyan petroleum companies have a high potential for e-Commerce adoption.

The findings identified in this study provide some empirical support and insight into the strengths and weaknesses found in the adoption of e-Commerce. The proposed theoretical framework has some limitations, and therefore care should be taken when interpreting the findings. The findings of this study should be beneficial to top management decision making in petroleum organizations. The next chapter will discuss the implications of the study, and offers some policy recommendations in the context of **LOGCs** and suggestions for further research.

The government of Libya has been eager to apply the emerging **ICTs** in order to join the rest of the world in the development and realization of the digital economy. In Libya, the **ICTs,** the oil and gas industries and the private sector must act as facilitators towards the adoption of e-Commerce. When the business sector starts adopting new **ICTs** in its operations, it relies heavily on local or locally available **ICTs** expertise in order to fully realize all the efficiency gains that the Internet makes possible at the level of a single firm as well as at the level of the industry.

e-Commerce technology, conducting business electronically over computer networks, has been used among industries in developing countries on a very limited scale to date. The maturing of Internet technologies and the development of Internet based e-Commerce applications have made e-Commerce much more popular technology tool for various companies because of the benefits it can bring.

e-Commerce represents a dynamic business model for the information society and an opportunity for **LOGCs** to increase competition, which will be reflected in improving the level of quality, enforcing competition, facilitating participation at the international level, increasing governmental transparency, and diffusing the use of **IT** for communicating and ordering goods and services electronically. This needs to be done through training, education and awareness creation by governments and private firms to avoid the risk of creating classes of information haves and have nots.

e-Commerce could enable Libya to develop a more open economy and increase its comparative advantage worldwide. This would helping the nation's economic development, and could provide new opportunities for penetrating international trading markets, especially for petroleum firms and for small and medium size enterprises which lack the resources enabling them to promote themselves globally.

The study indicates that Libyan petroleum firms face many obstacles with respect to e-Commerce adoption. Furthermore, it is noted that the government has an important role to play in encouraging firms to embrace e-Commerce in Libya. **LOGCs** need to be more competitive in promoting, developing and using Internet technologies. In particular the government must address the key issues of e-Commerce adoption and its potentials. Namely, they must address the areas of business infrastructure, commerce infrastructure, user infrastructure and telecommunications infrastructure. Measures should be taken to promote greater awareness of the opportunities and benefits of e-

Commerce technology for petroleum business firms, such as training and skills development programmes and the dissemination of best practice.

In addition, the government should enhance the climate for investment to attract and retain venture capital and investment in **LOGCs** with the potential for rapid growth. Also measures are needed to ensure consumer and supplier access to the Internet and to appropriate electronic payment systems, the enhancement of online protection, and the maintenance of business ethics and good business practice in e-Commerce. There is also the need to strengthen the domestic legal framework.

Systematic efforts by government and policy makers are needed to encourage the adoption of e-Commerce by firms, and at the same time to ensure that appropriate business plans are in place in order for Libyan petroleum firms to embrace e-Commerce technology. e-Commerce is critical to the long term success and sustainability of companies and it is imperative that the full e-Business potential that e-Commerce affords can be utilised and maximised.

This study has examined barriers and obstacles to the adoption of e-Commerce by **LOGCs** in Libya. Given the importance of the petroleum industry to Libya, further research is strongly urged in this area. e-Commerce holds many opportunities for Libya at the business and socio-economic development levels. With innovations in **ICTs**, such opportunities are providing more enabling environments for competition on a

global scale as well as introducing new business processes, trading communities and creating new revenue streams.

The objectives of the study have been met and a summary of the findings presented. This study contributes to the understanding of e-Commerce adoption based on the theoretical framework proposed. However, a lot more research is still necessary in this area. A framework for e-Commerce adoption (see Appendix 20) was developed to determine the influential factors in e-Commerce adoption. As innovation and enhancements in technology continue to develop, the factors of e-Commerce technology adoption needs to be more utilized. So, factors are perceived as important today may or may not be important in the formation of future of e-Commerce technology adoption.

For Libya, e-Commerce represents an opportunity to keep pace with the developed world and to leverage its developmental plans; however, there are a number of developments that need to take place to transform the above-mentioned challenges into opportunities. Such developments would have to be carried out by the government in collaboration with the private sector, and would have to be on a nation wide scale to provide a horizontal approach to development in order to avoid the creation of gaps within the community and also to be able to realize the critical mass required for a successful e-Commerce community to prevail.

CHAPTER XI

IMPLICATIONS, POLICY RECOMMENDATIONS, CONTRIBUTION OF THE STUDY, AND SUGGESTIONS FOR FUTURE RESEARCH

9.1 Introduction

The last chapter presented a discussion of the study's results in the context of **LOGCs.** This chapter presents the implications of the study results and considers policy recommendations, and offers suggestions for further research. This chapter examine the theoretical and industry implications of the findings. It also states the contributions of the study.

9.1.1 Implications of the Findings

The implications associated with e-Commerce adoption initiatives may allow firms to fully understand and appreciate the strategic, tactical and operational challenges faced when launching an e-Commerce based business. The findings from the current research have both theoretical and practical significance.

9.1.1.1 Theoretical Implications of e-Commerce Model

- ► Contribute to theory building in innovation adoption literature.
- ► Primary evidence is provided about organizational characteristics to embrace e-Commerce technology and give more attention for determining factors/variables influencing innovation adoption.
- ► Provide a body of appropriate literature, information, and statistics is provided on the nature of the technological environment in Libyan petroleum companies.
- ► Give more attention to determining factors/variables influencing innovation adoption.
- ► Help potential adopters to embrace e-Commerce innovation. Policy recommendations are suggested that will help to increase internet and e-Commerce adoption and diffusion.

9.1.1.2 Practical Implications of e-Commerce Model

- ► Provide some insight into **LOGCs** that actively plan to carry out Internet applications and e-Commerce adoption.
- ► Highlight the significance of factors adopting/developing e-Commerce technology.
- ► Provide some unique characteristics of the organizational and environmental context and how its affects the firm's move toward e-Commerce adoption.
- ► Help firms to boost and improve e-Commerce development/adoption in Libyan petroleum companies.

- Corroborate or disprove the relevance of some of the results found elsewhere as well as in identifying the factors and policy measures that are most important for Libyan oil and gas industry.
- Find out what has hindered and inhibited the development/adoption of e-Commerce technology in **LOGCs.**

9.2 Managerial Implications

This study has presented a theoretical framework to explain the determinants of e-Commerce technology adoption in Libyan petroleum companies. Based upon the results of the study, several strategies can be proposed with broad policy implications for the higher management of the various business organizations responsible for supporting and enhancing petroleum firms in Libya. These managerial implications apply at the micro and macro levels.

9.2.1 Implications at a Micro Level

At the micro level, top management should not only proactively encourage information technology **(IT)** use but should also allocate the necessary resources for the adoption of technology that are currently missing among most of the **LOGCs** surveyed. The present study indicated that managers and support staff of most **LOGCs** are not **IT** literate. Such support staff could increase **IT** awareness among top management and discourages the **IT** anxiety in using Internet applications. Along with support staff, **IT** consultants could launch various seminars and short workshops to provide extensive training to managers of the **LOGCs.** Qualified **IT** personnel should be available to the

users so that technology related problems can be resolved by providing relatively easy access to expertise.

Managers at different levels of Libyan petroleum companies also need to be trained in **IT** skills through workshops to develop their technical abilities. Such training programmes will further enhance the technological know-how of the managers. In addition, managers must also focus more on the benefits and concentrate on the crucial factors for e-Commerce adoption. A programme should be launched to identify tasks that could be beneficial to adopting business organizations and to act as role models for late and non adopters.

9.2.2 Implications at a Macro Level

At the macro level, government support and the role of various governmental bodies must be geared to enhancing efficiency and to promote e-Commerce technology within Libyan business organizations. At present the Libyan telecommunications and technology company **(LTC)** is providing support to various firms from a business point of view. The **LTC** should now revise its role and take a proactive approach rather than just subsidizing Libyan companies. Different divisions in the Libyan petroleum industry, **LTC,** both the public and private sectors, and other agencies should initiate the important role of e-Commerce technology and develop plans for their business organizations.

Currently, incentives regarding finance to Libyan firms are provided through government organizations. These governmental organizations should impose a condition on businesses to spend a reasonable amount of the available finance on setting up an **IT** infrastructure and use **IT** as a part of their business. An advisory board under the Libyan Telecommunications and Technology **(LTTC)** and the industries concerned should further monitor effective control of the resources in providing technical help and support to business organizations. It is, therefore, imperative that solution based technology at reasonable prices coupled with easy adoption, development, and implementation processes should be made available to **LOGCs.**

9.2.3 Policy Recommendations for e-Commerce Development

Policy recommendations and considerations for e-Commerce adoption and development based on the research data indicate that the level of government support and assistance is a major consideration in the adoption of e-Commerce. Two levels of support come from the petroleum industries and from the government. A number of government approaches, including education and awareness programmes, may break down the barriers of misinformation and fears over e-Commerce adoption; direct financial assistance in terms of capital funds would help e-Commerce adoption and development efforts.

9.2.3.1 Levels of Support from Industry and Government

The government is in a prime position to directly support those **LOGCs** engaging in Internet and e-Commerce, but the **ICTs** industry also plays an essential role in

providing services to companies requiring e-Commerce skills and services. The government and industry needs to promote and educate the value of e-Commerce technology to those companies that hesitate in incorporating e-Commerce applications within their businesses (Chau and Turner, 2002). The influence of government and industry can have a profound impact on firms implementing e-Commerce, and have the power to formulate policies to promote the participation of businesses in adopting e-Commerce technology.

9.2.3.1.1 The Role of Government

If the government is keen to promote the benefits of e-Commerce, it has a responsibility to ensure that businesses have access to the skills and knowledge required for successful adoption and implementation, and that they are supported by suitable infrastructures. Evans (2002) has suggested that the business environment, company characteristics and sectoral trends combined with regulatory frameworks, tackling market inefficiencies, and taking a leading role by example, lead to greater levels of understanding of the benefits and the overall net effect of e-Commerce on competitiveness. The government at all levels needs to determine how it will handle legal, infrastructure, and other trade and regulatory issues in relation to e-Commerce transactions (Iyer et al., 2002; Lewis, 2001; and D'Amico, 2001).

9.2.4 Addressing Policy Issues and Future Plans

From the study's findings and the earlier discussion, the obstacles facing Libyan petroleum firms can be categorized in terms of business infrastructure, commerce infrastructure, user infrastructure and telecommunications infrastructure.

1. The business infrastructure includes areas such as the need to raise business awareness of e-Commerce and to improve business access to the Internet and e-Commerce.
2. The telecommunications infrastructure includes, but is not limited to, the building, maintaining and support of phone line services, used by businesses.
3. The regulatory infrastructure includes how to develop an appropriate legal framework.

These elements provide a framework of e-Commerce potential for Libyan petroleum firms. Firstly, addressing these elements enable **LOGCs** to position their current status with respect to these parameters. Secondly, identifying areas that are essential to **LOGCs** in order to achieve the full potential of e-Commerce. This framework will facilitate governments efforts to address policy changes.

In order to maximise the full potential of e-Commerce, government policies will have to focus on investments in research & development **(R&D)**, attract foreign investment and educate the population. Language, awareness, education in technical skills, and

technical infrastructure are the major reasons cited for a country lagging behind in the e-Commerce race.

9.3 Policy Implications

There is a great expectation among experts and practitioners that the Internet and other forms of **ICTs** would provide developing countries with a relatively inexpensive and powerful tool to overcome some of the longstanding barriers to socio-economic development. It was hoped that poorer countries would be able to leapfrog some of the stages of development and eventually significantly narrow the gap with their counterparts in developed countries, not only with regards to telecommunications infrastructure but with respect to e-Commerce, so that they would now be capable of achieving a much wider global reach.

The growth of the Internet access in Libya is a clear vision towards bridging the digital divide. With Internet penetration, there is a tremendous potential for increasing global reach. The research results point out that technological infrastructure is one of the major barriers to increased Internet access. In this respect, recent developments in Libyan **ICTs** narrowed the gap in infrastructure penetration levels in comparison with other developing economies.

9.3.1 The Role of the Private Sector

One obvious policy is to provide greater incentives for the private sector to invest in the Internet. This can offer the best prospect of removing some of the infrastructure

obstacles. The Internet has the ability to transform large parts of the developing world where in the past costly infrastructure investment would have been required. Further policy in liberalizing the telecommunications sector would promote a competitive environment in Internet business. This is an essential component of any strategy to increase Internet penetration and e-Commerce usage.

This research provides evidence that competition is the most effective government policy for increasing Internet penetration and e-Commerce adoption and usage. This implies that telecommunications reforms should focus on providing a competitive environment for the telecommunications and petroleum sectors. Consequently, the further elimination of monopolies which are still prevalent in the telecommunications sector in Libya, should be a priority.

The most significant challenge facing Libya is how to harness the power of the Internet and other **ICTs** to improve infrastructure, and to increase access and usage. The government needs to provide the appropriate policy context by reducing costs and equipment and lowering barriers, where appropriate to encourage growth in the telecommunications sector as well as providing access to schools, businesses, workplaces, public places, community centres and industries for those who may need some type of support.

The Libyan government, private sector and non profit organizations will also have crucial roles to play in facilitating increased access to the Internet. The role played by

these different sectors and the policies that are put in place, will determine the success or failure of the Internet and e-Commerce penetration. Libya is trying to increase access to and use of **ICTs** and is in the fortunate position of being able to take advantage of the experiences of European countries, from both economic, and regulatory perspectives. Their experience has shown that Libya will have to adopt policies and strategies that promote the following:

1. Investment in telecommunications infrastructure.

2. Broader, faster, and low cost access to the Internet.

3. Training for users and educators.

4. Access to more local content.

5. A more competitive regulatory framework.

International organizations such as the World Bank, United Nations, International Telecommunications Union **(ITU)**, Arab League, African Union, and Arab Advisors Group, and Arab and African governments and other non governmental agencies that are very influential in the region are in a unique position to define the policy agenda. Given the resource commitment that will be required to make a widespread impact, these international organizations will need to provide strong technical, financial and infrastructure support.

9.3.2 Government Recommendations

The Libyan government can play an important role in ensuring that the main stakeholders are fully involved in promoting e-Commerce. Successful experiences have shown that the establishment of an entity at the highest level of government that includes all stakeholders is a key element of an e-strategy. e-Commerce and **ICTs** development is a multidimensional issue, and the design and implementation of effective e-Commerce technology require the involvement of all parties, including high-level government representatives, business organizations, civil society, non governmental agencies, the private sector and consumers. If possible, the Libyan government should follow other governments by adopting e-Government practices.

Despite the important role of the Libyan government in initiating and implementing e-Commerce technology, in the end much of the required investment needs to come from the private sector. Previous studies have shown that the private sector has been the most innovative player and the major driving force behind e-Commerce and **ICTs** development (Corbitt and Al-Qirim, 2002; UNCTAD Report, 2003). In general, the market is more efficient than government in deciding the modalities of applications of technology to business activities; however, an e-Commerce strategy that combines public intervention with private sector initiative in a mutually supportive manner is the only viable one. The following policy recommendations should encompass the most important elements for promoting e-Commerce.

1. Access and infrastructure

A key priority for Libya is to ensure that citizens and business organizations of all sizes have access to the Internet at reasonable cost. This means that the government in cooperation with other actors must:

- Increase access to computers and wireless Internet devices.
- Improve the quality, and prices of telecommunications services.
- Ensure that telecommunication services and access are available.
- Establish electronic payment gateways and platforms.
- Ensure secure hosting internet data centres.

2. Awareness Building, Training and Education

Unless businesses and consumers are educated about the opportunities and benefits offered by **ICTs**, and unless they are trained to use the Internet, and e-Commerce will not take off. While access to computers and the Internet is essential, it is not enough. It is equally vital to create a demand for the new technologies and for e-Commerce. The following measures and initiatives are important:

- The government must encourage the demand for digital information exchange by providing information and services online, and for communications with citizens and business organizations in all sizes in different sectors and industries.
- Education and training should be provided in the effective use of new technologies.

- Teachers, staff, employees, and managers should be trained in order to improve Internet access and computers in schools, work places, community based centres, etc.
- The government must be the pioneer of the use of **ICTs** in operations such as customs, and taxation in all areas in business society.
- Software engineers, programmers, and other technical specialists should be educated, as well as business people with **IT** skills.
- High-skills professional **ICTs** training programmes should be offered by universities and technical colleges.
- The government should cooperate with the private sector, an international organizations in providing specialized training, and mentoring programmes.

9.3.2.1 Sector Specific e-Commerce Policies

A number of different policies related to trade, investment and the development of specific industry sectors could be considered, such as changes in trade policies, developing the domestic **IT** industry of Libya, and offering investment incentives to **IT**-related businesses:

- Lowering import tariffs on computers, hardware and software, which are important inputs in the domestic **IT** industry.
- Sectoral policies aiming at strengthening the use of **ICTs** and e-Commerce in petroleum sector where Libya has a comparative advantage.

- Policies to attract foreign capital for the development of domestic IT-related industries, such as: general purpose software, Internet content, specialized software for local markets, and similar IT related services.
- Policies and programmes that support the private sector in using ICTs and e-Commerce, such as: financial aids to use the Internet, and e-Commerce applications, and the development of Web sites.

9.3.2.2 Legal and Regulatory Aspects

Legislation should aim at providing legal security and technological and commercial neutrality, as well as removing barriers to accessing and using e-Commerce and to the free movement of e-Commerce:

- Ensure that online transactions are legally valid and enforceable.
- Enact legislation in the field of data protection and information privacy.
- Enable on-line resolution of commercial disputes in the context of e-Commerce.
- Enforce intellectual property rights, and those of copyrighted work.
- Enact legislation pertaining to IT security and computer crime.
- Issue guidelines and code of conducts for good practices in e-Commerce.

9.3.2.3 International Support for e-Commerce

In relation to Libya, the international community could play a supportive role in efforts to develop and implement national and regional e-Commerce strategies:

- All major industries, organizations, and agencies should review their policies with the objective of mainstreaming **ICTs** and e-Commerce in their development programmes.
- National and regional e-Commerce strategies should be used to identify priority areas for international support.
- **ICTs** and e-Commerce need to be utilized within a development framework that would maximize its socio-economic benefits, including the positive effects of the new technologies on public health, poverty reduction, the redress of gender imbalances and democratic governance.
- The creation of regional networks enabling the countries to share similar challenges and socio-economic backgrounds to exchange experiences.
- Consider ways for Libya to participate in international fora where e-Commerce, **ICTs** policies and regulatory issues are discussed.

9.3.2.4 e-Commerce Strategy Perspective

e-Commerce raises a number of issues and actions which require synchronized and parallel measures taken by Libyan government, institutions, and the private sector. An overall division of responsibility for e-Commerce promotion in Libya could be based on the following:

- As in traditional business, the private sector should provide leadership for the growth and development of e-Commerce, including the establishment of

reliable and trusted business practices for conducting commercial activities in the digital age.

- The Libyan government should create a favourable environment for open and fair participation in e-Commerce, supporting business dealings that are in harmony with generally accepted international commercial practices.
- The Libyan government should support technological service and infrastructure developments that will lead to the establishment of global interconnectivity and interoperability.
- The legal system of Libya, and international agreements between nations, should, if necessary, be adjusted to accommodate e-Commerce.
- Education and training should be initiated to increase information and computer literacy among all citizens, as well as research and development in the domain of ICTs.

9.3.2.5 Encouraging the Adoption of e-Commerce

The following measures could be undertaken by Libya. In particular the government should address policy issues to encourage the adoption of e-Commerce technology.

9.3.2.5.1 Improving Information Infrastructure

The government should promote an open and competitive telecommunications industry in the country. The lack of poor telecommunications infrastructure in Libya generally makes e-Commerce a lot more difficult. The government should take special measures such as encouraging competition in the telecommunications industry, reducing ISPs

connection and communication costs, and developing and improving access to the Internet. The government should take measures toward improving and enhancing the development of the information highway and supporting the telecommunications infrastructure. Since Libya does not have electronic payment system infrastructure in place, government and financial institutions need to initiate the steps to increase credit card penetration among businesses and consumers and to develop the legal framework to support the acceptance of credit card transactions.

9.3.2.5.2 Raising Business Awareness of e-Commerce

A key factor influencing the adoption and use of e-Commerce by firms is increasing the awareness and understanding of the benefits and opportunities the e-Commerce can offer (Liedholm and Mead, 1998). Measures to increase awareness of the relevance of e-Commerce to the firms' business and of the capacity of e-Commerce technology to help increase customer and supplier services, competitiveness, productivity, and market access are thus important.

9.3.2.5.3 Improving Business Access to the Internet

Deregulation of the telecommunications industry will be important in lowering costs and increasing physical access to areas outside major cities. The government has to ensure that steps are taken to improve business access to the Internet. Libya has limited penetration of **ISPs** hosts and Internet applications among firms, perhaps due to restrictions such as the high cost of connection and limited access points. The government, industries, agencies, and other stakeholders have to promote and initiate

awareness campaigns, programme education and training in firms, and convince them that greater opportunities exist for firms if they were engaged as a part of the larger e-Commerce business network. There may be the need to establish development centres and to create business access centres.

9.3.2.5.4 Enhancing Government e-Commerce Use and Services

The government needs to improve its own services on the Internet, such as information products, advisory services, and business networking facilities, to increase the adoption and use of e-Commerce technology (UNCTAD, 2003; Turpin et al., 2004; and Beal, 2000; and Hall, 1995).

9.3.2.5.5 Enhancing the Competitiveness of Firms through Innovation

The enhancing of competition among firms is developed through awareness and understanding of innovation. The **LOGCs** need to develop an outline of competitive policies in order to gain a competitive advantage in the petroleum markets. The point of this policy oriented study is that innovation is a good thing (both on regional and organizational levels). The motivation for the present research arose from a practical problem: firms need suitable opportunities to assist them in adopting e-Commerce technology, not least because of the way that e-Commerce enables firms of all sizes to compete with and outmanoeuvre market dominants, and facilitates the radical transformation of both technical and business operations.

9.4 Contributions and Future Research

9.4.1 Summary

There are a number of limitations that must be considered in this study. The generalizability of these results across **LOGCs** needs to be carefully considered. The data presented in this study concerns the adoption of e-Commerce and the management of **LOGCs** in terms of the relevance of policies directed towards e-Commerce adoption. In conclusion, the most desirable outcomes for Libyan petroleum firms in adopting e-Commerce will be achieved only if appropriate public policies are introduced. It is the design, implementation, and evolution of these policies that is the real challenge facing policy makers. Clearly, further research needs to be undertaken on the issues raised.

The main objective of this study is to examine the adoption of e-Commerce technology; the study hypotheses that various factors may or may not facilitate or hinder the adoption of e-Commerce in **LOGCs**. It should be noted that this study was conducted on a single industry. The findings were derived based on the proposed theoretical framework. The findings provide some insights into decision-making mechanisms at organizational levels with respect to e-Commerce adoption/development.

The introduction of an innovation into a social system will be viewed in different ways by potential adopters in business organizations. Some organizations may readily accept the innovation while others may hesitate or even reject it. Both academic researchers

and business practitioners are interested in understanding these differences. A whole body of literature has been devoted to the objective of identifying which factors affect a firm's acceptance or rejection of innovations.

9.4.2 Contribution of the Study

The contribution of this research is to determine the factors that influence the development/adoption of e-Commerce technology in **LOGCs**. The petroleum industry is critical to the Libyan national economy and to the thousands of employees and managers of this industry. e-Commerce and other technical innovations have been changing the framework that govern the operations and profitability of this industry over the past decades.

The current study contributes to academic and practical research in several respects. Theoretically, the research addresses the timely issue of e-Commerce adoption. Unquestionably, e-Commerce represents a radical innovation in both technological and commercial sense. Innovation adoption and technology acceptance have been important research topics, but few empirical studies have investigated why firms would accept or reject e-Commerce adoption. This research was intended to fill this gap. Moreover, the research investigates the factors affecting organizational decisions about adopting e-Commerce. Most previous studies in the e-Commerce environment were conducted in the Western countries (developed economies) and studies in other settings are limited in number. The current research was conducted in Libya which is a developing nation, and hence enriches the empirical literature in this field.

The current research findings also have significant implications for e-Commerce practices. This study has explored Libyan petroleum companies that actively plan to carry out e-Commerce adoption. Largely consistent with prior findings in innovation research, the findings from this study have some unique characteristics. For instance, although top managers seem not to be directly associated with firms adoption levels; their perceptions of the organizational and environmental context do affect their firm's move towards e-Commerce adoption. The findings of this study have significant implications for managerial practices related to e-Commerce. For example, the effect of petroleum markets highlights the importance of petroleum firms worldwide and their concerns regarding the adoption e-Commerce decision.

9.4.2.1 Contribution to theory

1. e-Commerce is very different from other innovations in **IT**, in that it requires an organization to change its way of doing business by thinking of the whole picture of the business process rather then focusing on the company itself. In turn, e-Commerce requires a radical change in both technological and business approaches
2. This research study attempts a close examination of the factors determining e-Commerce adoption among **LOGCs**. A significant contribution is its attempt to broaden and deepen e-Commerce research and to explore the relationships between factors influencing the adoption levels of e-Commerce in **LOGCs**.
3. A theoretical framework has been developed to investigate e-Commerce adoption within **LOGCs**. The theoretical framework is built from the existing

literature and adds to the body of knowledge in the area of e-Commerce technology adoption.

4. Expanding the knowledge of adoption and diffusion literature on organizational adoption, and addressing the relationship among various factors and e-Commerce adoption level within the organization.

9.4.2.2 Contribution to Education and Knowledge

The significant contribution is toward education and knowledge of e-Commerce technology in the petroleum industry area needed to represent the trends of the industry. The business environment is changing significantly, and educators need to be aware of new industry trends, and to take a leading role in theory building to provide practitioners with both current industry facts and practices and a theoretical framework for further understanding, and to provide up to date knowledge and training to employees, managers, and students. Education can further existing e-Commerce research by strengthening the awareness and understanding of e-Commerce adoption in a specific and distinctive industry such as of **LOGCs**.

9.4.3 Suggestions for Future Research

The main objective of this study is to examine the adoption of e-Commerce technology in **LOGCs**. The findings indicate several promising future research directions. At the organizational level, future work might be done in four areas.

Firstly, the study focused on the Libyan petroleum industry. It will be interesting to investigate how firms in other industries respond to e-Commerce adoption/development. This may lead to new insights into the adoption of e-Commerce from other industries. Future surveys should be conducted in other industries to determine if the results obtained in the research are comparable to those in other industries.

Second, process-based theoretical perspectives and longitudinal research designs will be useful techniques in future research. For example, it will be interesting to explore how cultural, environmental and organizational determinants change over time and how these determinants interact with one another and jointly influence organizational decisions. Thirdly, future research should be conducted to broaden the coverage of the hypotheses with different factor groups. Finally, a promising research direction would be to refine the explanatory framework about innovation adoption. This would facilitate a better understanding of the key components of adoption factors.

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APPENDICES

Appendix 1

The Real GDP at Constant Prices (LD mn dinar)

Economic Sectors	1995	2000	2004
Agricultural, Forestry & Fishing	1443.9	1546.5	1383.7
Oil & Natural Gas	2000.7	3254.1	4528.1
Mining & Quarrying	156.9	215.4	309.6
Manufacturing	872.8	944.0	690.6
Electricity, Gas & Water	254.5	269.3	336.4
Construction	537.5	737.7	1105.4
Trade, Restaurants, & Hotels	1670.3	1965.9	1987.6
Transportation & Communication	1174.1	1275.8	1504.3
Finance Ins. & ownership of Dwellings	445.0	476.0	373.9
Ownership of Houses	469.0	507.2	525.2
General Services	1204.3	1238.7	1235.0
Education services	901.2	926.9	873.3
Health services	474.8	488.4	490.7
Other Services	380.9	439.9	401.2
GDP Distributed between:	**11985.9**	**14285.8**	**15736.0**
A) Oil & Natural Gas	2000.7	3254.1	4528.1
B) Non Oil economic activities	9985.2	11031.7	11207.9

Source: Secretariat of Planning, Tripoli, Libya 1996; Libyan Central Bank, Tripoli, Libya, 2002; Libyan Central Bank, Tripoli, Libya, 2004.

Appendix 2

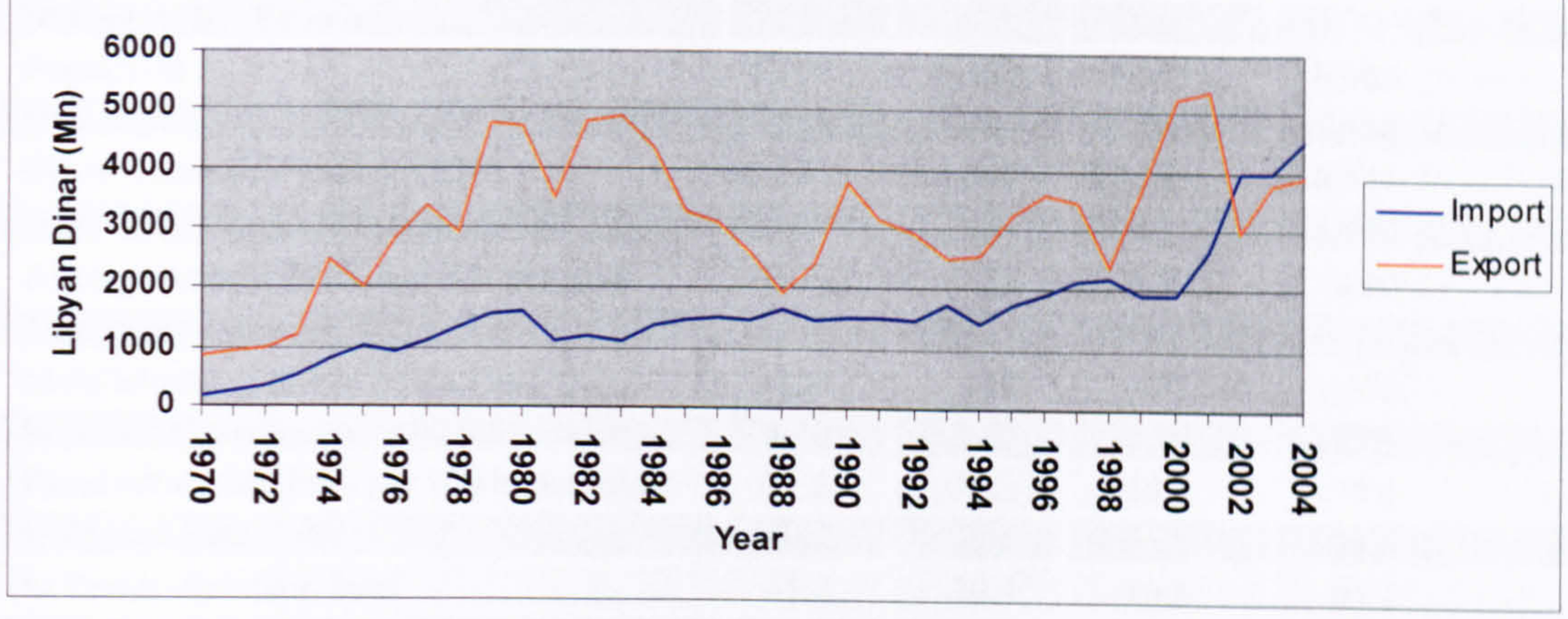
The Size of Employment in Libyan Economy 1990-2004 ('000 of workers)

Economic Activity	1990	2004
	Number	Number
Agricultural & Fishing	219.5	225.1
Oil & Natural Gas	20.5	22.8
Mining & Quarrying	10.5	11.9
Manufacturing	128.5	141.8
Electricity, Gas & Water	35.5	32.9
Construction	171.5	174.7
Trade & Hotels	73.5	64.8
Transportation	104.0	113.2
Finance Ins.	22.0	25.1
Ownership of Houses	112.5	114.6
General Services	183.0	186.0
Health Services	68.0	65.1
Education Services	76.0	76.1
Total Employment	**1224.0**	**1323.7**

Source: Libyan Central Bank, 2004; Libyan Secretariat of Planning, Tripoli, Libya, 2004. Although no official figures are available, unemployment is thought to be around 30%, and is believed to be particularly acute among young people. Nevertheless, Libya, like many oil rich countries, imports a substantial number of foreign workers for both skilled jobs and manual labour that as in some other rentier states, the local population is unwilling, or unable to do. Estimates indicate that the government employs up to 70% of all salaried Libyans.

Appendix 3

Libyan Import and Export during 1970-2004. (LD Mn)



Appendix 4

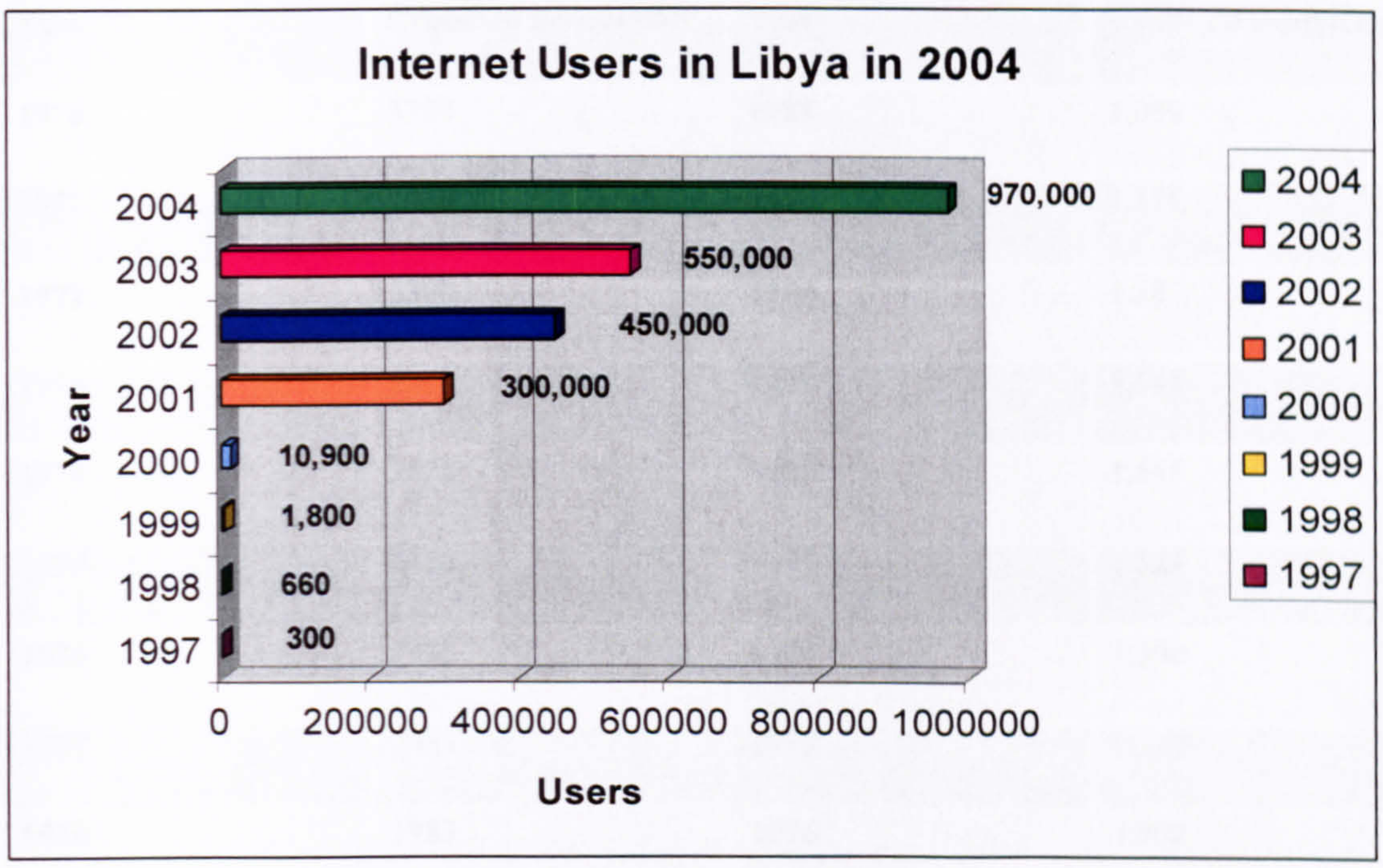
Libyan Telecommunications Indicators (1990-2004)

Indicator	1990	1995	2000	2004
Demography, Economy				
Population	4,200	5,408	5,605	6,000
Households	455	730	830	1,538
Gross Domestic Product (GDP)	8,521	10,680	17,395	30,541
Gross Fixed Capital Formation (GFCF)	1,000	1,245	2,281	5,100
Average Annual Exchange rate per US$	0.21	0.35	0.50	0.90
Telephone Network				
Main telephone line in operation	125	318	605	1,270
Main telephone line per 100 inhabitants	4.10	5.88	10.79	19.05
Residential main lines per 100 households	21.2	38.3	60.4	70.6
% Digital main lines	30.4	39.5	55.8	65.3
% Residential main lines	45.2	70.4	80.6	94.7
Public payphone	190	250	350	500
Waiting list for main lines	130	230	380	650
Mobile Services				
Cellular mobile telephone subscribers	0	100	40,000	400,300*
Digital cellular subscribers	0	1100	10,000	61,000
Cellular subscribers per 100 inhabitants	0.12	0.16	0.71	4.30
Other Services				
Telex subscribers	1,420	2,608	2,900	3,500
Staff				
Full-time telecommunication staff	7,100	10,267	12,329	13,000
Information Technology				
Internet hosts	0	1	2	7
Internet users	0	390	10,190	970,000*

Sources: www.ajeeb.com, www.dit.com Group, Libyan Technology and Telecommunication (LTT), http://www.nua/surveys/how-many-online/africa.html, e: *Estimation by LTT, http://www.lttnet.com/, Information & Communication Technologies (ICTs) Telecommunications, Internet and Computer Infrastructure in Africa, http://www2.sn.apc.org/africa/countdet.CFM?countries__ISO_Code=LY,

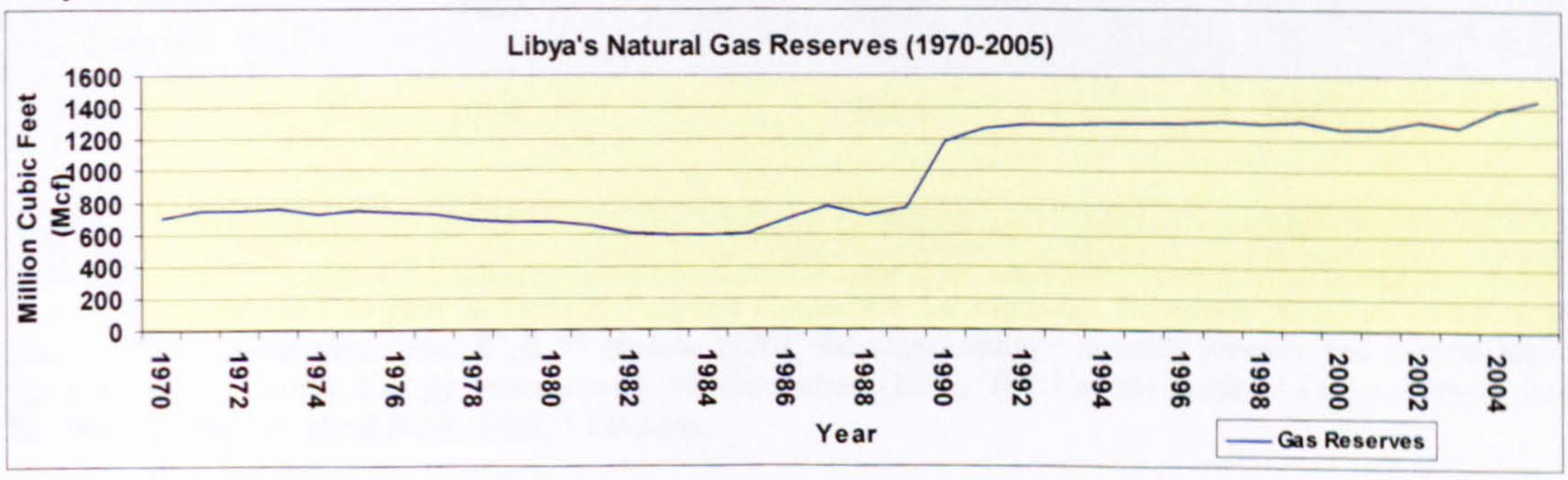
Appendix 5

Internet Users in Libya 2004



Appendix 6

Libyan Natural Gas Reserves (1970-2005)



Appendix 7

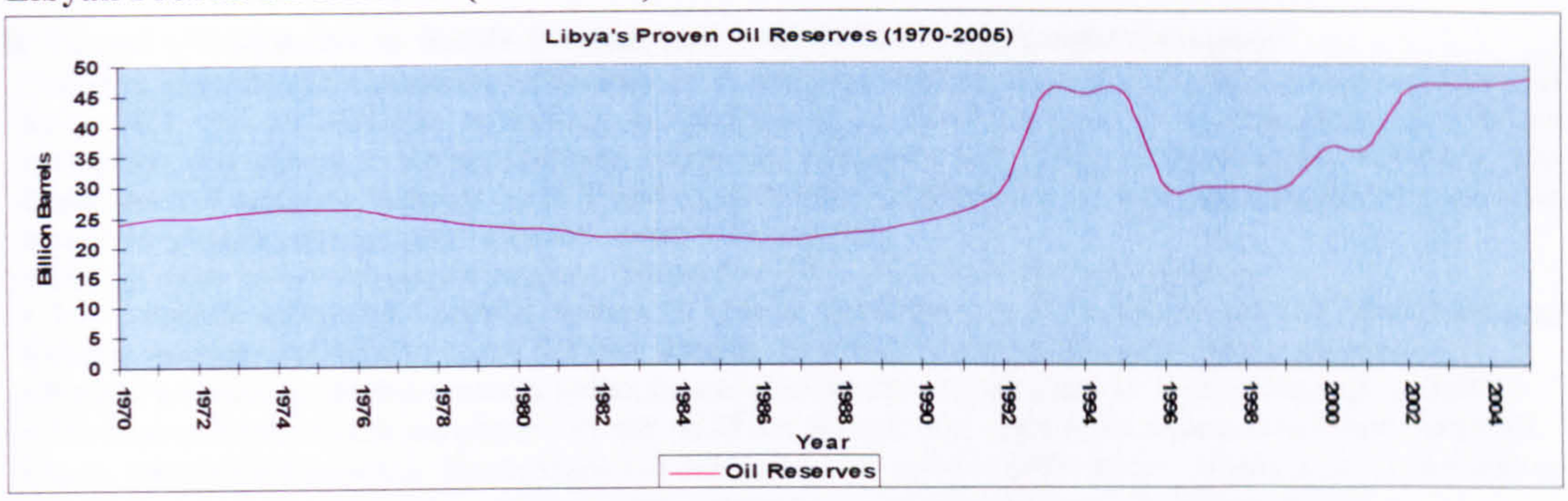
The Stages of Libyan Crude Oil Production 1970-2005 (mn b/d)

Year	Crude oil production	Year	Crude oil production
1970	3300	**1988**	1.059
1971	2800	**1989**	1.115
1972	2300	**1990**	1.38
1973	2200	**1991**	1.648
1974	1521	**1992**	1.545
1975	1480	**1993**	1.385
1976	1933	**1994**	1.390
1977	2063	**1995**	1.399
1978	1983	**1996**	1.502
1979	2092	**1997**	1.528
1980	1827	**1998**	1.207
1981	1109	**1999**	1.322
1982	1017	**2000**	1.392
1983	1030	**2001**	1.395
1984	957	**2002**	1.328
1985	1024	**2003**	1.534
1986	1034	**2004**	1.645
1987	973	**2005**	1.685*

Sources: National Oil Company & General People's Committee for Planning, Economic & Social transformation plans, OPEC General Secretaries 8th & 9th reports, OPEC the organisation's monthly journal, The Libyan National Oil Corporation (NOC), Energy International Administration (EIA), The Central Bank of Libya, various issues. *Estimates: Libyan Central Bank, 2004, * Estimate.

Appendix 8a

Libyan Proven Oil Reserves (1970-2005)



Appendix 8b

Libyan Gas Production, Oil and Gas Reserves ('000 metric tons)

Year	Gas Production m^3	Oil Reserve bn b/d	Gas Reserve bn m^3
1973	15931	25.5	764.2
1975	13834	26.1	744.8
1977	19996	25.0	728.2
1979	23456	24.3	685.0
1980	20380	23.5	680.0
1981	12700	23.0	674.0
1982	13100	22.6	657.0
1983	12500	21.3	-----
1984	12350	21.2	601.0
1985	450.5	21.3	606.0
1986	371.5	21.0	-----
1987	395.1	21.0	788.0
1988	306.7	22.0	728.0
1989	354.4	22.0	728.0
1990	360.7	23.2	734.5
1991	355.6	25.9	737.9
1992	371.4	26.4	747.2
1993	410.9	27.3	685.0
1994	478.2	27.3	680.0
1995	560.7	27.3	674.0
1996	588.6	29.1	657.0
1997	558.0	29.1	664.9
1998	441.0	29.0	727.3
1999	482.5	29.0	766.2
2000	490.2	29.0	788.0
2001	486.2	29.0	728.0
2002	464.3	29.5	728.0
2003	493.4	36.7	734.5
2004	545.4	36.1	800.2

Source: OPEC Secretary's General various Annual Reports, OPEC monthly reports, 1989, and 1990; Libyan Central Bank various issues, Libyan National Oil Corporation various reports and issues, 2004. Libyan Central Bank, Economic Bulletin, Research and Statistics Department, vol. 44, 2004.

Appendix 9

ICTs and e-Commerce in Saudi Aramco and Libyan Umm al-Jawabi Company

This is an example of e-Commerce technology in oil and gas company. Besides the Internet Petroleum Products Sales, ICT and e-Commerce technology is fundamental to Saudi Aramco in a wide range of business operations, and critical to the productivity, reliability, efficiency and safety of the company activities. The dependence of company business on ICT and e-commerce will become even more pronounced over the next decade (www.saudiaramco.com). Here are some of the trends:

- The corporate self-development program, initiated in 2001, relies heavily on the Intranet.
- The corporate Integrated Learning System is heavily dependent on IT solutions such as computer-based training, Internet- and Intranet-based distance learning, and desktop and room-based video conferencing.
- Process automation enhancements in refineries and other plants include many ICT solutions such as SAP.
- The Hawiyah and Haradh gas plants will rely on IT for exchange of operational information (Saudi Aramco).
- In its international activities, Saudi Aramco is deploying ICT solutions that gather, organize, share and deliver information, and automate many routine business processes to achieve productivity improvements.
- The quest for new hydrocarbon resources, as well as their production and reservoir maintenance, require computer simulation modelling, visualization centres and improved plant operations through ICT solutions.
- Electronic commerce is being developed to streamline purchasing operations and reduce costs.
- All of the company's business lines consider the Internet and Intranet as vital business information and knowledge-sharing tools for enhancing productivity and efficiency (www.saudiaramco.com).

Example of Umm al-Jawabi Oil Services Co. Ltd.

The Jawaby Oil Services Co. offices in London (UK) was set up by the Notional Oil Corporation in 1983 to take over certain functions that had been performed by the home offices of the original foreign owned oil companies and consortia. The Jawaby Co. also provides additional external services, appropriate to the changing role of the oil and gas industry in relation to Libyan national life. Umm al-Jawaby's vision is to connect and conduct business electronically, more so, automatically within the electronic framework. The Internet provides a way of developing secure business to business (B2B) communication links and processes without establishing and maintaining a private communication network.

Umm al-Jawaby's client connectivity:

1. **Strategy**
   a. Employ the Internet in the most cost effective ways of conducting business electronically
   b. The strategy is based on international standards for information exchange
   c. Web based services are a result of the strategy
   d. Jawaby will be promoting the strategy and solutions to clients.
   e. Develop and maintain an agreed sector wide approach.
   f. Develop standards based information exchange: secure data transfer and access, data format: secure HTTP transfers (SHTTP); Internet browser (IE or Netscape); XML data format and language to transfer information.
   g. Decrease timelines for reporting and queries
   h. Reduce transmission times for all information transfers.
   i. Cut transmissions costs.
   j. Significantly reduce the elapsed time in the supply chain process.
2. **Issues**
   a. The business processing requirements of the clients.
   b. The communications infrastructure constraints at the margins of the network, more specifically the ability of clients to reliably connect to any communications hub.
   c. An examination of alternate technology platforms that may be able to provide the functionality.
3. **Jawaby eBusiness services**
   a. Services: Web mail accounts; File transfer
   b. Newly launched services: eReports; eQuerries; eRequisitions
   c. Jawaby establishes accounts for authorised users
   d. Access to information is controlled by the logon
   e. Security is managed by Jawaby
   f. Jawaby secure eBusiness services: Extranet; Jawaby eRequisitions applications

Appendix 10

Predicting the Future of Petroleum Industry and e-Commerce Technology

	1990s	2000s and the Future
Communications	Fax, email, and phones	Wireless, voice recognition, unified messaging
Web Access	PC-Server centric	Proliferation of devices connected to the web
Meetings	Expensive travel	Online video conferencing
Foreign Languages	Manual translation	Electronic translation
Organizational Structure	Most functions are internal	Much greater use of outsourcing
Software	Licensed / installed in house	ASP services with a monthly fee
Training	Travel / central location	Online live training sessions with Q&A
Staffing	Full time employees	Greater use of "free agents"
Knowledge Management	Rudimentary	Massive databases with far better search engines
Risk Management	Expensive Software	Online ASP services and tools
Invoices	Paper, fax, mail	Online using XML
Bank loans	Personal marketing	Borrower submits request, banks bid online
Trading and hedging	Exchanges, some online	Much larger online marketplaces
Cars and trucks	Some have GPS	Most will have voice internet and GPS
Equipment Procurement	RFP's (fax & phone)	Online Catalogs and automated RFP's
Collaboration	Phone or meetings	Online collaboration among teams worldwide
Personal Computers	1,000 mhz	5,000 mhz or more
People with Web Access	350 million worldwide	Our guess, 1 billion

Source: Management of Oilfield Capital, www.oilfieldcapital.com, accessed July, 2003.

Appendix 11

Middle East Internet Usage and Population Statistics, 2000-2005

MIDDLE EAST	Population (2005 Est.)	Usage, in Dec/2000	Internet Usage, Latest Data	Use Growth (2000-2005)	Penetration (% Population)	(%) of M.E.
Bahrain	707,357	40,000	195,700	389.3 %	27.7 %	1.1 %
Iran	68,458,680	250,000	4,800,000	1,820.0 %	7.0 %	24.8 %
Iraq	26,095,283	12,500	25,000	100.0 %	0.1 %	0.1 %
Israel	6,986,639	1,270,000	3,040,000	139.4 %	43.5 %	15.7 %
Jordan	5,788,340	127,300	457,000	259.0 %	7.9 %	2.4 %
Kuwait	2,530,012	150,000	567,000	278.0 %	22.4 %	2.9 %
Lebanon	4,461,995	300,000	500,000	66.7 %	11.2 %	2.6 %
Oman	2,398,545	90,000	180,000	100.0 %	7.5 %	0.9 %
Palestine (West Bk.)	3,997,861	35,000	145,000	314.3 %	3.6 %	0.7 %
Qatar	768,464	30,000	140,800	369.3 %	18.3 %	0.7 %
Saudi Arabia	21,771,609	200,000	1,500,000	650.0 %	6.9 %	7.7 %
Syria	18,586,743	30,000	610,000	1,933.3 %	3.3 %	3.1 %
Turkey	73,598,181	2,000,000	6,000,000	200.0 %	8.2 %	31.0 %
United Arab Emirates	3,750,054	735,000	1,110,200	51.0 %	29.6 %	5.7 %
Yemen	19,600,009	15,000	100,000	566.7 %	0.5 %	0.5 %
TOTAL Middle East	**259,499,772**	**5,284,800**	**19,370,700**	**266.5 %**	**7.5 %**	**100.0 %**

NOTES: The Middle East Statistics were updated on March 24, 2005. The demographic (population) numbers are based on data contained in world-gazetteer.com. The usage numbers come from various sources and are consolidated here, see the site surfing guide. The most recent usage information comes mainly from the data published by Nielsen//NetRatings, ITU, and other reliable sources. For growth comparison purposes, the usage data published by ITU for the year 2000 is furnished. Data may be cited, giving due credit and establishing an active link back to InternetWorldStats.

Appendix 12

Internet Usage Statistics for Africa and Population Stats, 2005

AFRICA REGION	Population (2005 Est.)	Pop. % in World	Internet Users, Latest Data	Use Growth (2000-2005)	Penetration (% Population)	% Users in World
Total for Africa	900,465,411	14.0 %	**13,468,600**	198.3 %	1.5 %	1.5 %
Rest of the World	5,511,601,774	86.0 %	**875,212,531**	145.5 %	15.9 %	98.5 %
WORLD TOTAL	**6,412,067,185**	100.0 %	**888,681,131**	146.2 %	13.9 %	100.0 %

NOTES: Internet Usage and Population Statistics for Africa were updated on March 28, 2005. Population numbers are based on data contained in gazetteer.de. The most recent usage comes mainly from data published by Nielsen//NetRatings , ITU , and other local sources. Data on this table may be cited, giving due credit and establishing an active link back to Internetworldstats.com.

A Survey Questionnaire on the Development of e-Commerce Adoption in the Libyan Oil and Gas Industry

Questionnaire Supervised by
Dr. Barrie Craven
Dr. Richard Li-Hua

Prepared by
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2003/2004

Great Learning Great Experience Great Future

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Dear Sir/Madam,

I would appreciate it if you are willing to participate in a project to assess the e-Commerce adoption and the use of the Internet in Libyan oil and gas industry. The aim of this survey is to seek your views about issues related to your organization and also to identify your organization's capabilities and readiness for the use of Internet and e-Commerce technology.

Your views are **very** important. They will provide the researcher a greater understanding of organization for e-Commerce adoption and development. It will also provide valued feedback to assist your organization in its plans for continued improvement in the topics addressed in the survey.

Complete **confidentiality** is assured as the questionnaires will be coded and analyzed anonymously. Please answer all the questions by following the brief instructions given at the beginning. If you would like to add any additional comments on particular questions or the questionnaire as a whole, feel free to do so.

There are no right or wrong answers to the questions in this survey. What does matter is that you give your honest opinion in answering each of the statemenets. Even though it may be hard to decide for some of the statements, please be sure to answer all the questions and remember that it is your honest opinion that matters.

The usefulness of the research depends upon the number of completed responses received.

Thank you very much for participating in this study.

Yours Sincerely,

Mr. Khaled El-Mnawi
Ph.D Research Candidate
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Dear Sir/Madam

I am writing in my capacity as supervisor of Khaled El-Mnawi to kindly ask if you would participate in his PhD research project to explore and assess e-Commerce technology adoption, development and the use of the Internet in Libyan oil and gas industry.

Your participation in this matter is greatly appreciated and of the utmost importance to Khaled's research programme. All responses will be dealt within a confidential matter.

Thanking you in anticipation of your support.

Yours sincerely,

Dr Barrie Craven
Reader in Public Accountability/
Programme Leader in Research and Development
Newcastle Business School

Newcastle Business School

Appendix 13 Research Questionnaire

Please Note:

1. This questionnaire is concerned with e-Commerce technology adoption in Libyan Oil and Gas Companies.
2. Even if your organization has not yet embarked on any Internet and e-Commerce initiative, the researcher would still like to know your opinions. In order to fully understand the current Internet and e-Commerce usage and management practices, the researcher needs responses from a broad spectrum of organizations.
3. This questionnaire has 3 pages and it is divided into **FOUR** sections. Please read the instructions at the beginning of each section. Please try to respond to all questions applicable to your organization.
4. All responses will be anonymous and strictly **CONFIDENTIAL.** No individual will be identified in the questionnaire.

We greatly appreciate your time and cooperation

SECTION 1- YOUR COMPANY AND ITS BACKGROUND

In this section, the researcher would like to know a little bit about the companies participating in this survey. Besides the researcher would also like to information technology training, IT capability, e-Commerce knowledge, and competition within the industry.

---

1. Organization Name: .....
2. What is your position in the organization .....
3. How long have you worked for this organization.....☐.....*years/months*
4. Are you a Libyan? ☐ [1] Yes ☐ [2] No If No, please state your nationality.....
5. What is your industry?.....

Oil & Gas ☐ [1]

6.Location:.....
7. We are a: Libyan company ☐ [1] Libyan/Foreign partnership ☐ [2]

8. What is your department?.....

9. How many employees work in your department?

1-3 ☐ [1] 4-6 ☐ [2] 7-10 ☐ [3] 11-20 ☐ [4] >20 ☐ [5]

10. Approximately how many employees work in your organization?

1-50 ☐ [1] 51-100 ☐ [2] 101-200 ☐ [3] 201-500 ☐ [4] 501-1000 ☐ [5] 1001-5000 ☐ [6] >5000 ☐ [7]

11. How would you rate the level of **competitive intensity** in your industry?

Competitive 5 1 **Not competitive**

12. How would you rate your knowledge in the e-Commerce technology applications?

Knowledgeable 5 1 **Not Knowledgeable**

13. How do you keep current or learn about e-Commerce **(Please CHECK all applicable responses)**

Conferences/Seminars ☐ [1] Courses ☐ [2] Books ☐ [3] other.....☐ [4]

14. How would you rate your organization's IT capabilities?

Excellent 5 **Good** 4 **Satisfactory** 3 **Poor** 2 1 **Very poor**

SECTION 2- CURRENT AND FUTURE USE OF E-COMMERCE TECHNOLOGY

In this section the researcher would like to know how your organization is currently using the Internet and e-Commerce technology or is planning to use the Internet and e-Commerce in future. **PLEASE CIRCLE ONE OF THE RESPONSES FOR EACH STATEMENT.**

	YES	*NO but we intend to implement this*	*NO we do not intend to implement this*
1. Our organization uses the Internet.	2	1	0
2. Our organization establishes clear policies to adopt IT.	2	1	0
3. Our organization has an appropriate modern IT infrastructure.	2	1	0
4. Our organization has access to the Internet.	2	1	0
5. Our organization currently has a website.	2	1	0
6. Our organization uses email as a form of business communication.	2	1	0
7. Our organization uses the Internet for purchasing products online.	2	1	0
8. Our organization uses the Internet for making payment online.	2	1	0
9. Our organization uses Web catalogues to identify products/suppliers.	2	1	0
10. Our organization uses Electronic Data Interchange (EDI).	2	1	0
11. We can track our orders through the Internet.	2	1	0
12. We have an e-Commerce site to sell our products/services.	2	1	0
13. We have a corporate Intranet to access supplier information.	2	1	0
14. We have an extranet connecting our organization with our suppliers.	2	1	0
15. We use electronic funds transfer (EFT) or other electronic payment.	2	1	0
16. We have access to electronic catalogues of major suppliers.	2	1	0
17. We use electronic catalogues (on the Internet) to purchase products.	2	1	0

SECTION 3- YOUR OPINION ON E-COMMERCE TECHNOLOGY ADOPTION

In this section the researcher would like to know your opinion regarding e-Commerce adoption. Even if your organization is not using e-Commerce, your opinions are still important to us. The researcher wants to know your industry and business environment. Please consider each statement and express your level of agreement according the following scale. **PLEASE CIRCLE ONLY ONE NUMBER FOR EACH STATEMENT.**

Scale: 5 = Strongly Agree; 4=Agree; 3=Neutral; 2=Disagree; 1=Strongly Disagree

The issues involved in adopting e-Commerce technology in your organization

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. e-Commerce has been a top priority by top Management	5	4	3	2	1
2. Our firm has an e-Commerce strategy.	5	4	3	2	1
3. Top management understands the importance of e-Commerce.	5	4	3	2	1
4. Our firm's top management places the importance on e-Commerce.	5	4	3	2	1
5. Our firm's top management allocated resources for e-Commerce.	5	4	3	2	1
6. Managers are encouraged bring ideas regarding work performance.	5	4	3	2	1
7. Managers are provided feedback regarding their practice.	5	4	3	2	1
8. Employees should participate in decision made by management	5	4	3	2	1
9. e-Commerceis very useful for improving relations with businesses	5	4	3	2	1
10. We are concerned about making investments in e-Commerce.	5	4	3	2	1
11. Security has delayed or is delaying our adoption of e-Commerce.	5	4	3	2	1
12. We have not pursued e-Commerce due to financial constraints.	5	4	3	2	1
13. The lack of e-Commerce awareness is a barrier facing our firm	5	4	3	2	1
14. IT infrastructure is a barrier facing our organization.	5	4	3	2	1
15. Lack of understanding is a reason for non-take up of e-Commerce.	5	4	3	2	1
16. For us, lack of skilled people is a barrier to adopting e-Commerce.	5	4	3	2	1
17. Using e-Commerce technology has facilitated business operation.	5	4	3	2	1
18. e-Commerce provides the information that leads to better decision.	5	4	3	2	1
19. Using e-Commerce technology has increased sense of security.	5	4	3	2	1
20. Using e-Commerce technology e-Commerce increases productivity.	5	4	3	2	1

21. Using e-Commerce reduces the running cost of firm business.	5	4	3	2	1
22. Government plays an important role in promoting e-Commerce.	5	4	3	2	1
23. Government policies facilitate e-Commerce infrastructure.	5	4	3	2	1
24. e-Commerce has improved organizational relations with suppliers	5	4	3	2	1
25. Firm thinks that e-Commerce has improved business performance.	5	4	3	2	1

SECTION 4- YOUR ORGANIZATION AND ITS MANAGEMENT PHILOSOPHY

In this section the researcher would like to know about your organization and its management philosophy regarding the development and adoption of e-Commerce. The researcher also would like to know your policy initiatives and future of e-Commerce adoption. **PLEASE RESPOND TO ALL STATEMENTS IN THIS SECTION.**

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Our management places importance on IT.	5	4	3	2	1
2. Our management has allocated significant resources for Internet	5	4	3	2	1
3. Organization finds the ISP good business information support.	5	4	3	2	1
4. Managers in our organization are using the Internet.	5	4	3	2	1
5. In our organization managers and employees accessing the Internet.	5	4	3	2	1
6. Our firm experienced competitive advantage through e-Commerce.	5	4	3	2	1
7. We have long-term relationships with the majority of suppliers.	5	4	3	2	1
8. Organization uses web to perform general marketing activities.	5	4	3	2	1
9. Organization uses web to get international market penetration.	5	4	3	2	1
10. Organization uses web to find new suppliers.	5	4	3	2	1
11. Organization uses web to test new products and service ideas.	5	4	3	2	1
12. Organization uses web to communicate with customers/suppliers.	5	4	3	2	1
13. The organization has established IT training.	5	4	3	2	1
14. It is our intention to develop and adopt e-Commerce technology.	5	4	3	2	1
15. e-Commerce will be a focus of our business development	5	4	3	2	1
16. We have plans to increase our involvement in e-Commerce.	5	4	3	2	1
17. Our Government places importance on IT.	5	4	3	2	1
18. Our Government has intention to develop ICTs and online business.	5	4	3	2	1
19. Our firm has capable human resources to develop e-Commerce.	5	4	3	2	1
20. Top managers have in depth understanding about e-Commerce.	5	4	3	2	1
21. Our firm has competent IT staff.	5	4	3	2	1

Would you please check to ensure you have answered all appropriate questions in all the sections? Please tick this box if you wish to receive a summary of the findings of the research project ☐

Thank you very much for your time and cooperation

Appendix 14

Interview Questions

This interview survey is concerned with e-Commerce technology adoption in Libyan Oil and Gas Companies **(LOGCs)**. The interview items focuses on **LOGCs** considering the adoption of e-Commerce. The purpose of this interview is to get opinions on the relevant factors that determine the development and adoption of e-Commerce in **LOGCs**. Even though your organization has not yet embraced or embarked on any Internet applications and e-Commerce initiatives, the researcher would still like to know your opinion. In order to fully understand the current issues involving the development and usage of the Internet and e-Commerce in the organizations, the researcher needs to ask the following questions.

1. Background Information

* What is your company's major market?
* Is your company private or publicly owned?

2. Industry and Business Environment

* What do you consider to be the threat facing your company/industry?
* What are your company's key business drivers?

3. Observations on e-Commerce Adoption Development

* What are the most important factors leading to e-Commerce adoption?
* What are the major obstacles or barriers that need to be overcome for e-Commerce adoption?
* Are there any difficulties with e-Commerce adoption?
* Will the adoption of e-Commerce affect your relationship with your suppliers?

4. e-Commerce Trends

* What factors do you think the most important in e-Commerce adoption?
* What is your personal opinion of the e-Commerce adoption?
* What resources will influence your decision about initiating e-Commerce adoption?
* Where there any other factors that influence your decision about online business?
* Have your company started any type of Internet business?
* What is the most important concern when you consider e-Commerce adoption?

6. Policy Initiatives and the Future

* Do you think e-Commerce and the Internet, is redefining business processes in your industry?
* What policy will better effectively facilitate e-Commerce awareness in your company?
* What do you consider to be the major challenges to companies in future use of e-Commerce?
* Do you have any further comments?

Appendix 15

Reliability and Validity Analysis **N=211**

Variables	No. of items	Alpha value	Mean	Variance explained
Firm Size (FS)	**2**	**0.84**	**4.19**	**0.64**
Top Management Support (TMS)	**5**	**0.79**	**3.42**	**0.75**
Organizational Readiness (OR)	**5**	**0.88**	**3.05**	**0.73**
Organizational Culture (OC)	**5**	**0.77**	**3.48**	**0.82**
Perceived Benefits (PB)	**5**	**0.73**	**3.33**	**0.75**
Competitive Pressure (CP)	**3**	**0.73**	**2.16**	**0.84**
Critical Mass (CM)	**4**	**0.77**	**3.27**	**0.72**
Government Support GS)	**4**	**0.60**	**3.59**	**0.71**
National Infrastructure (NI)	**7**	**0.80**	**3.51**	**0.69**
E-Commerce Adoption Level (DV)*	**2**	**0.78**	**1.02**	**0.65**

*Dependent Variable (ECAL)

Mean, Std. Deviation, and Pearson Correlation Between e-Commerce Adoption and Antecedent Variables N=211

No.	IVs	Mean	Std. D	1	2	3	4	5	6	7	8	9	10
1	FS	4.19	1.915	1	.193**	.158*	.115	.173*	.122	-.193**	.114	.184**	.176*
2	TMS	3.42	1.174	.193**	1	.682**	.767**	.609**	.463**	.258**	.616**	.626**	.581**
3	OC	3.48	1.127	.158*	.682**	1	.617**	.606**	.424**	.279**	.538**	.610**	.646**
4	PB	3.33	1.097	.115	.767**	.617**	1	.617**	.426**	.266**	.637**	.636**	.540**
5	GS	3.59	1.026	.173*	.609**	.606**	.617**	1	.439**	.205**	.536**	.669**	.571**
6	OR	3.05	1.077	.122	.463**	.424**	.426**	.439**	1	.446**	.474**	.464**	.371**
7	CP	2.16	1.035	-.193**	.258**	.279**	.266**	.205**	.446**	1	.307**	.262**	.199**
8	CM	3.27	1.180	.114	.616**	.538**	.637**	.536**	.474**	.307**	1	.635**	.559**
9	NI	3.51	1.094	.184**	.626**	.610**	.636**	.669**	.464**	.262**	.635**	1	.705**
10	ECAL[d]	1.02	1.127	.176*	.581**	.646**	.540**	.572**	.371**	.199**	.559**	.705**	1

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

d: Dependent Variable: e-Commerce Adoption Level

Appendix 17

Regression: Performing a STEPWISE Procedure
Fitting all nine independent variables with method STEPWISE selected.

Table: 7.26 Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	NI	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	FS	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3	GS	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
4	TMS	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
5	OR	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a Dependent Variable: ECAL

Appendix 18

Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.153	.163		.935	.352
	NI	.903	.045	.871	19.870	.000
2	(Constant)	-.059	.174		-.338	.736
	NI	.797	.057	.769	13.947	.000
	FS	.196	.067	.160	2.907	.004
3	(Constant)	.049	.177		.277	.782
	NI	.822	.057	.793	14.436	.000
	FS	.228	.067	.186	3.381	.001
	GS	-.146	.059	-.112	-2.459	.015
4	(Constant)	.023	.174		.133	.895
	NI	.779	.059	.751	13.108	.000
	FS	.184	.069	.150	2.650	.009
	GS	-.157	.059	-.120	-2.666	.009
	TMS	.123	.055	.119	2.241	.027
5	(Constant)	.052	.171		.307	.759
	NI	.835	.062	.805	13.424	.000
	FS	.244	.072	.199	3.396	.001
	GS	-.145	.058	-.112	-2.524	.013
	TMS	.157	.055	.152	2.844	.005
	OR	-.175	.069	-.159	-2.543	.012

a Dependent Variable: ECAL

Appendix 19

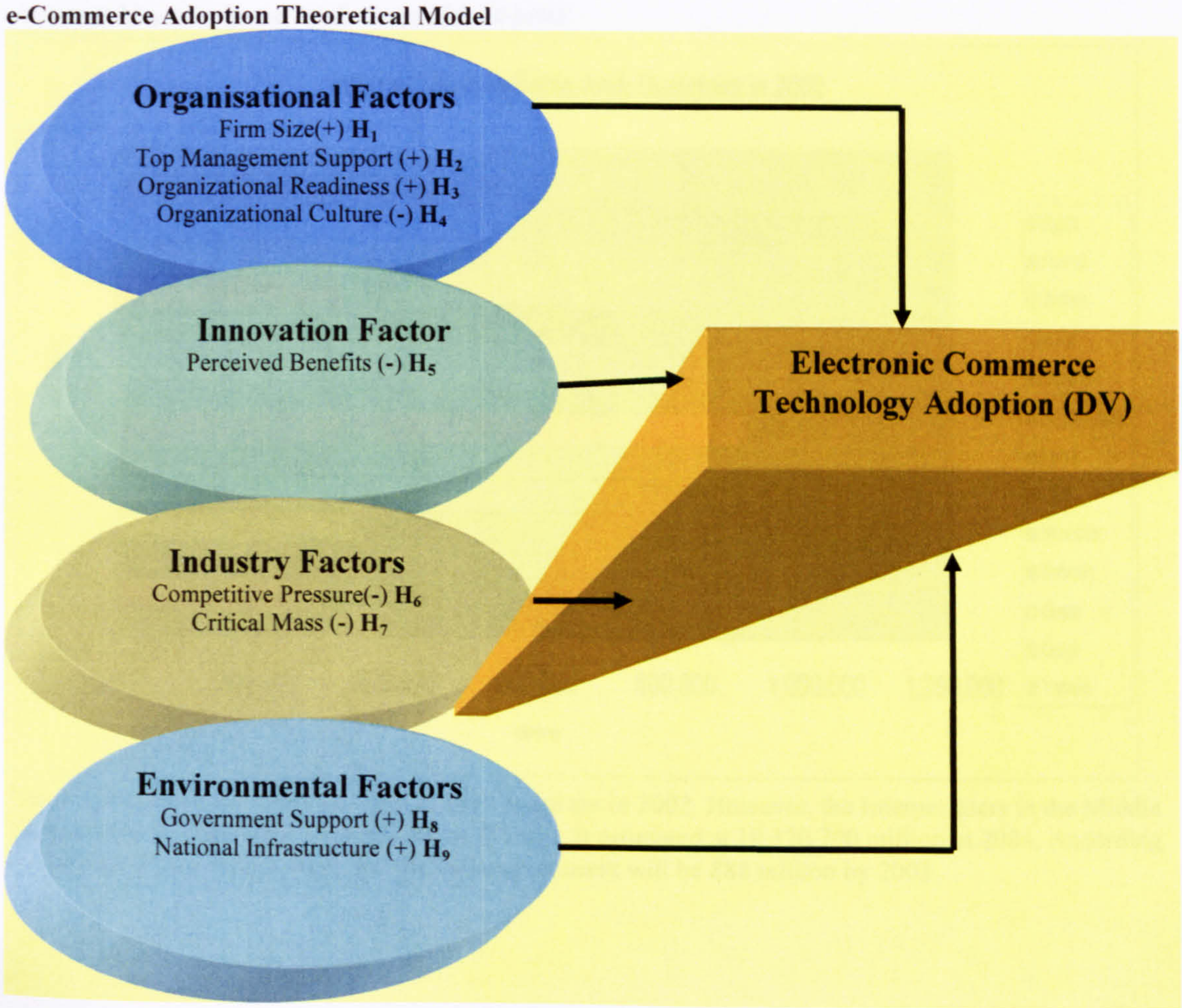
Stepwise Regression Analysis

Independent variables	Beta	T-value	VIF	Significant	Remarks
Firm Size (**FS**)	.104	2.591	1.050	0.000	H_1 supported
Top Management Support (**TMS**)	-.263	-2.576	1.048	-0.011	H_2 supported
Organizational Readiness (**OR**)	.328	3.632	1.171	-0.001	H_3 supported
Organizational Culture (**OC**)	.304	1.105	1.149	0.270*	H_4 not supported
Perceived Benefit (**PB**)	-.168	-1.109	1.194	0.270*	H_5 not supported
Competitive Pressure (**CP**)	.235	-1.542	1.141	0.126*	H_6 not supported
Critical Mass (**CM**)	.134	1.865	1.175	0.064*	H_7 not supported
Government Support (**GS**)	.330	3.933	1.048	0.001	H_8 supported
National Infrastructure (**NI**)	.285	4.550	1.075	0.000	H_9 supported

Dependent Variable (DV): e-Commerce technology Adoption Level (ECAL); * Indicates Statistical significant at $p > 0.05$); Multiple R=0.470; F=9.937; Significant =0.00; Durbin-Watson=1.90.

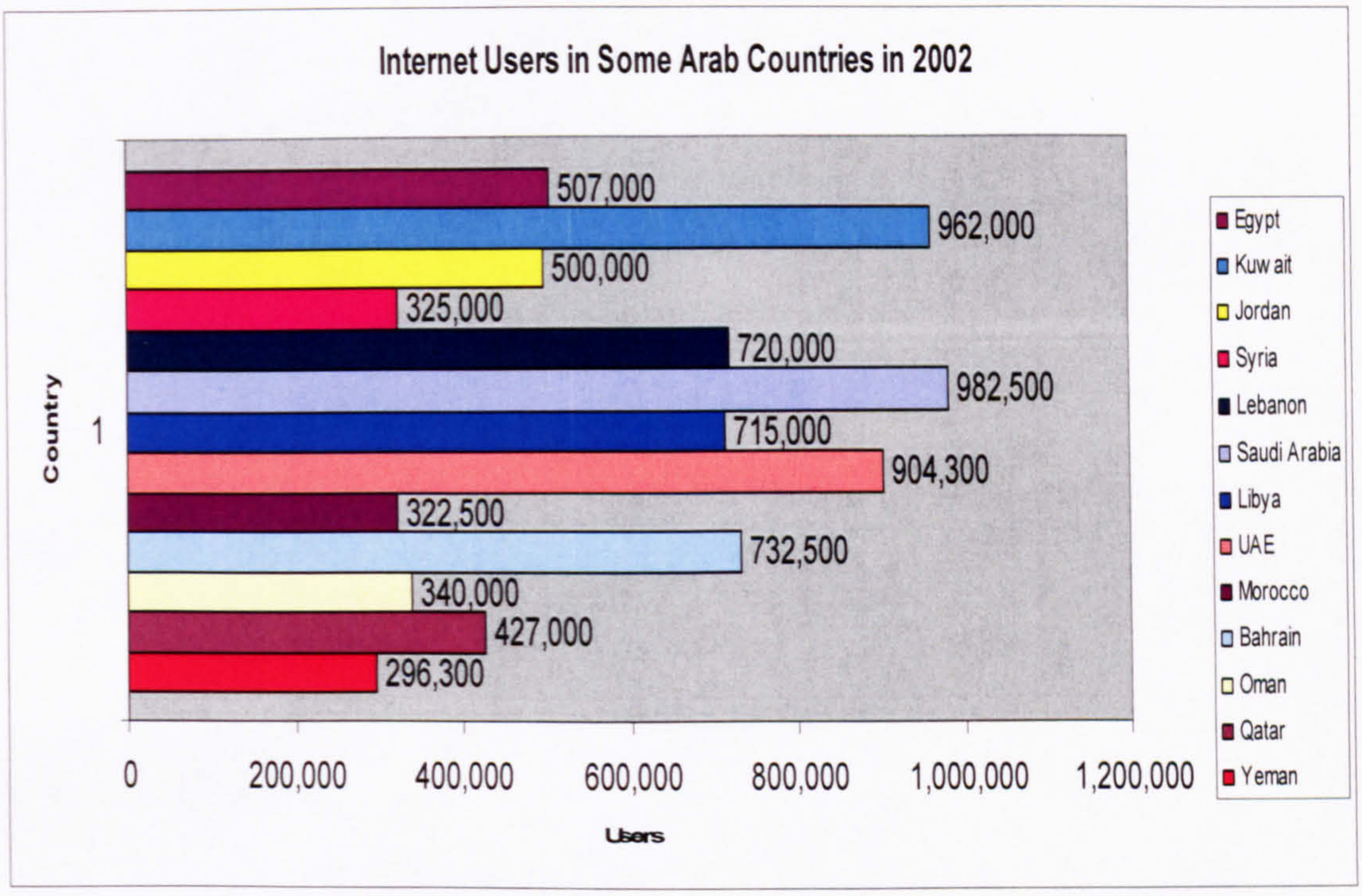
Appendix 20

e-Commerce Adoption Theoretical Model



Appendix 21

Internet Users in Some Arab Countries in 2002



Note: The statistics of Internet users in this Figure are in 2002. However, the Internet users in the Middle East and North Africa are substantially on the rise. It estimated at 19,370,700.million in 2004. According to Internet World Stats (2004), the global Internet users will be 888 million by 2005.