

*UNIVERSITY OF SOUTHERN QUEENSLAND*

*Emissions Trading and Sustainable Development: A Case  
Study of the Libyan Oil and Cement Industries*

*A Dissertation Submitted*

*By:*

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*In Partial Fulfilment of the Requirements for the award*

*of*

**Doctor of Philosophy**

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April, 2012

## Declaration

I hereby declare that this dissertation, submitted in partial fulfilment of the requirements for the award of Doctorate of Philosophy and entitled “Emissions Trading and Sustainable development: A Case Study of Libyan Oil and Cement Industries” represents my own and original work and that, to the best of my knowledge and belief, except where otherwise referenced or acknowledged in the text. I also declare that the document has not been submitted, either in whole or in part, for any other award at this or any other university.

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Signature of Candidate

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Date

## ENDORSEMENT

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Signature of Supervisor(s)

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Date

## Dedication

*I dedicate this study to:*

*My beloved mother and father*

*And*

*My best brother “**Eng. Abdalla Shibani**”*

*And the rest of my*

*Wonderful brothers and sisters,*

*For their love, prayers, advice and kind support, May Allah reward them all.*

*Especial dedication goes to my*

*Dearest wife “**Amel**” and the little son “**Ayman**”*

*For their patience, sacrifices and kind support, May Allah bless and reward them all.*

## Acknowledgment

I am exceedingly grateful to *Almighty Allah*, the creator, who gave me the opportunity and the ability to complete this work.

My sincere acknowledgement goes to my principle supervisor *Dr. Peter Phillips*, who has provided and guided me with endless support, inspiration, and friendship throughout the period of my study. His kindness, understanding, encouragement and critically constructive discussions have supported me greatly and contributed to constructing and completing this dissertation. His clear insight and knowledge has opened my mind to comprehend the complex ideology of the phenomenon and research methodologies.

I am also thankful to *Dr. Mafiz Rahman*, my associate supervisor, for his advice and comments particularly in the early stages of this thesis. I also wish to thank *Professor. Julie Cotter*, faculty research advisor, for her support, constructive feedback and suggestions especially in the early stages of this work. My gratitude must also go to *Dr. Melissa Johnson Morgan*, and *Dr. Phil Griffiths*, for their support during the early stages of this dissertation. I also thank *Ms. Sally Barrett* for her advice and comments regarding this work. I also would like to acknowledge and thank all the members of both academic and general staff at School of Accounting, Economics, and Finance, Faculty of Business and Law, University of Southern Queensland, for their help, kindness, fruitful discussions and valuable advices.

Last but not least, I am indebted and thankful to my country Libya and my university, Nasser University, which nominated me for this scholarship and provided me the required financial support to undertake the doctoral degree.

## Abstract

Concern has been growing about global warming and climate change phenomenon caused by greenhouse gas (GHG) emissions. Many experts have discussed and warned against the risk of global climate change deriving from the increase of GHG emissions in the atmosphere. The well-defined emissions reduction policies and environmental regulations are one of the major elements that can positively treat the problem of climate change. The debate has asserted that the impact of a changing climate will affect economic, social and environmental sustainability. In light of this, global efforts have been made to discover potential policies to limit and mitigate GHG emissions and contribute towards sustainable development. Despite the fact that the problem of climate change, in particular air pollution (the emissions of GHG) is often considered to be a contemporary phenomenon, Libya as a developing country has not undertaken any steps towards the reduction of its GHG emissions, particularly carbon dioxide (CO<sub>2</sub>) emissions.

Libya has recently been emerging from the extended period of isolation from the international community and seeking to address the very real environmental, social and economic concerns which affect its sustainable development. The study aims *to investigate the 'organisational or corporate context' surrounding the potential adoption of emissions trading policy in order to reduce GHG emissions in Libya, particularly CO<sub>2</sub> emissions and then contribute towards sustainable development.* This research objective has not been empirically investigated in any depth and there has been a dearth of prior research related to the developing countries, notably Libya. The focus was on Libyan oil and cement industries. A number of previous contributions to the literature state that only when income grows can the effective environmental policies be implemented (Coondoo & Dinda 2002; Dinda 2004). In addition, clearly before adopting a policy, it is important to understand the nature of any causal relationship between economic growth and environmental quality. As a developing nation, the economic development of Libya is proceeding quickly as the country moves towards the development of its infrastructure. Environmental pressure increases with the economic development. In order to achieve the research objective, the following research questions have been identified:

**RQ1:** *What is the relationship between environmental quality and economic development in the case of Libya? (This sets the scene for the main research question).*

**RQ2:** *How and to what extent can the implementation of an emission trading policy help to promote the reduction of GHG emissions, particularly CO<sub>2</sub> emissions and contribute towards sustainable development in Libya, particularly in the oil and cement industries?*

**RQ3:** *Does the use of an emissions trading policy have the opportunity to stimulate innovation to address emissions problems in Libya, particularly oil and cement industries?*

**RQ4:** *What are the environmental and economic implications of adapting an emissions trading program in the case of Libya?*

The research method used in this study was based on a combination of quantitative and qualitative techniques, in response to the objective of the research and questions to be answered. In this regard, a mixed research approach was adopted. Firstly, based on the environmental Kuznets curve (EKC) hypothesis, a regression analysis was conducted to examine the nexus between environmental quality represented in CO<sub>2</sub> emissions and economic development represented in income per capita GDP, in the case of Libya. The quantitative data was collected from a number of government and non-government annual reports. Secondly, to gain in-depth understanding of the phenomenon that has been investigated, the target population included both Libyan and foreign companies operating in the oil sector, as well as Libyan cement companies operating in the cement sector. 37 interviews were conducted. These interviews involved senior decision-makers (general

managers) and managers of several functional departments such as production, environment, energy, sales and finance. In addition, experts and consultants working for the companies were involved in the interviews. Data collected from the interviews has already been analysed in order to investigate the research objective and answer each of RQ2, RQ3 and RQ4.

Based on the EKC analysis, the results of this study indicate that the Libyan economic system is located on unfavourable part (position of the inverted-U shape). The study demonstrates that, income growth is significantly related to the emissions of CO<sub>2</sub>. Due to the lack of implementing such environmental regulations and the use of technological innovations, the analysis does not clearly reflect the existence of the turning point (inverted-U shape) in Libya. Therefore, the implementation of environmental regulations in Libya may improve the environmental quality in the long-run and in this regard developed nations can play a fundamental role by transferring their technologies in order to protect the environment.

The outcomes of the interviews revealed that the selected Libyan industrial companies are ill-equipped in handling environmental issues with respect to environmental conservation. The political ecology of Libya's potential engagement in carbon markets through the implementation of emissions reduction policies, such as an emissions trading system, is currently complex. It was obvious that adopting an emissions trading policy is constrained by the lack of institutional capacity and a stable investment environment. This is in addition to the absence of the vital governmental role to regulate those organisations by enacting and enforcing appropriate environmental legislations to be well activated in related fields.

Despite the obstacles in respect to the potential implementation of the emissions trading policy in the case of Libya, the results indicated that Libya still has a great opportunity to implement the emissions trading policy in the country. A key focus is on the oil and cement industries which have a dominant role in the country's economic growth because of various kinds of usage of fuels as energy input in the cement industry, this in addition to the important role of the oil industry and its major contribution to Libyan revenues and the GDP. Therefore, adopting emissions reduction policies in both the oil and cement industries and their potential for economic development will make a major contribution to the sustainable growth in Libya, while protecting the environment from degradation.

## List of Abbreviations

ABC	Arab Bank Corporation
ACPRS	Australian Carbon Pollution Reduction Scheme
AOO	Akakus Oil Operations
AUCC	Arab Union Contracting Company
bbl	Billion Barrels
BP	British Petroleum
bpd	Barrels Per Day
BP Congresses	Basic People Congresses
CAC	Command and Control
CBL	Central Bank of Libya
CCAP	Centre of Clean Air Policy
CO <sub>2</sub>	Carbon Dioxide
CDM	Clean Development Mechanism
EC	European Commission
ECCP	European Climate Change Programme
EGA	Environment General Authority
EIA	Environmental Impact Assessment
EKC	Environmental Kuznets Curve
EU	European Union
FE	Frontier Economics
FAR	Fourth Assessment Report
GCC	Gulf Cooperation Council
GCP	General Council of Planning
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIA	General Information Authority
GMRP	Great Man-made River Project
GNCASU	General National Congress of Arab Socialist Union
GP Committee	General People's Committee
GP Congress	General People's Congress
GPCP	General People's Committee of Planning
GRC	Gulf Research Centre

IGCC	Investor Group on Climate Change
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IRC	Industrial Research Centre
JLCCI	Joint Libyan Cement Company Incorporated
JT	Joint Implementation
LCC	Libyan Cement Company Incorporated
LYD	Libyan Dinar
LED	Libyan Economical Directory
LSJ	Libyan Secretary of Justice
MBI	Market-Based Instrument
MEI	Middle East Institute
MENA	Middle East and North Africa
MOGC	Mellitah Oil and Gas B.V Company
OECD	Organisation for Economic Co-operation and Development
OOC	Oasis Oil Company
OPEC	Organisation of the Petroleum Exporting Countries
Oxy	Occidental Petroleum
NGOs	Non-Government Organisations
NOC	National Oil Corporation
PCA	Portland Cement Association
POST	Parliamentary Office of Science and Technology
RCC	Revolutionary Command Council
RQ	Research Question
SAR	Second Assessment Report
SO <sub>2</sub>	Sulphur Dioxide
t CO <sub>2</sub> e	Tons of Carbon Dioxide Equivalent
UAE	United Arab Emirates
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change



USA	United States of America
WCED	World Commission on Environment and Development
WDI	World Development Indicators
WMRC	World Market Research Centre
WOC	Waha Oil Company
WRI	World Resource Institute
WTO	World Trade Organisation
ZOC	Zueitina Oil Company

## *Table of Contents*

Declaration.....	i
Dedication.....	ii
Acknowledgment.....	iii
List of Abbreviations.....	vi
List of Tables.....	xiii
List of Figures.....	xiv
CHAPTER ONE: INTRODUCTION TO THE RESEARCH.....	1
1.1 INTRODUCTION.....	1
1.2 OVERVIEW OF THE CHAPTER.....	2
1.3 BACKGROUND AND RESEARCH ISSUE.....	2
1.4 TERMS AND DEFINITIONS.....	5
1.5 THE MOTIVATION OF THE STUDY.....	6
1.6 RESEARCH OBJECTIVE.....	10
1.7 RESEARCH QUESTIONS.....	10
1.8 THE SCOPE OF THE STUDY.....	11
1.9 THE CONCEPTUAL FRAMEWORK.....	11
1.10 HYPOTHESIS AND PROPOSITION.....	13
1.11 ORGANISATION OF THE THESIS.....	13
1.12 SUMMARY.....	15
CHAPTER TWO: AN INTRODUCTION TO LIBYA.....	16
2.1 INTRODUCTION.....	16
2.2 OVERVIEW OF THE CHAPTER.....	16
2.3 OVERVIEW OF THE COUNTRY.....	17
2.3.1 LOCATION, RELIGION, LANGUAGE AND HISTORY.....	17
2.3.2 POPULATION.....	21
2.3.3 POLITICAL ENVIRONMENT.....	25
2.3.3.1 OVERVIEW OF THE LIBYAN POLITICAL SYSTEM.....	25
2.3.3.2 THE MECHANISM OF THE LIBYAN POLITICAL SYSTEM.....	27
2.4 THE ECONOMIC CONTEXT.....	30
2.4.1 LIBYAN ECONOMIC DEVELOPMENT.....	30
2.4.1.1 ECONOMIC DEVELOPMENT BEFORE THE DISCOVERY OF OIL.....	30
2.4.1.2 ECONOMIC DEVELOPMENT AFTER THE DISCOVERY OF OIL.....	32
2.4.2 THE ECONOMIC AND SOCIAL ASPECTS OF THE INDUSTRY.....	36
2.4.3 STRUCTURING OF THE ECONOMIC ACTIVITIES.....	37
2.4.4 LIBYAN OIL AND CEMENT INDUSTRIES.....	38
2.4.4.1 LIBYAN OIL INDUSTRY.....	38
2.4.4.2 LIBYAN CEMENT INDUSTRY.....	42
2.4.5 THE CURRENT ECONOMIC PICTURE.....	46

2.5 REGULATORY AND CONSITUTIONAL CONTEXT .....	50
2.5.1 LIBYAN ENVIRONMENTAL LEGISLATION .....	50
2.5.2 THE ROLE OF THE ENVIRONMENTAL LAW NO. 7 OF 1982 IN LIBYA.....	53
2.5.3 OIL AND CEMENT INDUSTRIES WITHIN ENVIRONMENTAL LEGISLATION .....	58
2.5.4 FUTURE ENVIRONMENTAL CHALLENGES .....	60
2.6 SUMMARY .....	63
CHAPTER THREE: REVIEW OF THE RELATED LITERATURE .....	66
3.1 INTRODUCTION .....	66
3.2 OVERVIEW OF THE CHAPTER .....	67
3.3 THE ECONOMICS LITERATURE.....	67
3.3.1 EMISSIONS TRADING (TRADABLE PERMITS), AND TAXES .....	67
3.3.1.1 EMISSIONS TRADING (TRADABLE PERMITS) .....	67
3.3.1.2 TAXES .....	71
3.3.2 MARKET-BASED APPROACH TO GHG EMISSIONS REDUCTION .....	77
3.3.3 THE ENVIRONMENTAL KUZNETS CURVE FRAMEWORK.....	81
3.3.4 SCENARIO OF EMISSIONS TRADING .....	85
3.4 THE POLITICAL ECONOMY LITERATURE .....	87
3.4.1 SUSTAINABLE DEVELOPMENT.....	87
3.4.2 HISTORY OF CLIMATE CHANGE DEBATE .....	89
3.4.3 SUSTAINABLITY AND CLIMATE CHANGE .....	92
3.4.4 THE RESPONSE STRATEGY DEBATE .....	96
3.4.4.1 ADAPTATION .....	96
3.4.4.2 ABATEMENT .....	98
3.4.5 THE RESPONS OF NON-GOVERNMENT ORGANIZATIONS .....	99
3.4.6 THE RESPONSE OF GOVERNMENTS (DEVELOPED COUNTRIES) .....	104
3.4.7 THE RESPONSE OF GOVERNMENTS (DEVELOPING COUNTRIES) .....	109
3.5 LIBYA AND THE MIDDLE EAST (OIL AND CEMENT INDUSTRIES).....	116
3.5.1 SPECIFIC GOVERNMENT POLICY .....	116
3.5.2 INDUSTRY ACTIVITIES (RESPONSE).....	125
3.6 THE GAP IN THE LITERATURE .....	130
3.7 SUMMARY .....	131
CHAPTER FOUR: RESEARCH METHODOLOGY AND PROCESS .....	134
4.1 INTRODUCTION .....	134
4.2 OVERVIEW OF THE CHAPTER .....	135
4.3 RESEARCH DESIGN .....	135
4.4 RESEARCH METHODS AND MEASURES .....	137
4.4.1 RESEARCH METHODS .....	137
4.4.1.1 QUANTITATIVE AND QUALITATIVE METHODS .....	137
4.4.1.2 THE ADOPTED RESEARCH METHODOLOGY .....	140

4.4.2 MEASURES .....	143
4.5 DATA COLLECTION .....	144
4.5.1 QUANTITATIVE DATA COLLECTION.....	145
4.5.2 QUALITATIVE DATA COLLECTION.....	146
4.5.2.1 INTERVIEWS .....	148
4.5.2.2 INTERVIEW RECORDING AND TRANSCRIPTION .....	153
4.5.2.3 INTERVIEW SAMPLE.....	154
4.5.2.4 DESCRIPTION OF COMPANIES' PROFILE .....	156
4.6 DATA ANALYSIS.....	169
4.6.1 QUANTITATIVE DATA ANALYSIS .....	170
4.6.1.1 THE ANALYSIS OF THE EKC FRAMEWORK.....	171
4.6.1.2 CONCEPTUAL FRAMEWORK OF THE EKC AND ITS HYPOTHESIS.....	172
4.6.1.3 CONDUCTING THE REGRESSION ANALYSIS OF THE EKC.....	173
4.6.2 QUALITATIVE DATA ANALYSIS .....	174
4.6.2.1 CONDUCTING THE INTERVIEWS .....	178
4.6.2.2 THE ANALYSIS OF THE SEMI-STRUCTURED INTERVIEWS .....	181
4.7 SUMMARY .....	183
CHAPTER FIVE: RESEARCH FINDINGS AND DISCUSSION .....	186
5.1 INTRODUCTION .....	186
5.2 OVERVIEW OF THE CHAPTER .....	187
5.3 THE FINDINGS OF THE EKC MODEL AND ITS DISCUSSION .....	187
5.4 THE FINDINGS OF THE CONDUCTED INTERVIEWS .....	196
5.4.1 EMISSIONS TRADING POLICY .....	196
5.4.2 THE IMPLEMENTATION OF EMISSIONS TRADING POLICY.....	200
5.4.2.1 THE STATE OF THE LIBYAN ENVIRONMENTAL REGULATIONS .....	200
5.4.2.2 THE CHALLENGES OF ADOPTING AN EMISSIONS TRADING POLICY .....	202
5.4.2.3 THE ADAPTATION TO CLIMATE CHANGE.....	204
5.4.2.4 THE CONTRIBUTION OF EMISSIONS TRADING POLICY TOWARDS SUSTAINABLE DEVELOPMENT.....	207
5.4.3 EMISSIONS TRADING SYSTEM AND INNOVATION OPPORTUNITIES .....	210
5.4.4 ANALYSIS OF THE FUNCTION OF ADAPTING EMISSIONS REDUCTION POLICIES IN BOTH LIBYAN OIL AND CEMENT INDUSTRIES .....	214
5.4.5 THE ENVIRONMENTAL AND ECONOMIC IMPLICATIONS .....	216
5.4.5.1 THE ENVIRONMENTAL IMPLICATIONS.....	216
5.4.5.2 THE ECONOMIC IMPLICATIONS.....	219
5.5 THE FINDINGS OF THE RESPONDENTS REGARDING YES/NO QUESTIONS .....	222
5.5.1 EMISSIONS REDUCTION TARGETS INTO THE COMPANY STRATEGY .....	222
5.5.2 THE DEVELOPMENT AND THE INVESTMENT IN RENEWABLE ENERGY GENERATING TECHNOLOGIES .....	224

5.5.3 COMMERCIAL RISKS AND/OR OPPORTUNITIES OF THE POLICY RESPONSES AND/OR ADAPTATION TO CLIMATE CHANGE .....	226
5.5.4 STRATEGIES REGARDING PREPARATION FOR EMERGING GHG EMISSIONS REGULATIONS AND TRADING REGIMES .....	228
5.5.5 MEASURING THE EMISSIONS IN THE RELATED COMPANIES .....	230
5.5.6 EMISSIONS REDUCTION PROGRAMS .....	233
5.5.7 EMISSIONS REDUCTION SCENARIOS .....	235
5.6 SUMMARY .....	237
CHAPTER SIX: RESEARCH CONCLUSION, RECOMMENDATIONS AND FUTURE RESEARCH .....	240
6.1 INTRODUCTION .....	240
6.2 OVERVIEW OF THE CHAPTER .....	240
6.3 THE RESEARCH IMPETUS AND SCOPE.....	241
6.4 CONCLUSIONS RELATED TO THE RESEARCH QUESTIONS .....	246
6.4.1 THE FIRST RESEARCH QUESTION .....	246
6.4.2 THE SECOND RESEARCH QUESTION .....	248
6.4.3 THE THIRD RESEARCH QUESTION.....	252
6.4.4 THE FOURTH RESEARCH QUESTION .....	255
6.5 THE OVERALL CONCLUSION .....	259
6.6 CONTRIBUTION OF THE STUDY .....	264
6.7 POLICY IMPLICATIONS .....	265
6.8 LIMITATIONS OF RESEARCH.....	266
6.9 RECOMMENDATIONS .....	267
6.10 SUGGESTIONS FOR FUTURE RESEARCH .....	270
6.11 SUMMARY .....	271
LIST OF REFERENCES .....	272
APPENDIXES .....	291
APPENDIX (A): Interviews Consent Form.....	292
APPENDIX (B): Interviews Questions in English Language.....	293
APPENDIX (C): Interviews Questions in Arabic Language.....	296
APPENDIX (D): Letter of Ethical Clearance .....	302
APPENDIX (E): Sample of Interviews Transcription and Analysis .....	303
APPENDIX (F): Data and Sources Collection, Data Analysis Strategy and Categorisation of the Findings .....	309
APPENDIX (G): The Autocorrelation Results of Both Equations 2 and 3 .....	320
APPENDIX (H): Some Photos that Compare the Status of the Cement Plants between Libya and the United Kingdom .....	322

## List of Tables

Table 2.1: Annual rate of increase of population.....	22
Table 2.2: Libyan GDP by sector over the period 1970-2008 (In million LYDs).....	35
Table 2.3: The transformational budget and actual expenditures for industrial sector from 1970-1996 (the amounts are in millions Libyan Dinars).....	37
Table 2.4: Oil and gas companies operating in Libya .....	39
Table 2.5: Libyan Oil Production during the period (1961-2010), (Million Barrel Per Day) .	40
Table 2.6: The Libyan economic indicators for the period 2000-2009 .....	50
Table 3.1: Initial National Communication and Date of Submission of Country Report.....	121
Table 3.2: Governmental Environmental Institutions and Agencies in the Middle East Countries .....	124
Table 4.1: Some differences between quantitative and qualitative research .....	138
Table 4.2: The sample of the interviewed companies and the percentage of the respondents .....	155
Table 4.3: The major plants and their design capacity in Libya.....	160
Table 4.4: ZOC, Historical development.....	165
Table 4.5: Managers of departments that were interviewed.....	180
Table 4.6: the sample units of the respondents and the percentage of their response rate ....	181
Table 5.1: Summary Statistics of the equation (2).....	188
Table 5.2: ANOVA table of the equation (2) .....	188
Table 5.3: Coefficients table of the equation (2) .....	189
Table 5.4: Summary statistics of the correlations of the equation (2) .....	190
Table 5.5: Summary statistics of the equation (3) .....	193
Table 5.6: ANOVA table of the equation (3) .....	193
Table 5.7: Coefficients table of the equation (3) .....	194
Table 5.7: Respondents view about considering emissions reduction targets in the company strategy .....	223
Table 5.8: Perceptions of the respondents about the development and the investment in any renewable energy generating technologies .....	224
Table 5.9: Participants' views regarding the commercial risks and/or the opportunities that would have been presented by the policy response and/or adaptation to climate change .....	227
Table 5.10: The perceptions of the respondents about strategy preparation for emerging GHG emissions regulation and trading regimes.....	229
Table 5.11: Respondents view about measuring the emissions associated with both the use and disposal of the products.....	231
Table 5.12: Respondents view about measuring the emissions generated by the supply chain .....	232
Table 5.13: Respondents view about having emissions reduction programs in place.....	234
Table 5.14: Respondents views about considering scenarios involving reduction in GHG emissions beyond existing national, regional and international targets.....	236

## List of Figures

Figure 1.1: CO <sub>2</sub> emissions by source in Libya 1998.....	10
Figure 1.2: The conceptual framework of the study. ....	12
Figure 1.3: The organisation of the thesis.....	14
Figure 2.1: Map of Libya. ....	18
Figure 2.2: The percentage distribution of the population within the four dominant regions in 2006.....	24
Figure 2.3: Areas of the four dominant regions.....	24
Figure 2.4: Development of the population of Libya from 1954 to 2010.....	25
Figure 2.5: The structure of the political system in Libya and the role of the state .....	29
Figure 2.6: Libyan daily average of oil production during the period (1965-2005), million barrels per day (mb/d). ....	40
Figure 2.7: African proven oil reserves holders, for the period 2007-2011. ....	41
Figure 2.8: The Libyan cement plants with the estimated annual production capacity in 2009. ....	45
Figure 2.9: Annual cement production in Libya for the period (1990-2010). ....	46
Figure 3.1: The efficient level of abatement represented in terms of both marginal costs and benefits. ....	80
Figure 3.2: The common economic, social and environmental sustainable development model.....	89
Figure 3.3: The Atmospheric Concentration of CO <sub>2</sub> . ....	91
Figure 4.1: Illustration Flow of Research Methodology and Process.....	143
Figure 4.2: The conceptual framework of the EKC.....	173
Figure 4.3: Components of data analysis .....	176
Figure 4.4: The percentage of the response rate of the sample units of the interviewees. ....	181
Figure 4.5: The process of analysing the semi-structured interviews.....	183
Figure 5.1: The relationship between CO <sub>2</sub> emissions and income per capita GDP (the observed plots). ....	191
Figure 5.2: The relationship between CO <sub>2</sub> emissions (per metric tonnes) and the income per capita GDP for a span of 35 years.....	192
Figure 5.3: The relationship between CO <sub>2</sub> emissions and population density. ....	194
Figure 6.1: The Analytical Methods and Phases of the Study.....	311
Figure 6.2: The Process of Analysing Qualitative Data .....	314
Figure 6.3: Key issue and aspects of studying the relationship between environmental quality and economic development.....	317
Figure 6.4: Issues and aspects emerging from the analysis of the interview survey .....	319

## **CHAPTER ONE: INTRODUCTION TO THE RESEARCH**

### **1.1 INTRODUCTION**

There is no doubt that carbon dioxide CO<sub>2</sub> emissions and other gases affect the environment. During the last decade many experts have discussed and warned against the risk of global climate change deriving from the increase of GHG emissions in the atmosphere. Increasingly, industrial companies are expected to monitor and take responsibility for environmental impacts of their activities. One of the major environmental issues that the companies have had to address in the past decades is that of reducing their release of GHG emissions, which augment the GHG effect, causing global warming and subsequent climate change. The well-defined emissions reduction policies and environmental regulations are one of the major elements that can positively treat the problem of climate change. The debate has asserted that the impact of a changing climate will affect economic, social and environmental sustainability. In light of this, global efforts have been made to discover potential policies to limit and mitigate GHG emissions and contribute towards sustainable development. Despite the fact that the problem of climate change, in particular air pollution (the emissions of GHG) is often considered to be a contemporary phenomenon, Libya as a developing country has not undertaken any steps towards the reduction of its GHG emissions, particularly CO<sub>2</sub> emissions.

This chapter explains the problem of the research study and summarises the research in this thesis. It provides an overview of the debate surrounding the adoption of the emissions trading policy in order to reduce GHG emissions, in particular CO<sub>2</sub> emissions. In addition, it gives concise information about the use of emissions reduction policies and their contribution towards sustainable development, particularly in developing countries such as Libya. The



chapter also provides detailed information regarding the justification of the study where the strong global desire to reduce GHG emissions, and the debate surrounding the implementation of emissions reduction policies which can assist to reduce the environmental damage, were the main motivation to embark on this study.

## **1.2 OVERVIEW OF THE CHAPTER**

This chapter has twelve sections. The first and second sections describe the introduction and overview of the chapter. The third section describes the background of the research issue. Then, the fourth section defines some important terms. The fifth section explains in detail the justification and the motivation of the study. Both the sixth and the seventh sections provide the objective of this research study and the research questions that have been investigated. The following section is the scope of this study, where this study has focused on both Libyan oil and cement industries. The ninth section provides the conceptual framework of this study and illustrates the ideas and the interrelations between the main elements of the subject. Then, the hypothesis and the proposition are explained in the tenth section. The eleventh section contains the organisation of the whole thesis. The final section provides a summary of this chapter.

## **1.3 BACKGROUND AND RESEARCH ISSUE**

Concern has been growing about global warming and climate change caused by GHG emissions, which are derived from human activities that involve fossil fuel combustion (Baumert et al. 2005). The Intergovernmental Panel on Climate Change (IPCC) in its assessment on climate change concludes that at least 90 per cent of the global warming observed over the past 50 years is attributable to human activities (IPCC 2007c). Also, the assessment of IPCC (2007c) provides stronger evidence than prior assessment that human activities are the major cause of recent climate change. The report has found that emission of

heat-trapping gases from human activities has caused most of the observed increase in global temperatures since the mid-20<sup>th</sup> century.

Many experts have discussed and warned against the risk of global climate change deriving from the increase of GHG emissions in the atmosphere (Ang 2007; Annicchiarico et al. 2009; Apergis & Payne 2009). In this regard, IPCC (2007c) concluded that the increase in GHG emissions in the atmosphere had led to the increase in average global air and ocean temperatures, and rising global mean sea level due to widespread melting of snow and ice. The report also confirms that global warming phenomenon is occurring due to the current atmospheric concentration of CO<sub>2</sub> emissions<sup>1</sup>. At the present time, several countries and societies around the world are concerned about GHG emissions and the climate change phenomenon. This climate change will affect sustainability in terms of economic, social and environmental aspects (Harris 2000; Huber 2000). In addition, many of these parties seek to discover some potential policies that contribute towards sustainable development (Onishi 2007), and to promote these policies to limit and mitigate CO<sub>2</sub> emissions and other GHG emissions (Raymond & Shively 2008).

In 1997, the United Nations Framework Convention on Climate Change (UNFCCC) adopted the Kyoto Protocol, signed by 84 countries, under which all the major industrialised nations must limit their GHG emissions and bring them back down to 1990 levels (UNFCCC 2003). Under the Kyoto Protocol, developed countries agreed to reduce their six GHGs emissions by an average of 5.2 per cent relative to 1990 levels during 2008-2012. For example, the European Union (EU) has committed to reducing its GHG emissions by 8 per cent, and other countries such as United States and Japan by 7 and 6 per cent respectively (Heil et al. 1999; UNFCCC 2003). There are three mechanisms introduced under the Kyoto Protocol emissions

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<sup>1</sup> CO<sub>2</sub> emissions are now believed to be primary greenhouse gas responsible for the problem of global warming (IPCC, 2007).

trading (ET), joint implement (JI) and clean development mechanism (CDM)<sup>2</sup>. Their key objective is to reduce and mitigate GHG emissions.

One approach to mitigate global warming is an emissions trading mechanism, which is covered by article 17 of the Protocol. Rehan and Nehdi (2005, p. 108) state that, 'it is designed for reducing the overall cost of climate change mitigation', and to allow Annex I economies<sup>3</sup> to meet their GHG emission limitations by purchasing GHG emission reductions credits from elsewhere. Non-Annex I economies<sup>4</sup> have no GHG emission restrictions but have incentives to develop GHG emission reduction projects to receive carbon credits. Therefore, through financial exchanges there can be exchangeable credits between both Annex I and Non-Annex I parties which in turn encourages sustainable development (Barrett 1998). The trading of permits to emit CO<sub>2</sub> has been calculated in tons of carbon dioxide equivalent (t CO<sub>2</sub> e). The overall concept is that this mechanism allows trading of GHG emission permits globally and enables countries to reduce emissions or enhance carbon sinks at lower costs (UNFCCC 2003).

The current debate on the GHG emissions has consisted of two intertwined parts. As Sonnebron (2005) argued, the first part is the scientific side which deals with questions such as, how fast and by how much is the Earth going to warm? Is the warming already happening? What impacts will it have? The second part is the political side of the debate essentially concerned with the question; what should be done about it? This political concern has seen countries and societies taking action towards GHG emissions reduction. The

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<sup>2</sup> JI and CDM are the two project-based mechanisms which feed the carbon market; also they are respectively defined under articles 6 and 12. JI enables industrialized countries to carry out joint implementation projects with other developed countries, while the CDM involves investment in sustainable development projects that reduce emissions in developing countries (see the UNFCCC [www.unfccc.int](http://www.unfccc.int) ).

<sup>3</sup> Annex I economies are the 36 industrialized countries and Economies in Transition (EIT) listed in annex I of the UNFCCC. These countries have taken emission caps-regulatory devices that set a ceiling on emissions that can be released into the atmosphere from any country within a designated timeframe.

<sup>4</sup> Non-Annex I economies, all countries that are not listed as annex I parties, labelled "Non-annex I countries", do not have binding emission reduction targets for the first period (2008-2012) of the Kyoto Protocol (see the International Emissions Trading Association 2009 [www.ieta.org](http://www.ieta.org)).

emissions trading program to GHG emissions reduction, which was discussed above, is one such action. This involves many controversial issues which indicate how this program works. One of several approaches to an emissions trading program is market-based instruments (MBIs) to GHG emissions reduction (Sheila & Nathaniel 2007).

Many economists claim that MBI for environmental protection is one of the best options that encourage emissions reductions by those who can achieve them at lowest cost (Andersen & Sprenger 2000; Sheila & Nathaniel 2007; Sterner 1999). Furthermore, Sonnebron (2005, p. 2) states that 'Market-based approaches or economic instruments have their foundation in the operation of market forces'. Their objective is to align private costs with social costs so that there is an economic incentive for polluters to reduce emission. A variety of MBIs have been developed, including pollution taxes/fees, permit trading systems, subsidies, deposit-refund systems, performance bonds and liability payments, incentive/marketing schemes, licensing and quota systems. As one example, the EU emissions trading scheme (ETS) offers an opportunity for critical insights into the design and implementation of a market-based environmental program of significant size and complexity. Through MBIs such as taxes or a system of tradable pollution rights (emissions trading), a financial incentive will be established in order to steer the polluting behaviour of industries (Andersen & Sprenger 2000).

#### **1.4 TERMS AND DEFINITIONS**

The terms, GHG effect, global warming and climate change are often used interchangeably.

**The GHG effect:** is a natural process by which the earth retains heat from the sun: simply put, sunlight passes through the earth's atmosphere, warming the planet. Some of the shortwave radiation (heat) is released from the earth's surface to return to space; the rest of it is trapped by a 'blanket' of GHGs, primarily water vapour, CO<sub>2</sub> and methane. This blanket of

GHGs makes life on earth possible; without it the planet would be far too cold. It is the augmentation of GHG effect that is of concern.

**Global warming:** is the result of the natural of GHG effect being intensified by human activities, which are adding GHGs to the atmosphere. The primary activities of concern are the burning of fossil fuels for energy and transport, release of methane from agriculture activities and destruction of forests which act as a biological 'CO<sub>2</sub> sink', i.e., a means for storing CO<sub>2</sub> . These additional GHGs act to trap more heat in the atmosphere and threaten to raise the average global temperature.

**Climate change:** is the expected outcome of global warming, i.e., that the average temperature of the earth will increase. Some of the changes this is expected to cause are: shifting of climate zones with some areas warmer, colder, wetter or drier than before; raised sea levels as a result of thermal expansion of oceans, melting of glaciers and in the long term, melting of polar ice caps; a greater number of tropical storms, bush fires and drought, with an increase in vector-borne diseases and desertification; changes in agriculture productivity and diminished fresh water supplies. Unpredictability is often cited as the main danger of climate change. The climate system is not understood well enough at present to predict the specific change—or response needed—in certain regions (UNFCCC 2003; IPCC 2007c).

## **1.5 THE MOTIVATION OF THE STUDY**

The purpose of the study is to examine the organisational or corporate context surrounding the adoption of an emissions trading scheme in order to reduce GHG emissions in Libya. To provide contextual completeness, the environmental Kuznets curve (EKC) which explains the relationship between environmental quality represented in CO<sub>2</sub> emissions and the economic development represented in income per capita GDP, is deployed (AkboostançI et al. 2009; Annicchiarico et al. 2009; Atici, Cemal 2009; de Bruyn et al. 1998; Grossman & Krueger 1995; Koop 1998; Panayotou 1993; Selden & Song 1994). More information will be provided

in relation to the EKC approach in both sections of the related literature and the related theories in this study. If the Libyan economic system is located on an unfavourable part of the EKC, investigations along the lines of the study are warranted.

The key motivation of this research comes from the strong global desire to reduce the risk of GHG emissions, whether in the present or in the future. More specifically, the increased debate on implementing emissions reduction policies that can help to reduce GHG emissions and their environmental and economic implications on both advanced industrialised countries and developing nations (FE 2009; UNFCCC 2003). In the Libyan context, there is no known research which investigates the organisational or corporate context of the potential implementation of an emissions trading policy to effect GHG emissions reduction.

There are several reasons that can justify selection of Libya as a case study for this research. One reason is that the Libyan political relationships with advanced nations have greatly developed since 2003, especially with the EU and the United States of America (USA). When Libya announced its intention to eradicate weapons of mass destruction, cancellation of Libya from the list of state sponsors of terrorism followed (Elhage et al. 2008). Also, the strong intentions of many foreign companies from various industrialised nations to invest in the Libyan oil sector, as well as the construction sector, were derived from the Libyan intention to shift towards the development of its infrastructure and to ensure the evolution of economic growth.

The second reason is that the United Nations Development Programme (UNDP) and International Monetary Fund (IMF) have characterised Libya as one of the developing countries which are attempting to rapidly move towards economic growth (UNDP 2007). Libya is the world's 11<sup>th</sup> largest oil producer (OPEC 2009; Pratten & Mashat 2009; WMRC 2002), and as a result of increasing oil production and its substantial revenues (accounting for approximately 95 per cent of export earnings and contributes more than 54 per cent to the

Libyan GDP), the country had a significant rise in GHG emissions, particularly CO<sub>2</sub> emissions (CBL 2007; Elhage et al. 2008). In this regard, HDR 2007/2008 indicates that the annual change of CO<sub>2</sub> emissions was 4.2 per cent during the period 1990-2004. In addition, the report found that Libya accounts for 0.2 per cent of global emissions—an average of 9.3 tonnes of CO<sub>2</sub> per person. Moreover, among environmental agreements, Libya has signed and ratified several conventions such as the Vienna Convention in 1990, the United Nations Framework Convention on Climate Change in 1999 and the Kyoto Protocol in 2006 as a Non-Annex I party (UNDP 2007; UNFCCC 2003; WRI 2003). Therefore, the country has the opportunity to implement emissions reduction policies such as an emissions trading mechanism. Furthermore, in terms of the global trading, Libya is one of the main Members in the Organisation of the Petroleum Exporting Countries (OPEC). It plays a fundamental role in producing and exporting both the raw oil and natural gas to many advanced industrialised nations such as the USA, the United Kingdom (UK), France, Italy, Germany, Spain and other countries.

As mentioned earlier, this study focuses on the case of the Libyan manufacturing industry. Both the oil and cement sectors dominate GHG emissions in the country because the oil sector is considered the main resource in the country with its substantial contribution to the revenue (Elhage et al. 2008; UNDP 2007). The use of fossil fuels in the cement sector as energy input is also a contributing factor (Baumert et al. 2004; Mobbs 2001). In addition to this, the cement industry is presently at a large scale in Libya, producing as much as 50 per cent of the total particulate emissions (stated by the World Bank 1995 cited in Otman & Karlberg 2007, p. 372). Global cement production alone plays a role in contributing to approximately 3.8 per cent of the global GHG emissions (IGCC 2007). Furthermore, Mehta (2002) has argued that the cement industry is considered to be one of the major industrial emitters of GHG emissions, particularly CO<sub>2</sub> emissions.

Both the oil and cement sectors represent a substantial amount of CO<sub>2</sub> emissions in Libya coupled by source which is illustrated in Figure 1.1. In this context, in 1998 the WRI (2003) divided CO<sub>2</sub> emissions by source into liquid fuels, gaseous fuels, gas flaring and cement manufacturing; these sources represent the percentages of CO<sub>2</sub> emissions of 57, 29, 10 and 4 per cent, respectively. Further justification for the selection of cement industry in Libya is that all cement companies and their plants are closely located in the biggest cities such as Tripoli, Al-Khums, Zliten, Musratah, Benghazi and Darnah where the majority of the Libyan population lives.

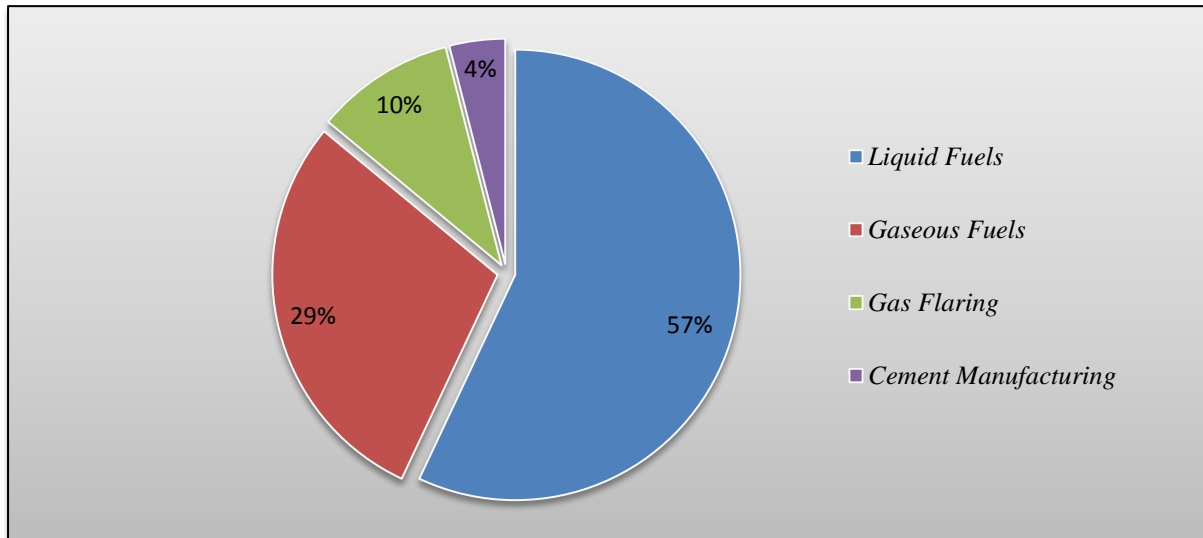
Libya's economy is growing at over 6 per cent per annum and its population growth rate is one of the fastest in the world, which accounts for about 2.9 per cent during the period 1975-2005 (CBL 2007; IMF 2008; UNDP 2007). According to the National Development Plan (2007), working to a budget of US\$120 billion for 2008-2012, is calling for massive infrastructure expansion involving the construction of new housing units, new airports, roads, schools and hospitals. This places greater demands on the cement industry, which is already under pressure to meet the government's target of doubling production to 15 million tonnes per annum by 2012 (CBL 2007). Therefore, this substantial production leads to the release of a huge amount of CO<sub>2</sub> emissions, which in turn will affect the environment.

As a result of the increased oil production and its contribution to the Libyan GDP and the increased demand for cement production as a key factor towards the rapid economic development (economic prosperity). The production from both the oil and cement sectors released a significant amount of CO<sub>2</sub> emissions. Therefore, there is a need to implement emissions reduction policies in Libya in order to reduce GHG emissions, particularly CO<sub>2</sub> emissions, therefore contributing towards sustainable development. Furthermore, in relation to GHG emissions and CO<sub>2</sub> emissions in particular, little or limited literature has been produced in developing countries. Thus, this research seeks to fill up some gaps in the



literature and provides the policy-makers with insights in order to achieve their GHG emissions reduction and attain long-term environmental and economic objectives.

**Figure 1.1:** CO<sub>2</sub> emissions by source in Libya 1998.



Source: Adapted from World Resource Institute (WRI 2003).

## **1.6 RESEARCH OBJECTIVE**

The key objective of this study is as follows:

*Investigate the ‘organisational or corporate context’<sup>5</sup> surrounding the potential adoption of emissions trading policy in order to reduce GHG emissions in Libya, particularly CO<sub>2</sub> emissions and then contribute towards sustainable development.*

## **1.7 RESEARCH QUESTIONS**

The following research questions have been identified in order to achieve the above objective:

- 1) What is the relationship between environmental quality and economic development in the case of Libya? (This sets the scene for the main research question).

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<sup>5</sup> Within this context, the researcher seeks to conduct interviews with those stakeholders in order to investigate the potential adoption of an emissions trading policy.

- 2) How and to what extent can the implementation of an emission trading policy help to promote the reduction of GHG emissions, particularly CO<sub>2</sub> emissions and contribute towards sustainable development in Libya, particularly in the oil and cement industries?
- 3) Does the use of an emissions trading policy have the opportunity to stimulate innovation to address emissions problems in Libya, particularly oil and cement industries?
- 4) What are the environmental and economic implications of adapting an emissions trading program in the case of Libya?

## **1.8 THE SCOPE OF THE STUDY**

The study is limited to both the Libyan oil and cement sectors. Both multinational and Libyan companies operating in the oil sector will be included in this project. In addition to this, cement manufacturing will be included, which consists of three main companies coupled with approximately nine plants. To support the purpose of this study, several items of relevant literature have been reviewed to seek to identify some gaps to be addressed in this research.

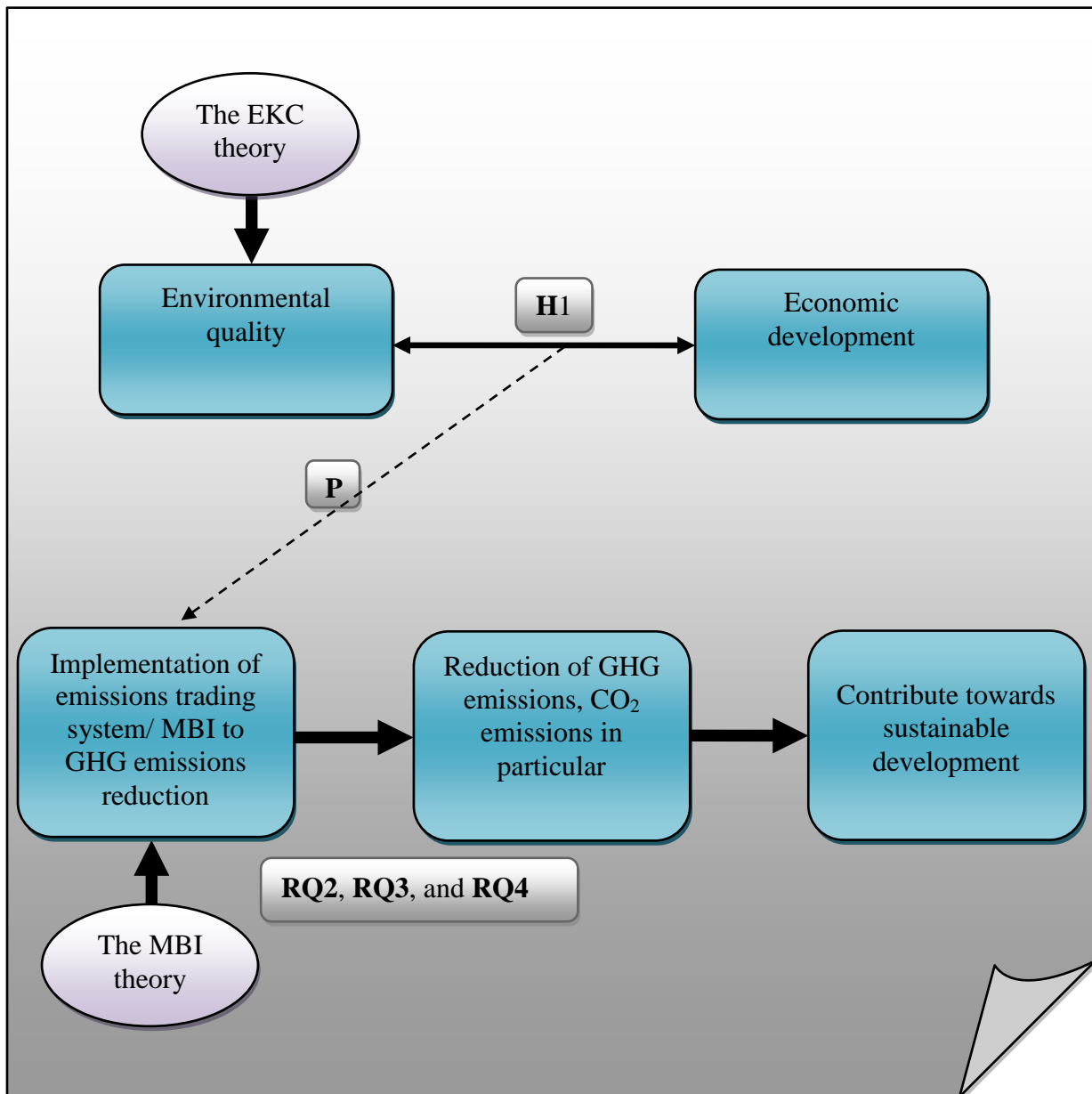
## **1.9 THE CONCEPTUAL FRAMEWORK**

The existence of strong policies and appropriate institutional structures is fundamental to contributing towards sustainable development (Sharp 2002). Based on the relationship between environmental quality and economic development, this study assumes that there is a link which is illustrated by one direction, and this direction reflects the adoption of emissions trading in Libya with respect to MBIs in order to reduce GHG emissions, particularly CO<sub>2</sub> emissions, and its contribution towards sustainable development. The idea is that the adoption of an emissions trading programme will reduce GHG emissions (UNFCCC 1997) and through trade-off (property rights or emissions trading) between all countries and/or firms,

economic incentives will be established in order to attain sustainable development objectives.

Figure 1.2 illustrates the conceptual framework within which an investigation of organisational context sits.

**Figure 1.2:** The conceptual framework of the study.



Based on the EKC model, a suitable instrument (regression analysis) has been applied in this research in order to understand the nexus between environmental quality represented in CO<sub>2</sub> emissions, and the economic development represented in income per capita GDP. This was

undertaken to provide contextual completeness. If the Libyan economic system is located on an unfavourable part of the EKC, investigations along the lines of the study are warranted. In this regard, in depth (semi-structured) interviews were conducted to achieve the objective and to answer the research questions of this study.

## **1.10 HYPOTHESIS AND PROPOSITION**

As mentioned previously, this research seeks to examine the organisational context surrounding the implementation of an emissions trading program in Libya. *Therefore, this study hypothesises that:* There is a relationship between environmental quality and economic growth, in Libya, particularly between CO<sub>2</sub> emissions and income per capita GDP.

*This study also makes the proposition that:* There is a need to implement emissions reduction policies, and this will positively affect firms in both oil and cement sectors in Libya.

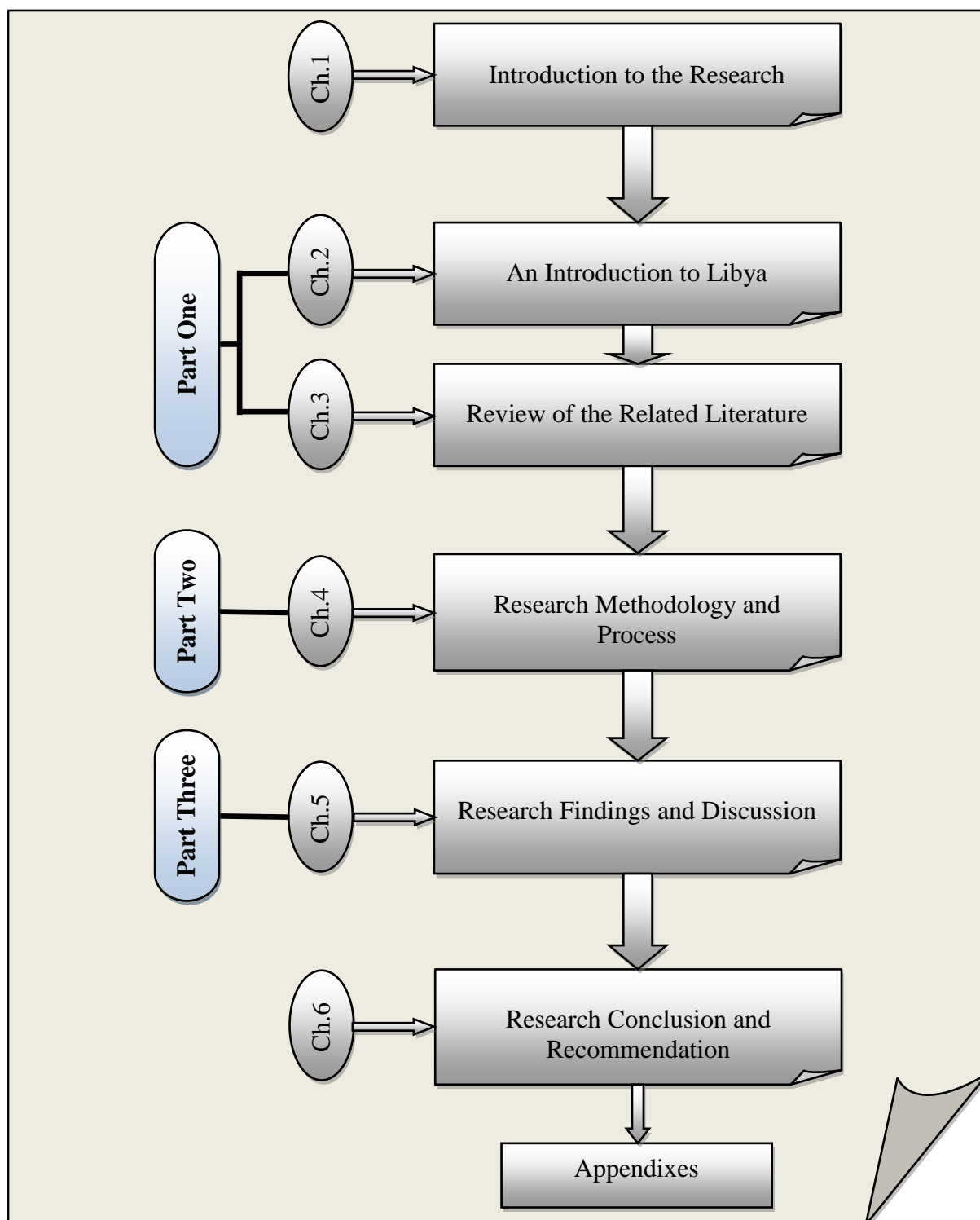
## **1.11 ORGANISATION OF THE THESIS**

Figure 1.3 clearly demonstrates the structure, outline and organisation of this study. The thesis comprises three main parts, described as follows:

*First:* the first part is devoted to reviewing and exploring the geographical, political, social and economic circumstances of the place of the study, the current status of the Libyan environmental legislation, and the future environmental challenges. Then, the discussion moved to reviewing the related literature and exploring the key issues surrounding the debate of emissions trading policy and sustainable development, and to build up the theoretical framework of the study.

*Second:* the second part introduces the research methodology and process. The use of both quantitative and qualitative approaches for collecting and analysing the data was discussed in details in this part.

**Figure 1.3:** The organisation of the thesis.



**Third:** the third part discusses and interprets the study's findings regarding the data gathered from both primary and secondary sources.

In addition to these three main parts, chapter one introduces and justifies the study, chapter six draws conclusions and outlines the recommendations of the study and gives some insights

for further research. Additionally, eight appendixes include the consent form and the interviews checklist in English and Arabic languages, Letter of Ethical Clearance, a sample of interview transcripts, data and sources collection, data analysis strategy and categorisation of the findings, the autocorrelation results of both equations 2 and 3, and finally some photos which compare and describe the environmental situation between cement plants in Libya and some cement plants in the UK.

## **1.12 SUMMARY**

This chapter provides a brief overview regarding the nature of the study. The chapter starts with providing a precise background about the research issue of the study. Subsequently, clarifications and justifications regarding the reasons for selecting Libya as a field for the study are introduced. Then, the chapter moves to provide statements which identified the research objective and the research questions to be investigated in this study. By highlighting the scope of the study, it also provides brief information about the population of the study. Then, the chapter gives insights and ideas regarding the conceptual framework of the research and how it works, followed by a clear list of research hypotheses and propositions to be tested. Finally, it concludes by providing a concise summary of the main outcomes, and explains clearly the outline and the organisation of the thesis.

## **CHAPTER TWO: AN INTRODUCTION TO LIBYA**

### **2.1 INTRODUCTION**

This chapter shows both the modern and historic side of Libya, with information sequentially given in more detail. In addition, this chapter introduces Libya as the operating environment where the oil industry and some other manufacturing sectors, such as the cement industry, play an important role to push forward the Libyan development wheel. Therefore, the key purpose of this chapter is to explore and review the environmental characteristics within Libya in order to gain better understanding of the context of the study and to build a foundation to interpret the current economic picture of Libya.

The chapter concentrates on the economic and environmental contexts of the Libyan state, and also attempts to examine the Libyan economic development in line with the Libyan environmental law (the Libyan environmental legislations). Focusing on both the economic and environmental sides will determine whether the Libyan environmental legislations work in line with its economic development and how this can have either positive or negative impacts on the environmental situation in Libya.

### **2.2 OVERVIEW OF THE CHAPTER**

The chapter is divided into sections. The next section gives a brief description of Libya's geographical location, religion, history, population, and the country's political system. The economic context is outlined in the fourth section and explains in detail Libyan economic development including: the economic and socialist aspects of the industry, structuring of the economic activities, oil and cement industries, and finally describing the current economic picture. The fifth section indicates the regulatory and institutional context including Libyan

environmental legislation, oil and cement industries within environmental legislation and the future environmental challenges. The last section provides a summary of this chapter.

## **2.3 OVERVIEW OF THE COUNTRY**

### **2.3.1 LOCATION, RELIGION, LANGUAGE AND HISTORY**

Libya is a developing Arab state. It is located in the north-central part of Africa (see Figure 2.1) and has an area of approximately 1,775,500 square kilometres, making it the fourth largest country in Africa (Otman & Karlberg 2007) It lies between latitudes of 22° N and 32° N of the Equator and longitudes of 10° E and 25° E of Greenwich. The country is bordered to the north by the Mediterranean Sea, to the south by the Republics of Chad and Niger, to the east by the Republics of Egypt and Sudan, and to the west by the Republics of Tunisia and Algeria. It is divided into four climate regions: coastal strip; plateaus directly following the coastal strip; semi-desert region; and the Sahara. The country's climate is affected by the Mediterranean Sea in its northern region and the Sahara in the south. This means that the northern region has the benefit of excellent warm and sunny weather with temperatures averaging between 20° C and 30° C for most of the year, while in winter the temperature varies between approximately 20° C and 8° C for the coastal cities and between 20° C and around 1° C in the oases regions located in the Sahara (General Information Authority (GIA) (2008).

Most of the lands of Libya are vacant lands: 94.7 per cent is desert, 3.9 per cent is agricultural and 0.29 per cent is forests (Otman 2007b). Rainfall in Libya is of the stormy type, varying one year to the other in its quantities or monthly distribution. During September-April rainfall at the coastal strip ranges between 100-350 mm. This quantity decreases as one moves away from the sea. Higher areas of the Green Mountain (Al-Jabal Al-Akhdar), around Al-Bieda



and Shahat cities, are the rainiest areas, where the annual average is about 600 mm. Southern regions of Libya are almost dry areas, with scarce rainfall (EGA 2008).

**Figure 2.1:** Map of Libya.



Source: The US Department of State, *Diplomacy in Action* (2007), (<http://www.state.gov/r/pa/ei/bgn/5425.htm>).

Islam is the State religion and about 97-98 per cent of the Libyan population is Sunni Muslim, although there are small Christian communities mainly composed of foreigners. A small Anglican community is formed mostly by African immigrant workers in Tripoli, part of the Diocese of Egypt, with the Anglican Bishop of Libya residing in Cairo. It is estimated that there are 40,000 Roman Catholics in Libya, with two Bishops, one in Tripoli to serve the Italian community and the other in Benghazi for the Maltese community. There are also Coptic and Greek Orthodox priests in both Tripoli and Benghazi.

Arabic is the official language of the State. Both Italian (reflecting Libyan's colonial past) and English are widely understood in the major cities. However, many other languages are

spoken in Libya, reflecting its long history as a colonised territory, and more than 100 nationalities live in the country.

Overall, the history of Libya has been one of long-time colonisation. Until 1951 the country had enjoyed independence for only 300 years in the period from 1200 B.C. to 900 B.C. when its own king ruled Libya. For a period of about 3,000 years the country was subject to wave after wave of military invasion. The Phoenicians arrived from Lebanon in 900 B.C. to establish their commercial centres in Libya. The three main centres are Tripoli, Lebits and Sabratah (Wright 1981). In 600 B.C. the Greeks had colonised “Cyrene”, the city of Shahat today, in the eastern region of Libya. It was raised to become a powerful city. During the next 150 years, the four more important Greek cities were established near the Libyan coast: Barce (Almarj today); Eusperides, or later Berenice (Benghazi today); Teuchira (Tukrah today); and Appolonia (Susah today) (Vandewalle 2006).

The Romans subsequently invaded Libya in around 100 B.C. They stayed there until the Vandals defeated them in the fifth century throughout the whole area of North Africa. In about 534 A.D. the Byzantines came to Libya. Byzantine control lasted for about a century (Vandewalle 2006). During the first half of the seventh century Libya (in 643 A.D.), as well as the rest of North Africa, turned away from the identification with European world to the culture and influence of Islam and Arab’s east (Otman 2007b). Beginning from the Arabic conquest in 643 A.D., the history of Libya took an entirely different course. Its culture was changed and so were its language, religion and population. In few years the Arabs were able to do in Libya and the rest of North Africa what neither the Romans nor the Byzantines were able to do in centuries. By the Sixteenth century, the northern coast of Africa had become infested with pirates and was attracting the crusading and imperialistic designs of Christian Spain. Ferdinand, the Catholic, sent an expedition that took Tripoli in 1551 (Drysdale & Blake 1985).

In 1551, the whole of Libya became a part of the Turkish Empire, under the doctrine of Islam, until the occupation of Italy in 1911 - 360 years later. In October 1911, the Italians started their invasion and assault of Tripoli, Benghazi, Tobruk and other Libyan coastal towns. However, the Libyans resisted that invasion and fought alongside the Ottoman army in the country as Muslim subjects of the caliphate. The war lasted for about twenty years and during this period the two parties suffered heavy losses (Wright 1981). The Italians colonised the country for over thirty years until the Second World War.

By the beginning of the Second World War, Libya was a battlefield between the Axis (Germany and Italy) and Allies. With the help and participation of eastern Libya (Cyrenaica), under Sanussi leadership, the Axis were defeated at Al-Elamien battle on the 23<sup>rd</sup> of October 1942 (Barker 1996). British armed forces acknowledged this participation and considered it vital in gaining the victory. Italy was thoroughly trounced by the British and French in late 1942. By the end of 1943, Britain ruled over the Northern part of the country (Tripolitania and Cyrenaica). Meanwhile, the Southern part (Fezzan) came under French control. British and French occupation continued up to the declaration of Libyan independence by the United Nations on the 24<sup>th</sup> of December 1951. As a result, the Turkish, Italian and British had contributed to the formation and the determining of the current system implemented in Libya (Shareia 2006).

On the 24<sup>th</sup> of December 1951, Libya was declared an independent united kingdom, with a federal constitution according to the constitution promulgated in October 1951. The state of Libya was a federal monarchy ruled by King Al-Sanussi and the country was divided into the three provinces of Tripolitania, Cyrenaica and Fezzan. The federal government consisted of a bicameral legislature. In April 1963, the federal government introduced legislation designed to transform Libya from a federal into a unitary state.

In 1969, the monarchy was overthrown by a group of army officers who planned for the 1<sup>st</sup> of September Revolution. The Revolutionary Command Council (RCC) took power and proclaimed the Libyan Arab Republic. The principle force underlying the revolution's policies was Arab nationalism. Thus, laws required businesses operating in Libya to be controlled by Libyans, with banks being particularly affected, and Arabs replaced most of the European and American specialists. Freedom, Socialism and Unity were declared to be the principles of the revolution. Under a decree promulgated by the RCC in November 1976, provision was made for the creation of the General National Congress of Arab Socialist Union (GNCASU); the country's only permitted political party. Afterward, the GNCASU became the General People's Congress (GP Congress) in 1977. Libya then became a "State of the Masses" or Jamahiriya, after the declaration of the people's authority on the 2<sup>nd</sup> of March of that year.

### **2.3.2 POPULATION**

The population of Libya has a uniform composition, although of different ethnic origins. Because of Ottoman rule and Italian colonisation, there were no early official records made of the Libyan population and the first census took place only in 1954, three years after the country became independent. The 1954 census gave a total Libyan population of around 1,088,889, of whom: 738,338 lived in Tripolitania, 291,236 in Cyrenaica, and 59,315 in the Fezzan region (Otman 2007b).

Three decades after the first Libyan official census in 1954, a second census took place in 1984. The population had registered a considerable increase to approximately 3.637 million inhabitants. Men accounted for 1.950 million, or around 53.6 per cent, while 1.687 million, or about 46.6 per cent, were women. In addition it was also apparent that the population was exceptionally young and was growing at a rapid pace, with some estimates placing those under the age of fifteen at up to half of the total population (GIA 1984).

Based on the results of the 1984 census, the United Nations (UN) placed the annual rate of population increase for the 1980-1984 periods at an extremely high 4.5 per cent (see Table 2.1), while the Central Bank of Libya (CBL) placed the figure at 3.9 per cent annually for nationals only. Official sources put the average annual growth rate for the 1970-1986 period at 4 per cent, a figure that agreed with World Bank Data (WDI 2008); the bank projected that this rate would prevail until the year 2000, when Libya's population was expected to reach a total of 6 million.

**Table 2.1:** Annual rate of increase of population

Year	Population	Annual Growth Rate (%)
1954	1,088,889	-
1964	1,559,399	3.7
1973	2,249,237	4.1
1984	3,637,488	4.5
1995	4,799,065	2.5
2006	5,670,688	1.8

Source: General Information Authority, Statistical Book (2008).

This high rate of population increase reflected an official policy of fostering rapid growth to meet labour needs and to fuel economic development. It was also well above comparable rates in other North African countries, which had instituted family planning programs to contain their burgeoning numbers. Libya had no such national program. On the contrary, the government offered incentives to encourage births and improved health facilities to ensure infant survivability. Libyan population policy thus emphasised growth over restraint, large families over small ones, and an ever-expanding population-luxury Libya felt it could afford, given the vastness of its wealth in petroleum and geographical area (Otman and Karlbreg 2007).

Throughout its history the distribution of the population and human settlements in Libya have been influenced by geographical factors. In this context, the geographical problems such as

few sources of water and the extreme climate were influential in pushing the people to live in difficult places in order to obtain water, especially in the desert. Most of the Libyan cities are separated from each other by a few hundred miles as on the coast, and more than this distance in the desert. This phenomenon is still one of the key features of Libya's demography. For instance, analysis of available data from the General Information Authority confirms that there are four dominant regions in Libya in terms of the concentration of the population. These are the Tripoli, Benghazi, Al-Kalig (Gulf) and Sebha regions. These settlements are separated by wide areas of desert lands and huge distances (see Figure 2.1).

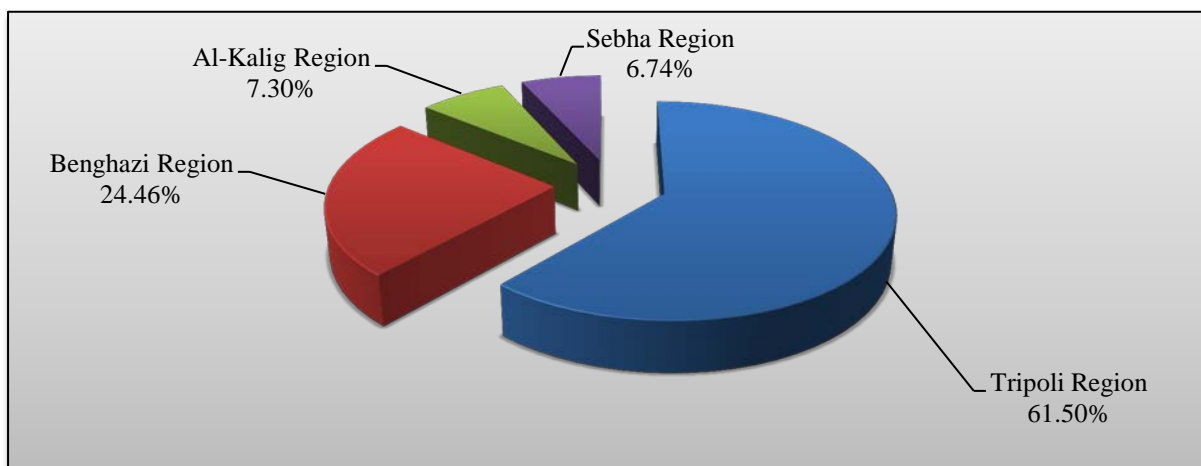
Based on the above dominant regions, in 2006 61.5 per cent of the population resided in Tripoli, 24.47 per cent in Benghazi, 7.3 per cent in the Gulf and 6.74 per cent in Sebha. Figure 2.2 clearly indicates that the Tripoli region is the largest in terms of population. It is located in the north-west of the country. For a variety of reasons, this region is considered the most important in the country in terms of the population, as well as social and economic activities.

The second region is Benghazi, located on the north-eastern coast of the country. Approximately 24.47 per cent of the total population was settled in this region. However, the region covers only 8 per cent of the total area of the country, as can be seen in Figure 2. Benghazi city is the centre of this region; it is the second-largest city in terms of the size of the population. It is important to mention that the distance between Tripoli and Benghazi (the largest two cities in the country) is around one thousand kilometres; most of the areas in between are desert and semi-desert lands, particularly from Misurata to Benghazi, which can be seen in Figure 2.1.

The third region is Al-Kalig region (Gulf Region), which is located between Tripoli and Benghazi cities. Only around 7.3 per cent of the total Libyan population is settled in this

region. However, it accounts for 39 per cent of the total area of the country (see Figure 2.3). Moreover, a large number of oil and gas fields are located within this region.

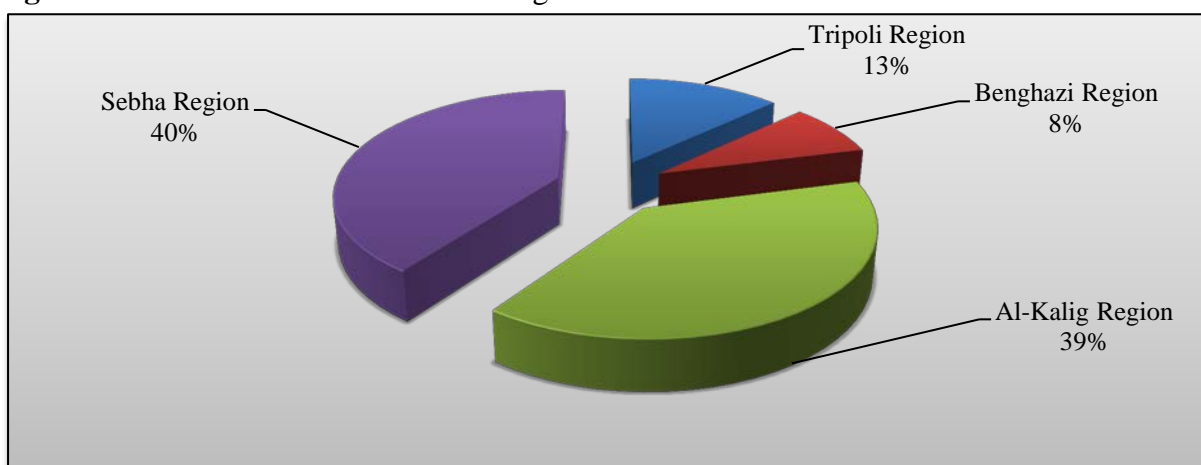
**Figure 2.2:** The percentage distribution of the population within the four dominant regions in 2006.



Source: Compiled and Calculated from the statistical book, General Information Authority, Yearly bulletin, 2008.

The fourth region is Sebha, located in the south of the country and covering 40 per cent of the total area of the country. However, only 6.74 per cent of the population of the country dwells in this region.

**Figure 2.3:** Areas of the four dominant regions.

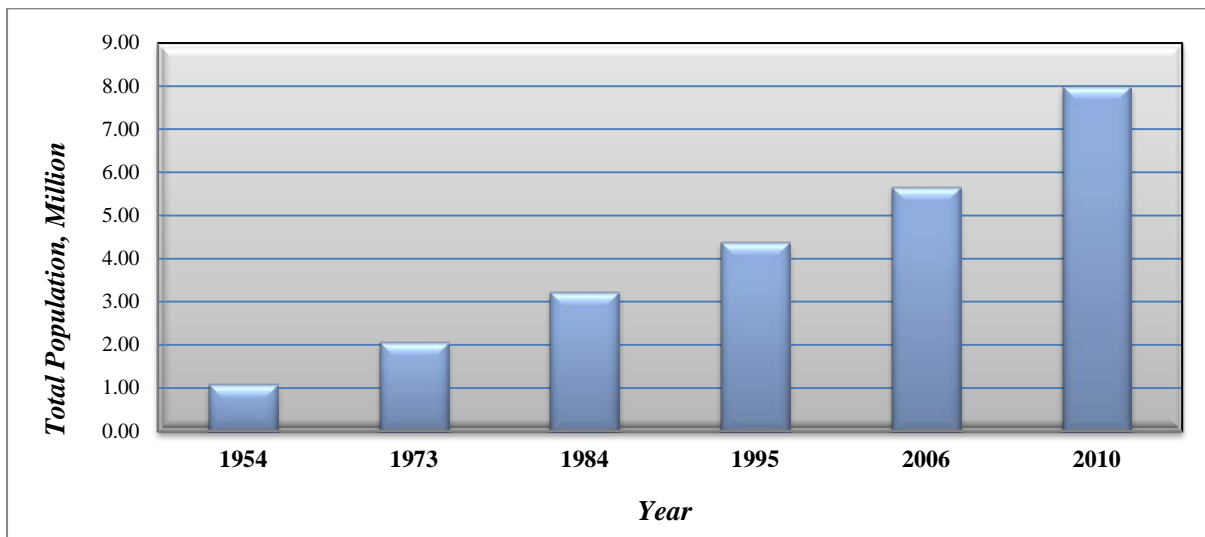


Source: Compiled from General Information Authority, Yearly bulletin (2008).

More recently, the results of the September 2006 census showed the Libyan population at approximately 5.67 million, which had grown at rate of around 2.8 per cent between 1995

and 2006 and was one of the fastest population growths in the world (GIA 2009; WDI 2008). Furthermore, it was expected that by the year 2010, the total population will rise to around 8 million inhabitants (GIA 2009). Figure 2.4 indicates the development of the population of Libya over a period of about 56 years.

**Figure 2.4:** Development of the population of Libya from 1954 to 2010.



Source: Compiled and calculated from the 1954, 1973, 1984, 1995 and 2006 Population Censuses and the Reports from General Information Authority in Libya (2009).

### **2.3.3 POLITICAL ENVIRONMENT**

#### **2.3.3.1 OVERVIEW OF THE LIBYAN POLITICAL SYSTEM**

The political structure in Libya is based on popular democracy in which the people themselves: determine political, economic and social objectives; make decisions; and pass legislation concerning various features of public and private life. However, the process of direct popular democracy is founded on two key institutions, the General People's Congress (GP Congress) and the General People's Committee (GP Committee). Law and regulations in Libya are approved by the GP Congress, whereas the executive regulations and the executive decisions are issued by the GP Committee (Otman 2007b).



The 1<sup>st</sup> of September 1969 was the day of the Libyan Revolution that changed the political system in Libya from the monarchy era to the masses era<sup>6</sup>, led by Colonel Qathafi and his companions. A historical speech was made by Qathafi in the city of Zwara in the spring of 1975. It introduced a new political, administrative and legislative system as a result of five main reforms leading to major changes in the structure of the country (People Revolution) (Otman 2007b).

According to Obeidi (2001), these five points are: that all existing laws should be nullified and revolutionary action should continue; that all elements that oppose the march of revolution should be purged; arms should be distributed to the toiling masses of people who believe in the principles of the First September Revolution; that the administration should be revolutionised by firing unqualified administrators and selecting new ones; and finally that the culture revolution has to be carried out in a way that all imported books of misleading thought should be burned, giving way to real human thought as described in the Quran, “the Holy Book of Islam”<sup>7</sup>.

In 1977 Libya became a “State of Masses”, or Jamahiriya, after the Declaration of People’s Authority on the 2<sup>nd</sup> of March that year in the city of Sebha (South of Libya). This declaration became the cornerstone of the Libyan political system based on theory known as the “Third Universal Theory” of the Green Book (Otman and Karlbreg 2007). It includes the following points: (1) The official name of Libya has become the Socialist People’s Libyan Arab Jamahiriya; (2) The Quran is the law of society in the Socialist People’s Libyan Arab Jamahiriya; (3) Popular, direct authority is the basis of political regime of the State. The power belongs to the people and only to the people. The people practice their power through

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<sup>6</sup> Since 1951, the country has experienced two political regimes; the first was monarchical regime between 1952 and 1969, and the second is the revolutionary regime since 1969. As a result, the official name of the country has changed three times. The first name was ‘The Kingdom of Libya’ between 1951 and 1969; the second was ‘The Libyan Arabic Republic’ between 1969 and 1977; and the third is ‘The Great Socialist People’s Libyan Arab Jamahiriya’ since 1977. The term “Jamahiriya” is an Arabic word referring to the authority of the people.

<sup>7</sup> See Mummar Al-Qathafi, 1975, *The Green Book: the Political Problem*, Part One, pp. 11-16.

Basic People Congresses (BP Congresses), people committees, trade unions, professional unions and the GP Congress. The law sets the limits of its action; (4) The defence of the homeland is the responsibility of all men and women citizens. The people will be trained by means of general military training. The law rules the formation of military cadres as well as general military training.

In 1992 additional changes were made to Libya's political structure, with the introduction of communes, or "Mahallat", authorised to be governed through local representation. In 1998 the system was further reformed with the formation of 26 governorates, or "Shabiyat", each headed by a governor who is given wide municipal and administrative power. The most recent restructure of government took place on the 2<sup>nd</sup> of March 2000, which distributed more power at local levels. Only five secretariats (Ministries) have remained, these are secretariats for Interior, Foreign Affairs, Finance, Economy and Commerce, and African Unity. All other governmental authorities were devolved into the General People's Authorities, becoming consultant bodies for the secretariats that have been liquidated. There are no other political parties in the country as the people, "the Masses", are those who make the political decisions in the country directly by voting in the GP Congress.

### **2.3.3.2 THE MECHANISM OF THE LIBYAN POLITICAL SYSTEM**

According to the Jamahiriya system, Libyan society is divided geographically into a number of BP Congresses all over the state. These congresses, described in the Green Book, are only means to achieve people's democracy. All Libyans over 18 years old should attend meetings of the BP Congresses. In addition they should state their views, opinions, and decisions about political, social and economic affairs at local and national levels. The people comprising the BP Congresses must choose the congress Secretariat members and a secretary who will present in the GP Congress. According to Ayoub (1987) this complex political system allows each member of society to participate in the process of decision making. Thus, environmental

protection, the impact of enterprises' activities upon the environment, or other issues are discussed by BP Congresses or people committees, syndicates and unions and take their final shape in the GP Congress, where the secretariats of people's congresses, people's committees, syndicates and unions meet.

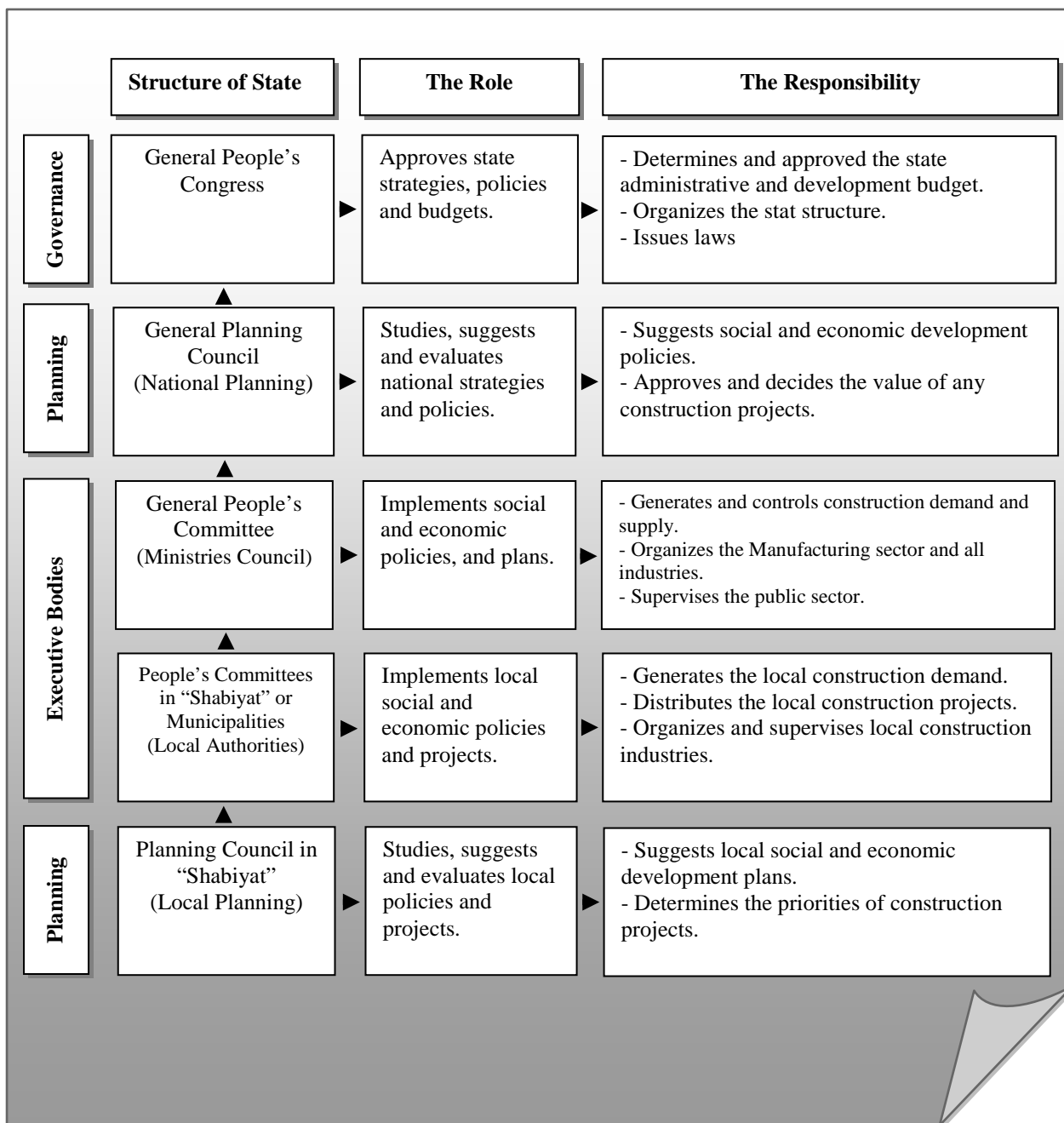
Currently, the state comprises three key authorities: the political, planning and executive authorities. At the national level the GP Congress (equivalent to parliament in western systems) is the highest political authority in the country. It is responsible for all state political issues and affairs. The GP Committee (Council of Ministries) is selected and appointed by the GP Congress. Furthermore, all state legislation is issued by this authority. Figure 2.5 explains and summarises the structure of the political system in Libya and the role of the state.

The executive authorities comprise two levels of institutions: national and local government. The first is known as the GP Committee (Council of Ministries). The GP Committee is responsible for the management, supervision and implementation of national, social and economic policies and development plans. The second is executive level local government, responsible for the management, supervision and implementation of social and economic policies and development plans and projects at local level in the "Shabiyat", or Municipalities (see Figure 2.5). The third body of the Libyan state is the planning authority, known as the General Council of Planning (GCP), which is considered the highest national planning authority in the country (LED 1984).

The GCP consists of all members in the GP Congress and the GP Committees in the state. It is responsible for conducting national planning studies and the assessment and approval of national social and economic strategies as well as budgets. Subsequently, Local Councils for Planning were established in the municipalities, or "Shabiyat". These are responsible for carrying out local studies and approving local social and economic projects and budgets.

Therefore, all environmental policies should be approved by both authorities of the GP Congress and the GP Committee.

**Figure 2.2:** The structure of the political system in Libya and the role of the state



Source: Compiled from the General People's Congress (1977), the Libyan Economical Directory (1984), and the General Information Authority (1999).

In the light of the above brief outline it becomes clear that one of the key features of the political system in Libya is that it is based theoretically on a classless society and the enablement of all members of society to state their views, opinions and decisions regarding

their political, social and economic affairs. However, the process of decision making is fragmented between political, planning and executive authorities. The impact of this fragmentation on the environmental policies and its operations will be discussed in more detail in the fifth section of this chapter.

## **2.4 THE ECONOMIC CONTEXT**

### **2.4.1 LIBYAN ECONOMIC DEVELOPMENT**

The evolution of the Libyan economy can be discussed under two historical stages: economic development before and after the discovery of oil.

#### **2.4.1.1 ECONOMIC DEVELOPMENT BEFORE THE DISCOVERY OF OIL**

Prior to the discovery of oil in 1959, Libya was in deep poverty. Most of the Libyan people earned a per capita income of less than US \$50 per a year and the primary sector was mostly agriculture. During the 1950s and early 1960s the Libyan economy was described by many well-known economists, including Benjamin Higgins (who worked as an economic adviser to Libya and its prospects for development in 1959), as a deficit economy<sup>8</sup>. Higgins (1959, p. 26) stated that:

“Libya’s great merit as a case study is as prototype of a poor country. We need not construct abstract models of an economy where the bulk of the people live on a subsistence level, where per capita income is well below \$50 per year, where there are no sources of power and no mineral resources, where agriculture expansion is severely limited by climate conditions, where capital formation is zero or less, where there is no skilled labour supply and no indigenous entrepreneurship...Libya is at the bottom of the range in income and resources and provides a reference point for comparison with all other countries”.

The deficit economy was caused by the fact that Libya experienced so many wars and colonial administrations. For instance, during the period of Italian colonisation in Libya, education and technical abilities were ignored and the Libyans were excluded from the administration and any duties which might improve their skills. At that time, the backbone of

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<sup>8</sup> For more details about the Libyan economy during this period, see Otman and Karlberg 2007.

the Libyan economy consisted of primitive agriculture, animal husbandry and a few small industries. The agriculture sector was handicapped by extraordinary difficulties, for most of the land in Libya is desert. Even in coastal plain areas such as Tripoli and Cyrenaica, the soil is not good and the rainfall is inadequate and unreliable. The southern area of the country (Fezzan) has virtually no rainfall, but has underground water near the surface.

Overall, prior to the development of oil, the Libyan economy was characterised as having: low levels of domestic products and consumption; a chronic trade deficit, offset only by foreign aid; a low level of literacy and health; and inadequately exploited natural resources (Wright 1981). Thus, the Economic and Social Council of the UN issued a decree in the early 1950s stating that Libya was in urgent need of aid to promote its economy and also requested all specialised agencies to take necessary action immediately (Ghanem 1975).

The country then relied on advisors, consultants and technicians from Great Britain, the United States (US) and the United Nations to establish its diverse systems (Wright 1981). Therefore many foreign agencies, mainly from the UK and the US, flooded into the country. For instance: the Libyan Public Development and Stabilization Agency; the Libyan American Reconstruction Commission; the Libyan-American Joint Service; and the Libyan American Technical Assistance Service (Otman 2007b). According to Kilani (1988), the Libyans played no role in administration of these agencies.

The country's dependence on foreign aid continued until the discovery of oil in 1955, which made extraordinary modifications to all aspects of life in Libya. The country became one of the richest countries in the world, in contrast to being one of the poorest only a short while ago. Financial aid was no longer wanted. However, dependence on foreign aid was replaced on foreign oil companies who hurried to the country, predominantly from the UK and US (Bait-Elmal 1973). The Libyan Petroleum Law of 1955 was designed to encourage all types of companies, as well as large and small oil companies, independent, private and

government-owned companies to explore and carry out oil development operations in Libya. The law itself was formulated by the western advisers.

#### **2.4.1.2 ECONOMIC DEVELOPMENT AFTER THE DISCOVERY OF OIL**

Although the turning point of the Libyan economy was the discovery of oil in 1959, the economy started to pick up gradually after independence in 1952. The Libyan economy changed dramatically after the discovery and export of oil in October 1961. The country no longer had to rely on foreign assistance and the conditionality associated with its usage, and the petroleum industry became the key source of income for the Libyan treasury.

The oil revenues accounted for 24.4 per cent of the country's Gross Domestic Product (GDP) in 1962, 61.7 per cent in 1969 and 28.3 per cent in 1992 (Otman & Karlberg 2007). In 1968 Libya became the second largest oil producer in the Arab world, and the per capita income climbed from US \$50 in 1951 to US \$1,250 in 1967 (Bait-Elmal 1973).

After the revolution of 1969, a number of steps were taken by the new administration to recognise the existing state of the economy and change the structure of the Libyan economic system. Furthermore, the new government structured the new rules to the economic activities because it saw international and foreign companies that were working in Libya as unequal, and that industries were in need of being nationalised. In addition to the establishment of publicly-owned enterprises, this period witnessed the rapid disappearance of the private sector, the rapid development of the economy and a formation of a wide range of public enterprises (Kilani 1988).

As a result, this revenue encouraged the country to carry out some ambitious economic development plans. These development plans can be divided into three main types according to their time period: a short-term plan which covered a span of one year and specified individual projects (water projects, roads, schools, hospitals, etc.); a medium-term plan for the development of certain economic sectors (industry, agriculture, etc.) over five years; and

a long-term plan which covered twenty years (1980–2000), the aim of which was to diversify the economy and also to turn Libya from a developing country into a developed one.

According to Kilani (1988), the Libyan development planning followed types (1) to (4) in the Enthoven (1973) classification<sup>9</sup> during the early years of its economic and social development. However, since the 1980s the role of the private sector in Libyan economic development has been totally overtaken by the state sector (see types 2, 3 and 4 of Enthoven's classification) and accordingly development planning has been of type (5) in the Enthoven's classification.

However, the aims of the development plans in Libya can be summarised as follows:

- (1) To modify the structure of the Libyan economy in favour of agriculture and industry.  
The role of the oil sector is to be gradually reduced and exports are to be limited to the financing requirements of other sectors.
- (2) To achieve a greater degree of self-sufficiency in a broad range of agriculture and industrial products, particularly in certain key food groups and in industries catering for people's basic needs.
- (3) To build industries based on oil and natural gas to capitalise on areas where the country possesses clear advantages for exports.
- (4) To develop an indigenous manpower base capable, in due course, of carrying out the development effort with minimum foreign participation.

As a result of these development plans, GDP has developed over the same period. Table 2.2 shows a remarkable increase in GDP in million Libyan Dinars (LYDs) achieved during the period 1970–2008. This increase can be attributed to the policy of the government in

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<sup>9</sup> Enthoven (1973, p.151) classified planning development into the following types: (1) a mere forecast of trends accompanied by recommendations or few guidelines of government policy; (2) a plan for the public sector (mandatory implementation) unaccompanied by planning for other sectors of the economy; (3) a plan for the public sector combined with a forecast of activities for other sectors of the economy; (4) a plan for the public sector as well as a programme for other sectors of economy, the fulfilment of which is ensured as far as possible 'indirect' instruments of government policy; (5) a comprehensive plan covering all sectors of the economy and mandatory for implementation in government organs and other agencies (i.e. centrally planned economies).



nationalising the formerly foreign-owned oil industry in 1970 and the simultaneous increase in oil price on the world markets (Edwik 2007). Looking at the GDP structure in Table 3, one can find that Libya depends primarily upon revenue from the oil sector, which contributes practically all export earnings and about one-third of GDP. This oil revenue and a small population give Libya one of the highest per capita GDPs in Africa which accounts for approximately US \$6.70 (CBL 2001).

Additionally the table also indicates that there is a slight decrease in the contribution of the hydrocarbon sector to the total percentage of the GDP. Where in the early 1980s it accounted for about 27.1 per cent, in the beginning of the second millennium it started to rise, reaching the highest percentage in 2008 with approximately 65.2 per cent. Furthermore, the contribution of the manufacturing sector to the total GDP can be accounted from the same table. This percentage has increased from 1.96 per cent in 1970 to 8.02 per cent in 2004 due to the earlier investments in the petrochemicals industries, which entered the production stage in 1980s.

Table 2.2 also clearly shows that, between 1970 and 2008, the economy was transformed from a primitive economy into an oil-based economy. Since then it can be said that Libyan society has moved from being a primitive agriculture society to a hydrocarbon society. In addition, the economy moved from capital deficits to capital surpluses.

**Table 2.2:** Libyan GDP by sector over the period 1970-2008 (In million LYDs<sup>10</sup>)

<b>Economic Sector</b>	<b>1970</b>	<b>1977</b>	<b>1980</b>	<b>1986</b>	<b>1991</b>	<b>1995</b>	<b>1999</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
Agriculture & Fishing	33.1	90	183	320	678.2	947	1449.9	1348.8	13039.3	1328.6	1447.5	1643.1	1905.3	2020.7
<b>Petroleum &amp; Gas<sup>11</sup></b>	<b>812.6</b>	<b>3276</b>	<b>6571</b>	<b>1784</b>	<b>3054</b>	<b>2468</b>	<b>3995.9</b>	<b>13164.2</b>	<b>20217.9</b>	<b>29227.4</b>	<b>43946.7</b>	<b>55649.0</b>	<b>58963.8</b>	<b>70691.0</b>
Mining and Quarrying	17	28.5	48.8	49	72.5	148.6	223.3	364.0	1333	1328.6	1447.5	1643.1	1905.3	2020.7
<b>Manufacturing<sup>12</sup></b>	<b>25.5</b>	<b>124.7</b>	<b>192.2</b>	<b>401.8</b>	<b>706</b>	<b>799.7</b>	<b>863.1</b>	<b>813.5</b>	<b>3865.5</b>	<b>3996.9</b>	<b>4324.2</b>	<b>4643.5</b>	<b>5218.9</b>	<b>5723.8</b>
Electricity & Power	6.2	26.1	49.7	112	177	216.7	270.4	293.7	755.0	734.3	876.6	972.7	1019.1	1255.6
Construction	87.8	602	935.7	895	1319.5	483.9	803.6	1262.7	1787.0	2159.2	2683.5	3129.3	4198.4	5994.5
Trade, Restaurants & Hotels	47	292	489.8	485.9	1041.5	1254	1693.3	2089.5	1875.9	2194.9	2657.5	2863.6	3396.3	3949.5
Transport & Communication	43.2	220.1	356.1	395.5	812	892.6	1211.7	1429.2	1812.0	1944.0	2412.6	2724.2	3299.5	3884.2
Banking & Insurance	13	144.1	246.4	285.4	370.5	286.2	323.5	414.2	590.7	627.7	717.1	816.5	980.8	1081.3
Ownership of housing	59.6	157.3	210.4	252.4	315.3	391	452.7	515.0	1991.9	2448.7	3131.7	3606.9	4032.1	4746.6
General services <sup>13</sup>	153.6	614.6	946.6	1521	1894.5	1853.3	2429.2	2859.5	3279.2	3658.6	4481.9	4935.1	6507.3	6670.7
Other services	8	37.4	47.4	75	172	307.7	358.6	427.5	217.6	226	241.4	279.2	321.4	363.7
<b>Total GDP</b>	<b>1303.6</b>	<b>5612.7</b>	<b>10277.1</b>	<b>6577</b>	<b>10612.5</b>	<b>10048.7</b>	<b>14075.2</b>	<b>24981.2</b>	<b>50765.0</b>	<b>49847.9</b>	<b>68368.2</b>	<b>82906.2</b>	<b>91748.2</b>	<b>108402.3</b>
<b>Petroleum &amp; Gas</b>	<b>63.1 %</b>	<b>58.4 %</b>	<b>63.9 %</b>	<b>27.1 %</b>	<b>28.8 %</b>	<b>24.6 %</b>	<b>28.4 %</b>	<b>53 %</b>	<b>39.8 %</b>	<b>58.6 %</b>	<b>64.2 %</b>	<b>67.1 %</b>	<b>64.2 %</b>	<b>65.2 %</b>
<b>Other Sectors</b>	<b>36.9 %</b>	<b>41.6 %</b>	<b>36.1 %</b>	<b>72.9 %</b>	<b>71.2 %</b>	<b>75.4 %</b>	<b>71.6 %</b>	<b>47 %</b>	<b>60.1 %</b>	<b>41.3 %</b>	<b>35.7 %</b>	<b>32.8 %</b>	<b>35.7 %</b>	<b>34.7 %</b>

Source: Central Bank of Libya (CBL), Research and Statistics Department, Economic Bulletin (1980- 2009). General Information Authority in Libya, Statistics Book (2008).

<sup>10</sup> Exchange Rate of Libyan Dinar L.D/1 US\$= 0.64409 (Central Bank of Libya, 2001).

<sup>11</sup> The decline in oil prices during the mid-1980s led to a decrease in the GDP. However, it is clear that the contribution of oil sector to GDP during the 1970s and the early-1980s was of significance; in 1970 was 63.1 per cent and in 1980 was 63.9 per cent.

<sup>12</sup> The share of the manufacturing industries sector in GDP increased from 1.96 per cent in 1970 to 6.13 per cent in 2004 due to the earlier investments in petrochemicals, which entered the production stage in the 1980s.

<sup>13</sup> This includes education, health care and social activities.

## **2.4.2 THE ECONOMIC AND SOCIAL ASPECTS OF THE INDUSTRY**

In order to build the country's socialist economy, a strategy was adopted in the period 1970–1983 with the intention of recognising both domestic needs and internal and external trade. The strategy was based on nationalising the existing foreign and local enterprises, rationalising imports only to the necessary items, organising and developing the production and marketing strategies of local products and seeking access to external markets to export the surplus products. Great consideration had been given to the industrial sector and the heavy industry in particular. This emphasis within the industrial sector was spurred on by the Qathafi perspective in his rhetoric in several occasions such as the Producers' Day, where he stated that 'there is no freedom for people who are nourished from outside the country...we must press ahead in building an industrial fortress in order to achieve real freedom' (Otman & Karlberg 2007).

Thus, in the 1973–1975, the 1981–1985 and the 1986–1990 plans, the emphasis was given to the industrial sector. The goal of the industrial sector in the 1981–1985 transformational plan, for instance, was to improve the economic structure for the benefit of transformational industries, to produce industrial commodities, to meet consumption needs and increase surplus for export. The growth in industrial output was hoped to lead to improvement in the national economy. These plans gave priority to chemical, petrochemical and oil refining exporting industries in addition to accelerating the pace of growth of basic metal, cement and engineering products industries, which constitute the key basis for industrial development (Buzied 1998; Saleh 2001).

Furthermore, Table 2.3 shows that great interest was given to the industrial sector as it was considered an important element to ensure sustainable development and to provide substitute resources for revenue to achieve varied productive economy.

**Table 2.3:** The transformational budget and actual expenditures for industrial sector from 1970-1996 (the amounts are in millions Libyan Dinars)

Year	1970	1975	1980	1985	1990	1996
Budget	21.8	129.9	614.9	254.2	139.0	20.0
Expenditures	15.0	100.0	583.2	260.6	35.9	71.3

Source: The General People's Committee of Planning (GPCP), Tripoli, Libya (2000).

### **2.4.3 STRUCTURING OF THE ECONOMIC ACTIVITIES**

Since the revolution in 1969, Libya has completely changed from capitalism to socialism. State intervention in the economy has increased and the government started expanding the public sector and cutting back the private sector. The state and public ownership structure of businesses was started in the early 1970s, gained momentum in the mid-1970s and reached its peak in the 1980s where most business became owned or controlled by the public (society).

The public or state came to dominate all manufacturing activities, foreign and domestic retail trade, banking and insurance services. Gzema (1999) pointed out that private spending in manufacturing had steadily declined after 1969 overthrow and had almost reached zero before the total nationalisation in 1977. The key objective of such enterprises is to offer goods and services to the public rather than to make a profit (socio-economic development target).

However, whilst the Libyan economy is characterised by its central control and authority policies, some private companies emerged and started to operate in Libya in the 1990s. The promulgation of Law (9), issued in 1992 on partnerships provisions, could be regarded as the beginning of this shift towards production under the new economic activities structure, where individuals, in partnership and collectively, engage in manufacturing, agriculture, the professions and other productive ventures, as sole owner or in partnership with others and in

accordance with the provisions of the Law (9) of 1992<sup>14</sup> (Otman & Karlberg 2007). Moreover, in 1997 Law No. (5)<sup>15</sup>, was enacted by the GP Congress to attract foreign investment projects into Libya, within the framework of policy of the society and for the objectives of commercial and social development (Otman & Karlberg 2007). However, Arab Banking Corporation (ABC) (2001) stated that foreign involvement in Libya was severely reduced as a result of the sanctions and embargoes placed upon it since 1992.

## **2.4.4 LIBYAN OIL AND CEMENT INDUSTRIES**

### **2.4.4.1 LIBYAN OIL INDUSTRY**

The oil industry plays a significant role in the Libyan economy. It presents the main source for foreign exchange proceeds and represents approximately 95 per cent of the total exports. Also, its share of the budget revenue is considerable. Crude oil revenues increased at an exceptional rate, GDP and per capita income increased substantially, the relative importance of the economic sectors (agriculture, industry and services) changed and the surplus in the balance of payments increased each year, making it the most important source of capital formation, see Table 2.6 in the following section of the current economic picture.

The oil sector provides Libyan job opportunities and foreign investment as well. Recently, the government has become aware of the sector's importance, particularly with foreign investment increasing in this sector. In this context, Libya's policy has allowed various overseas private companies to invest in the oil and gas sector. Twenty-six (81.25 per cent) are multinational companies from a variety of countries, while the rest (6 companies or 18.75 per cent) are Libyan (see Table 2.4). Companies which have been chosen in this study will be discussed in more details in chapter four. Since the early 1960s, the petroleum industry has

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<sup>14</sup> According to this Law, individuals have to carry their economic activities within the bounds of the range of spiritual and moral values in which society believes. Workers in such activities, also, must be treated as partners (not wage workers).

<sup>15</sup> According to this Law, projects which are established in less developed areas, contribute to food security, or those which use installations conducive to saving energy, water, or contribute to environment protection shall be exempted from all custom duties and taxes including income tax for up to five years (Article 10).

increasingly dominated the whole economy. However, it provides direct employment for fewer than 20,000 Libyans. The development of the oil industry was remarkable, both in terms of its rapidity and in terms of its proliferation.

**Table 2.4:** Oil and gas companies operating in Libya

<b>Company's Type</b>	<b>Name of the Company</b>	<b>Total (%)</b>
<b>Libyan Companies</b>	Es Sider, Marsa el-Brega, Tobruk, Ras Lanuf, Zawia, Zuetina	<b>6 (18.75)</b>
<b>Multinational Companies</b>	Amerada Hess, Canadian Occidental, Chevron Texaco, CNPC, Eni, Husky Oil, Indian Oil Crop., Liwa (UAE), Medco Energy (Indonesia), Naftogaz Ukrainy, Nimr Petroleum (Saudi Arabia), Norsk Hydro, Occidental, OMV, ONGC, Pedco (South Korea), Petrobars (Brazil), PetroCanada, Petronas (Malaysia), Red Sea Oil Crop. (Canada), Repsol, Shell, Total, Verenex (Canada), Wintershall (Germany), Woodside (Australia).	<b>26 (81.25)</b>

Source: U.S Energy Information Administration (EIA) 2007.

Libyan crude oil, having high wax content, is lighter and easier to handle than crudes from most other petroleum areas (Gurney 1996). It also has a low sulphur content, which makes it easier on internal combustion engines and less polluting than other crudes. For this reason, Libyan crude oil had a receptive market in Europe from the start; not forgetting that Libya is close to the European markets, due to the oil ports of the eastern Mediterranean (OPEC 1999). In addition, Libya's petroleum development benefited from the technology and experience acquired by the industry in other parts of the petroleum world during the preceding fifty years. Production of crude oil in Libya began in 1961 (see Table 2.5) and, by the end of the decade, Libya had become one of the leading oil producers and exporters in the world.

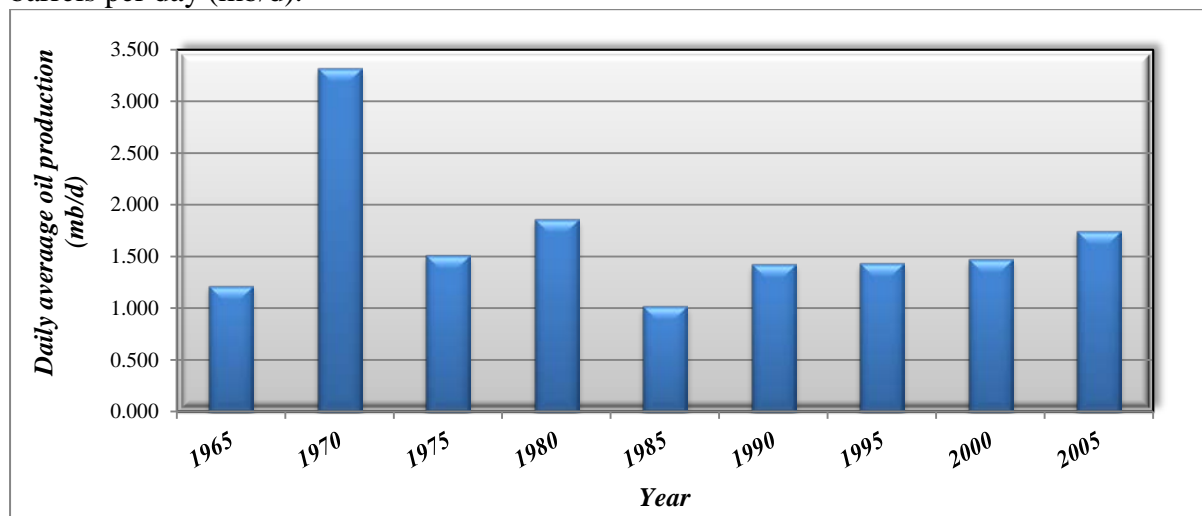
**Table 2.5:** Libyan Oil Production during the period (1961-2010), (Million Barrel Per Day)

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Production	0.20	0.18	0.465	0.860	1.220	1.505	1.745	2.506	3.110	3.321
Share (%)	0.10	0.40	2.00	3.50	3.84	4.36	4.67	6.43	7.12	6.98
Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Production	2.765	2.240	2.180	1.520	1.514	1.972	2.108	2.023	2.139	1.862
Share (%)	5.41	4.19	3.78	2.66	2.71	3.26	3.36	3.19	3.24	2.96
Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Production	1.253	1.176	1.151	1.022	1.025	1.064	1.003	1.051	1.164	1.424
Share (%)	2.10	2.05	2.03	1.77	1.78	1.76	1.65	1.66	1.82	2.18
Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Production	1.439	1.473	1.402	1.431	1.439	1.452	1.491	1.480	1.425	1.475
Share (%)	2.20	2.24	2.12	2.13	2.11	2.08	2.07	2.01	1.97	1.97
Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Production	1.427	1.375	1.485	1.623	1.745	1.815	1.820	1.820	1.652	N/A
Share (%)	1.91	1.84	1.93	2.02	2.15	2.23	2.23	2.22	2.07	N/A

Source: British Petroleum (BP) (BP) Statistical Review of the World Oil Industry (2010), and (OPEC) Annual Statistical Bulletin for the Years (1999-2009). N/A: Data not available.

As can be seen from the above table, oil production noticeably fluctuated during the period between 1970 and 2010. The fluctuation in oil production is due to some reasons which can be explained as follows: the oil price crisis that happened in the late 1970s and the early 1980s, where the crude oil at that time had reached approximately US \$14.22 per barrel (OPEC 1999); and the international sanctions which were imposed on Libya during the period between 1992 and 2003—due to the UN Security Council resolutions of 731 and 748, the production of crude oil had declined to around 1.9 million barrels per day in 2003.

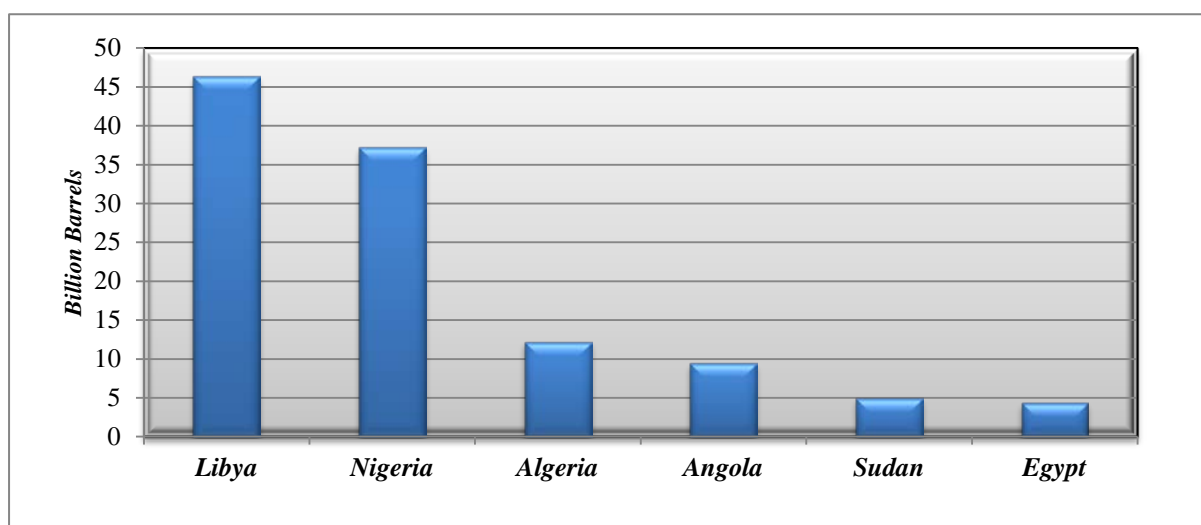
**Figure 2.6:** Libyan daily average of oil production during the period (1965-2005), million barrels per day (mb/d).



Source: (OPEC) Annual Statistical Bulletin, (2005).

Figure 2.6 also demonstrates that the share of oil in GDP has dramatically changed over time. Libya's production rose rapidly during the 1960s to make it the third largest oil producing country by 1969 and one of the dominant members of OPEC at that time. Libya's oil production has largely followed OPEC's overall production profile, although over the last fifteen years has been growing modestly compared with OPEC's average growth of around 3 per cent per annum (Ghanem 1975). Libya's oil capacity has been constrained by lack of investment, mainly due to economic sanctions. However, the country's oil sector is again attracting foreign capital and technology, and production is rising. Current production of 1.65 million barrels per day is little more than half the peak of the early 1970s. Hence, the country has the resource base to raise production capacity significantly. In terms of the oil reserves, and in the recent period of 2007–2011, the Libyan oil industry has crude oil reserves of approximately 46.4 billion barrels, the largest proven oil reserves in Africa, but most analysts agree that the country is still unexplored (OPEC 2011), Libya is followed by Nigeria and Algeria for proven oil reserves (see Figure 2.7). Close to 80 per cent of Libya's proven oil reserves are located in the Sirte basin, which accounts for most of the country's output.

**Figure 2.7:** African proven oil reserves holders, for the period 2007-2011.



Source: OPEC Monthly Oil Market Report, April (2011).



More recently, Libya hopes to increase oil reserve estimates with incentives for additional exploration, both in established oil producing areas as well as more remote parts of the country. This will open the oil industry up for more foreign investment, which will obviously have a positive impact on pushing forward the Libyan economic development wheel (Otman 2007a). One of the major impacts on the environment is the hydrocarbon sector. As mentioned above, this sector plays a considerable role in driving the country towards development and to ensuring its economic prosperity. In addition, the oil sector accounts for approximately 70 per cent of the country's total emissions (EGA 2003). Therefore more careful attention must be paid from both the government and the policy maker's sides to those environmental policies which can reduce the emissions and tackle the problem of air pollution.

#### **2.4.4.2 LIBYAN CEMENT INDUSTRY**

Cement plays a key role in our lives; it is a basic material for all types of construction, including housing, roads, schools, hospitals, dams and ports. In general, cement is a mixture of limestone, sand, clay and iron. The most common type of hydraulic cement is Portland cement. The term hydraulic cement is used because cement hardens when mixed with water. According to the Portland Cement Association (PCA) (2008), Portland cement is a closely controlled chemical combination of calcium, aluminium, iron and small amounts of other ingredients to which gypsum is added in the final grinding process<sup>16</sup>.

Cement is the basic component of making concrete, and was patented and produced in 1842 by a British Stonemason (Lesley 1924). Presently, more than 1,700 million tonnes a year of cement are used worldwide, with different manufacturing types and producers to meet various physical and chemical requirements (Hokoma et al. 2008). In addition, the cement industry is considered one of the most energy intensive industries in the world and one of the

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<sup>16</sup> For further information see: <http://www.cement.org>

largest energy users, consuming about 2 per cent of the globally produced electricity and about 1.5 per cent of total global fuel production (Benzer et al. 2001).

The cement production field is considered to be a high level competitive industry because of its strong relations to gross domestic product growth for many countries. Libya has paid strong attention to this industry as all raw materials required to produce the cement are locally available. The importance of cement in the construction sector, as well as for the infrastructure buildings, is paramount and it is extensively used in most of the major civil engineering projects. This makes the cement industry an extremely important manufacturing entity requiring further development and better organisation.

Nationally, the cement sector in Libya is not a major economic actor. Nevertheless, on a sectoral level, the impact of the production of the cement on the natural and social environment in Libya is very important. The cement industry is considered one of the vital sectors in producing constructing materials in the Libyan state, as this sector plays an important role in achieving several fundamental development plans. The non-oil manufacturing and construction sectors account for about 20 per cent of the GDP and range from production of cement, iron, steel and aluminium to food processing and manufacture of textiles and handcrafts (Pillet 2005).

Cement production is one of the most promising industries in the non-oil sector. This industry is very important to Libya because there are many things to consider. Primarily, the country has the raw materials needed to produce cement of a very high quality. This allows the cement sector in Libya to make cement of excellent quality. This factor alone made the cement business one of the most successful local industries. Secondly, the demand for cement is very high for building and construction projects, such as the Great Manmade River Project

(GMRP)<sup>17</sup>, which consumed more than an estimated 800,000 tonnes per year of sulphate-resistant cement and required 5,200 kilometre of pipeline made of the same type of cement (Taib 2007). For any industry to be successful, it is important to have the raw materials at a reasonable price, which Libya already has. This industry has been active for more than 30 years and therefore, to some extent, it has the technical experience and efficiently trained personnel.

In recent years, Libya has focused on improving its industry in general and the cement industry in particular (Hokoma et al. 2008). Libya post-1969 has witnessed considerable industrial and urban development. Al-khums is one of the cities where several cement factories were built because of its strategic location and the availability of the necessary raw materials for cement production. The cement company named Al-Ahlia, which was involved in this study, is one of the largest companies in Libya and one of the largest producers in North Africa (Graisa & Al-Habaibeh 2010). The company is located in the north-west region of Libya. It has a cement production target of approximately 3,330,000 tonnes per annum. It also has additional manufacturing facilities, for instance, it also produces gypsum, lime, factory bags, factory block, marble, concrete plant and cement mixes<sup>18</sup>.

Cement manufacturing in Libya is the sole domain of three key firms, producing about 8 million tonnes of cement annually from nine plants<sup>19</sup>. Figure 2.8 demonstrates all Libyan cement plants and their estimated annual production capacity in 2009. This production satisfies most of the domestic needs and the surplus is exported. However, as evident, the average capacity utilisation and the manufacturing efficiency are about 50 per cent, due to a number of manufacturing planning and control reasons (Hokoma et al. 2008; Mobbs 2001).

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<sup>17</sup> A project designed to transfer water from huge freshwater aquifers in the south to the northern residential and agricultural areas of Libya, (see the Great Manmade River Project Authority at, <http://www.gmmra.org>).

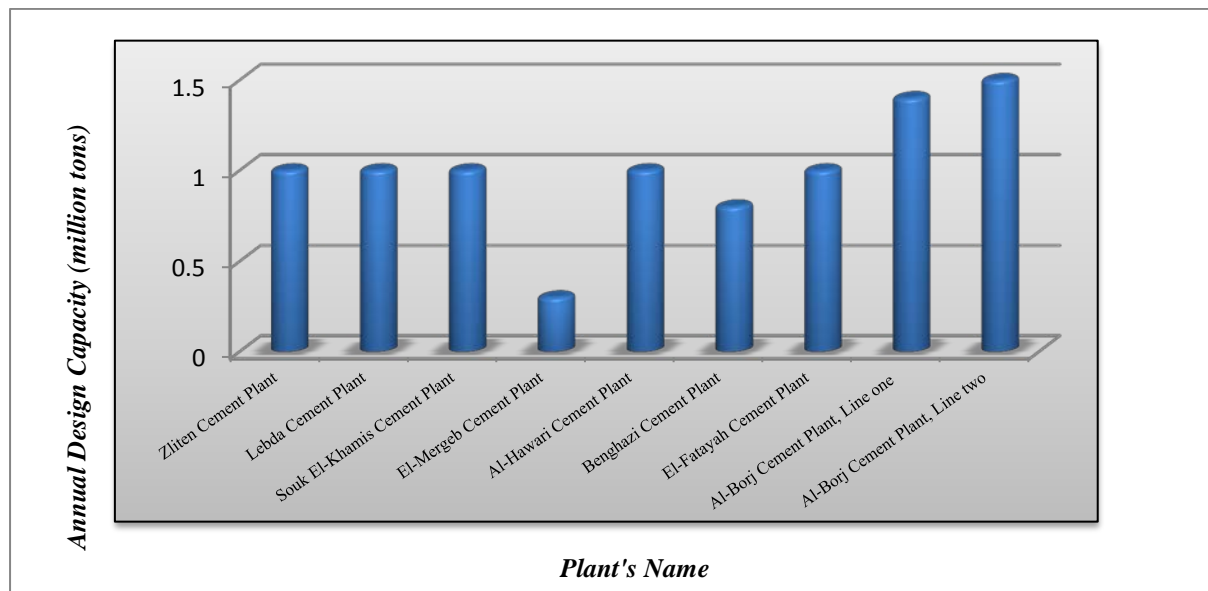
<sup>18</sup> More details are provided in chapter four regarding the cement companies that are involved in this study. These companies are as follows: Al-Ahlia Cement Company; Libyan Cement Company; and Arab Union Contracting Company.

<sup>19</sup> The Libyan cement plants are discussed in more details in chapter four.

Because of its importance, the cement industry in Libya has been made a high priority to be upgraded with advanced manufacturing technologies, as well as to be managed effectively. It requires application of the recent advances in manufacturing technologies and managerial techniques.

The Cement production in Libya started in 1969 with a small production capacity of around 330,000 tonnes and the production has increased year after year until it reached approximately 8 million tonnes per annum in 2010 (see Figure 2.9), which indicates the annual cement production in Libya for the last two decades.

**Figure 2.8:** The Libyan cement plants with the estimated annual production capacity in 2009.

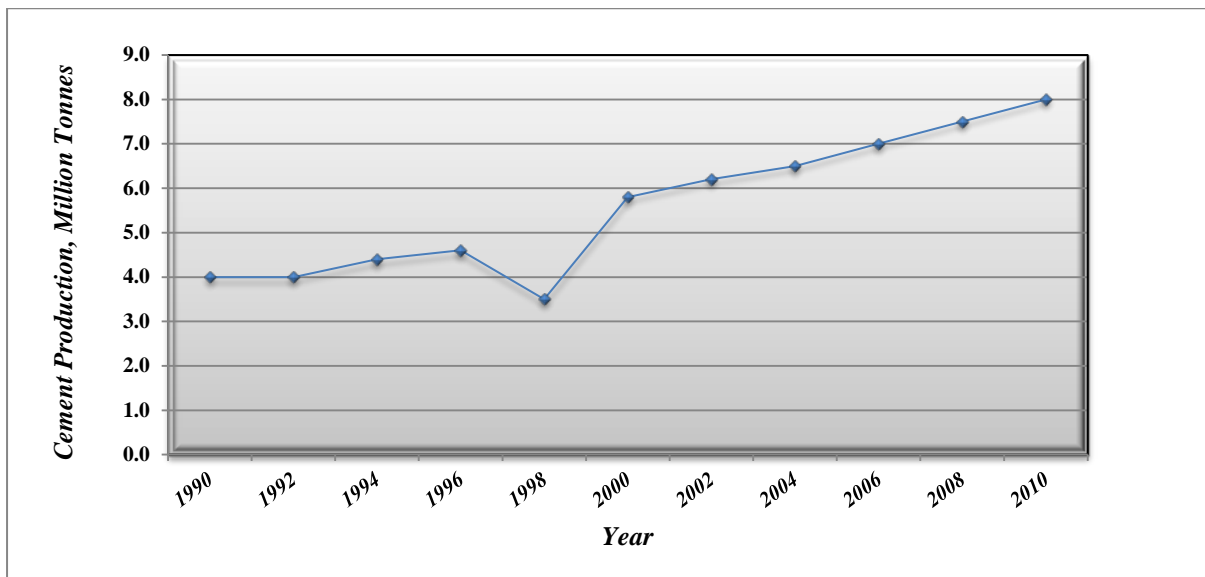


Source: Compiled from the booklets of all Libyan cement companies, (2009).

The cement produced from all of the cement companies is for internal consumption, due the fact that the total production is required for the infrastructure of Libya. The Libyan cement companies are producing cement according to specific Libyan specifications, which are similar to those of British Portland cement. All of them use a dry process method in all factories.

Libya is to almost double cement output to 15 million tonnes by 2012 from 8 million (Graisa & Al-Habaibeh 2010). This amount of cement production will require careful attention regarding the current environmental policies that have previously been applied to those cement companies. The environmental law should also be updated in accordance with the above amount of cement production and its impact on the environment (closed cities, farms, etc.). A clear understanding and careful planning and control of the manufacturing operations and processes are required to efficiently produce these huge amounts of cement every year.

**Figure 2.9:** Annual cement production in Libya for the period (1990-2010).



Source: Compiled from the Industrial Research Centre (IRC) in Libya, 2010.

## **2.4.5 THE CURRENT ECONOMIC PICTURE**

In 2003, the Libyan leader described the Libyan socialist experiment as a failure, and clearly stated that reform and transformation to an open economy was imperative. A new Libyan government emerged to manage Libya's economic transition process (Otman 2007b). The GP Committee (cabinet) has since made several major decisions ultimately aimed at the elimination or reduction of state subsidies on basic foodstuffs and fuel, an increase in

government salaries and the commencement of a massive privatisation effort, encompassing over 360 firms.

Since then, the current approach to the economic transition in Libya is much more determined and mature than previous efforts in the 1990s. This is because the government has learned many lessons from the preceding phases of national economic development. In the period from the early 1990s to the present, the government continues to support and encourage the private sector, as well as privatise most of the state economic and service bodies so that they can operate in a modern and efficient manner (Otman & Karlberg 2007). This has been supported by the creation of the Libyan General Planning Council by Law No. (2), of 1997, a body which will operate separately from the General People's Committee for Planning (Ministry of Planning), while both, at later stage, will combine to secure the objectives of overhauling the national economy (Otman 2007b), these goals are summarised as follows: 1) Establishing a flexible approach to economic policy to create economic stability, by viewing short term results which, if positive, will be encouraged in the long term; 2) Improving efficiency and productivity in existing production facilities in order to reconstruct the national economy and infrastructure; 3) Establishing a new policy for encouraging foreign investment in all state sectors based on their experience elsewhere; 4) Continuous development in social development and in education and health; 5) Reducing state expenditure and increasing national income from new industries, such as tourism, fishing, trade, foreign investment, and extending the tax base; 6) Increasing the participation of national manpower in sectors and professions presently occupied by foreigners; 7) Continuing financial support through loans towards the continuous expansion of the agriculture sector; and 8) Supporting and directing the private service sector to take over from public institutions.

Recently, there is no doubt that Libya has been making significant progress towards economic development, as reforms affecting the corporate, financial, and foreign direct investment sectors began to make their mark in 2006 (Otman 2007a). In particular, there has been major investment in two key sectors: the hydrocarbon sector, where the lifting of US sanctions has signalled the return, in a big way, of major US international oil companies such as Occidental, Conoco Phillips and Amerada Hess; and the industrial sector, where the industry has changed from the command economy to the market economy, comprising several industries such as cement, steel and food.

In 2006 the crude oil prices, reflected by the OPEC Reference Basket Price—which up to the end of August in the same year had averaged US \$62.75 barrel per a day—had been extremely favourable to the overall macroeconomic picture (OPEC 2006). Generally, in 2005, macroeconomic performance was extremely strong, with large fiscal and external account surpluses. It appears that 2006 was equally promising, with the most recent IMF review in 2006 being positive. However, excessive reliance on central government and the hydrocarbon sector still remain downside risks, while the decoupling of the Libyan economy from excessive reliance on the hydrocarbon sector still has a long way to go.

In 2008 the government announced ambitious plans to increase foreign investment in the oil and gas sectors to significantly boost production capacity from 1.2 million barrels per day (bpd) to three million bpd by 2012. The government is also pursuing a number of large scale infrastructure development projects such as highways, railways, air and seaports, telecommunications, water works, public housing, medical centres, shopping centres and hotels.

Libya faces a long road ahead in liberalising the socialist-oriented economy, but initial steps—including applying for World Trade Organization (WTO) membership, reducing some subsidies, and announcing plans for privatisation—are laying the groundwork for a transition

to a more market-based economy. The non-oil manufacturing and construction sectors, which account for more than 20 per cent of the GDP, have expanded from processing mostly agricultural products to include the production of petrochemicals, cement, steel, iron and aluminium.

Climatic conditions and poor soils severely limit agricultural output and Libya imports about 75 per cent of its food. Libya's primary agricultural water source remains the GMRP, but significant resources are being invested in desalinisation research to meet growing water demands. Government officials have also indicated interest in developing markets for alternative sources of energy, pharmaceuticals, health care services and oil production.

The main economic indicators for the period 2000–2009 are presented in Table 2.6 and demonstrate the present economic picture of Libya. The strong financial position presents an excellent window of opportunity for the Libyan policy makers to implement the economic reforms discussed above, as well as to deal with issues related to both consumer goods subsidies and the generous fuel and energy subsidies provided to the Libyan populace, which have the long term potential to destabilise the economy if not dealt with. Similarly a growing unemployment problem is also one which the Libyan authorities are, with the strong financial position, in a better position to deal with by massively increasing investment in Libya's ageing infrastructure and housing sectors, which can provide many direct and indirect employment opportunities, especially to a growing population of under-30-year-olds.

The strong economic and social development Libya intends to attain must work side by side in order to also achieve environmental improvement. Therefore, governments (the GP Congress and the GP Committee) must concern the Libyan environmental issues and pay careful attention towards enacting strong environmental regulations and implementing better environmental policies that would reduce air pollution and protect the environment from degradation.



**Table 2.6:** The Libyan economic indicators for the period 2000-2009

<i>Economic Indicator</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>
<i>The Real GDP (growth rate %)</i>	3.7	4.3	1.3	4.4	4.6	9.9	5.9	6.0	3.8	3.7
<i>The Real GDP (US\$ per capita)</i>	6340.1	5945.0	5748.8	6364.3	6509.3	7008.6	7272.1	7553.5	10662.0	6241.0
<i>Inflation (GDP annual %)</i>	18.4	3.5	48.5	8.2	35.0	24.5	14.9	14.3	25.4	N/A
<i>Inflation Consumer Prices (annual %)</i>	-2.9	-8.8	-9.8	-2.2	-2.2	2.7	1.5	6.3	10.4	N/A
<i>Current Account Balance of GDP</i>	18.5	11.7	3.5	14.1	13.8	34.0	39.2	39.7	38.3	20.0
<i>Exports (% of GDP)</i>	35.6	31.9	46.2	62.4	63.3	66.4	71.3	67.6	67.4	50.0
<i>Imports (% of GDP)</i>	15.5	20.0	35.2	36.7	32.1	28.3	25.5	29.4	27.2	38.0
<i>Trade Balance (million LD)</i>	3310.1	2733.6	4591.3	9208.7	12593.1	23194.5	28104.6	32470.7	43537.2	N/A
<i>Exchange Rate (LD to USD end of year)</i>	0.54340	0.64409	1.21063	1.30187	1.24440	1.34864	1.28178	1.22116	1.24540	1.30220
<i>Deposit Interest Rate (%)</i>	3.0	3.0	3.0	3.0	2.1	2.1	2.5	2.5	2.5	N/A
<i>Debt Service Ratio (%)</i>	2.2	2.6	3.4	3.5	3.9	3.2	2.7	2.3	1.7	4.7
<i>Consumer Price Index</i>	123.8	112.9	101.8	99.6	97.4	100.0	101.5	107.8	119.0	N/A
<i>International Reserves (million LD)</i>	6534.0	8587.0	17416.1	25611.7	32100.4	53475.6	76244.8	97270.1	115304.3	118427.6
<i>Actual Non-Oil Revenues for Public Budget (million LD)</i>	2459.2	2395.8	2023.1	2984.6	3131.0	2728.0	3522.0	4728.0	8324.2	4019.6
<i>General Government Final Consumption Expenditure (% of GDP)</i>	20.8	22.8	16.2	13.6	13.1	11.8	10.7	11.6	9.3	7.9

Source: World Development Indicators, (2009); Economist Intelligent Unit, Country Report, (2004-2008), Central Bank of Libya, Economic Bulletin, (2009).  
N/A: Data is not available.

## **2.5 REGULATORY AND CONSITITUTIONAL CONTEXT**

### **2.5.1 LIBYAN ENVIRONMENTAL LEGISLATION**

From 1958, Libyan environmental legislation was not well developed until the issuance of Law No. 7 in 1982 concerning the protection of the environment (LSJ 1982). This section summarises the main local legislation that was established within the frame of protecting the environment, in addition to the elimination of the various causes affecting pollution in Libya.

In this context, Otman and Karlberg (2007) argue that the gradual development and endorsement of environmental legislation in Libya has gone through three phases.

**The First Phase (1969-1975):**

The phase started when Law No. 5 was issued in 1969. It was linked to organisation and planning. Consequent amendments included planning provisions that contributed to environmental reform protection against pollution. In chapter five, the law contained provisions for the establishment of a department responsible for operating and maintaining the public utilities. In 1973, Law No. 130, concerning local administration systems, was established. The law was issued with the aim of providing services to citizens in their respective locales and allowing them to participate in dealing with daily issues in a de-centralised context managed by the local executive bodies.

**The Second Phase (1975-1982):**

During this phase, following laws<sup>20</sup> were issued: Law No. 28 (1975) for the organisation of the ministry of municipalities; and Law No. 39 (1975) concerning municipalities. Law No. 28 dealt with the organisational structure of the ministry decreeing the establishment of certain general departments, among which was the general department for protecting the environment. It was responsible for the actual supervision of all matters related to the safety of drinking water in terms of its conformity to sanitary requirements and applying modern health methods. In connection with the disposal of waste and other pollutants, departments were required to take necessary measures to restrict and eliminate such pollutants. The ministry was given the right to supervise issues pertaining to environmental improvement and development. Moreover, Law No. 39 (1975) and its executive regulations dealt with details of

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<sup>20</sup> In the execution of these two laws, many regulations were issued in the capacity of the conservation of the environment, such as: the ministry of municipalities decision No. 18 (1976) for a model regulation to regulate the water and drainage utility services at the municipalities issued on the 28<sup>th</sup> of April, 1976; the ministry of municipalities decision No. 94 (1976) for a model regulation related to public cleanliness; and the ministry of municipalities decision No. 142 (1976) concerning the rules for disposal of waste materials at the municipalities, issued on the 19<sup>th</sup> of May, 1976.

the responsibilities related to the protection of the environment against pollution and adopting preventive measures to avoid pollution of foodstuff through the proper inspection of both products and outlets.

**The Third Phase (1982- to Date):**

In order to execute the decisions of the people's congresses in its third session for 1981, the GP Congress formulated Law No. 7. In 1982 it was issued<sup>21</sup> to protect the environment (the habitat of man and all living creatures which include air, water, soil and food) against pollution, along with funding appropriate methods for measuring pollution. This was carried out in order to draw public plans and programs to eliminate environmental pollution. Article (2) of the Law No. 7 of 1982 stated that 'this law aims at protection of the atmosphere in which man lives and all living creatures including water, soil and food against pollution and finding appropriate ways for measuring pollution therein in order to draw up plans and general programmes to minimise environmental pollution'. Due to the desire to found an authority that had the responsibility to handle all the environmental concerns in Libya, the EGA was established according to the GP Committee's decision No. 263 of 1998<sup>22</sup>. The decision gave the body the right to inspect and supervise all individual, public, private and foreign bodies in matters relating to the protection of the environment.

The authority practices the duties assigned to it through its specialised technical departments, namely (Article (3) of the decision No. 54 of 1999 for EGA's internal structure): 1) Environmental Studies and Research Department; 2) Inspection and Environmental Control Department; 2) Nature and Natural Resources Conservation Department; 3) Prevention and

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<sup>21</sup> It is worth mentioning that during the phases referred to above much pertinent legislation was issued concerning environmental reform and protection, such as: decision No. 8 (1974) by the Minister of labour on Issuance of Rules for the Protection of Workers' Health and Safety; Law No. 93 (1976) on Industrial Security and Employee Safety; Law No. 5 (1982) concerning protecting forests and range management; Law No. 13 (1984) on General Sanitation; Law No. 15 (1989) concerning protecting animals and trees; and Law No. 5 (1990) on Standardisation and Metrology.

<sup>22</sup> In 2001, EGA became directly responsible to the Secretariat of the environmental protection and water resources in the GP Congress (the highest legislative body in the state) in order to give the authority the right to inspect and supervise all individual, public, private and foreign bodies in matters relating to the protection of the environment.

Environmental Health Department; 4) Laboratories and Technical Affairs Department; and 5) Environmental Information Department.

## **2.5.2 THE ROLE OF THE ENVIRONMENTAL LAW NO. 7 OF 1982 IN LIBYA**

Law No. 7 of 1982 regarding environmental safety and its accompanying Executive Regulations, was issued by the Resolution of the GP Committee No. 386 (1998) and can be considered to be Libya's first important law on the environmental protection, defining clearly and unequivocally most environmental terms, meanings and situations. Together it comprises 45 Articles, with Chapter 1 dealing with general provisions, and Article (1) providing concise definitions as follows:

- 1) **Environment:** the atmosphere/surroundings in which man and all organisms live, including air, soil and food.
- 2) **Environment Safety:** the control of all environmental factors as would have direct or indirect effect on human physical, psychological, and social safety.
- 3) **Environmental Pollution:** the occurrence giving rise to risks to human health or environmental safety as a result of pollution of air, seawater, water sources or soil, imbalances of living organism, including noise, vibration and bad odours, or any other pollutants resulting from the activities of natural or corporate person.
- 4) **Air Effects:** includes vehicle exhausts, radiation, dust volatile compounds, macromolecules, and biocides.
- 5) **Spillage:** oil spilling, leakage, or mixing for whatsoever reason.
- 6) **Oil:** crude oil, fuel oil, heavy diesel oil, lubrication oil, and other oil by-products.
- 7) **Oil Waste:** that is oil exhaust of all types, forms and properties.
- 8) **Oil Mixture:** that is any mixture including any oil contents.

- 9) **Centre:** the Technical Centre for Environmental Protection, established in accordance with Article (7) of the law, and which is substituted by the EGA.

The objectives of the law are previously explained in Article (2), which explains that the law is aimed at the protection of the milieu in which man and all living organisms exist. Article (3) stipulates that all individuals, organisations, corporations, companies and public departments must make every effort to contribute to pollution control and observance of the relevant instructions. Article (4) stipulates that if any mentioned body in the previous Article causes by its act the pollution of environment in any way, it shall take the necessary procedures in order to eliminate it, within the limits of the caused pollution.

Article (5) explains that the bodies indicated in the preceding Articles which perform activities as would cause environmental pollution shall apply all conditions and procedures specified in this law and other laws related to the environmental affairs. These bodies should inform the Centre of the incidents occurring due to performing their activities as would lead to environmental pollution, and should provide the necessary equipment and devices to control pollution in order to protect the environment.

Article (6) provides that public authorities must take into consideration the methods and all necessary means to maintain environmental balance when planning for urban development.

Article (7) deals with the establishment of the Technical Centre for Environmental Protection, which has been superseded by the EGA, the power that will be discussed later in this section.

In Chapter 2 of this law, Articles from (11) to (18), the protection of air and atmosphere from pollution is dealt with, while Chapter 3 deals with protection of the sea and marine wealth, laying down the rules and provisions to achieve this, essentially filling gaps in Law No. 8 (1973). It includes many prohibitions, whether in respect of fishing, boats, tankers, or other vessels, on waste disposal into the sea, with many provisions preventing both corporate

bodies and individuals from disposing of waste and poisonous substances on to Libyan territorial beaches and waters.

In view of the crucial importance of this comprehensive piece of legislation, which currently is in force and in practice, it is necessary to detail its important provisions. The law lists many important provisions in regard to the prevention of pollution and protecting the air and the atmosphere, stating that:

- 1) It is not allowed for any factory, company and laboratory which emit any air pollutants in contravention with the approved scientific rules and criteria, in compliance with this law. The factories, companies and laboratories in the process of experimental operation at the time of implementing this law shall be excluded from this provision, as well as those to be constructed in future, provided that the exclusion period shall not exceed six months from the date of starting official operation (Article, 11).
- 2) Each factory, company and laboratory from which any air pollutants emit should keep a record quality, quantity and components of such discharged pollutant and submit it to the competent body (Article, 12).
- 3) The Centre may issue the necessary instructions for any factory, company or laboratory for making changes to the relevant building or the method of operation or disposal of air pollutants or changing the type or closing it for the period specified, if it is proved that the quantity of air pollutants exceed the rules and criteria issued in this respect, and continuity thereof would endanger public health or cause environmental pollution (Article, 13).
- 4) Each industrial establishment in which an incident or emergency will probably happen during operation as would cause discharge of a large quantity of air pollutants shall take the prompt procedures in the event of the incident or emergency for

restoring the establishment of its normal condition before occurrence of the accident or emergency (Article, 14). If it is proved that the incident or emergency would lead to harm the public health or result in environmental pollution in the surrounding area to the factory or establishment in which the incident or the emergency occurred, the Centre issued its instructions and orders to the establishment concerned for taking of necessary prompt procedures for preventing the spread of damages caused by the accident.

- 5) It is prohibited to set fire to rubber and oil materials, garbage and other organic materials in order to eliminate it in the inhabited areas (Article, 15).
- 6) It is not allowed to transport hazard materials that cause dust, micro particles or frames into the air, as would result in environmental pollution or harm to public health, unless covered tightly during transport, and putting safety marks and instructions indicating that the extent of danger of the carried materials (Article, 16). Volatile organic materials as well as solvents and acids shall not be left in a manner causing air pollution without covering them tightly to prevent them from leakage to the atmospheric air. Such materials shall not be disposed of, unless in accordance with scientific conditions and rules specified by the Centre.

In 2003, the GP Congress updated and replaced the Law No. 7 (1982) with Law No. 15 (2003) which is concerned with all issues related to the environmental protection and is considered to be the most important environmental law in the state. It contains 12 Chapters and 79 Articles. It is clearly apparent that Chapter 2, which is concerned with air pollution and protecting the atmosphere, including all Articles and provisions that have been given in this chapter, have not been changed or even updated. Therefore, several important gaps related to this law and environmental policies will be discussed in more details in Chapter Five, regarding both the results and discussion.

In this landmark piece of Libyan environmental legislation, the Technical Centre for Environmental Protection was substituted with the EGA, and gave powers to EGA under 16 main headings. The most important among these being the registration of all chemical substances that may cause environmental pollution, including pesticide use for public health, agriculture and veterinary purposes, as defined by a resolution of the People's Committee of Authority (Otman & Karlberg 2007).

The EGA also has the power to provide opinions and approvals on the environmental effects and impacts of particular development projects, prior to the execution of such projects, to be followed up by environmental plans and agreements covering such projects in the future. In this context, the Authority issued Decision No. 43 (2000) regarding the organisational structure of the Authority.

EGA is the body holding the responsibility for the environment in Libya. The key objectives of EGA are to protect the natural resources, fight against environmental pollution, protect biodiversity and biological balance, and achieve sustainable development and integrated social planning (EGA 2002, 2003, 2005).

The activities of EGA are to: 1) Engage Libyan industrialists in environmental action and sustainable development; 2) Offer environmental training and tools that can support industrialists in adopting eco-efficient principles and practices; 3) Propose plans and programs related to environment and supervise on the execution and follow up, taking into account the environmental aspect within the plans of economic and social development; 4) Track scientific and technologic development in the field of environmental protection and improvement of its technical aspects; 5) Collaborate with international authorities for the protection of the environment; and 6) Give suitable authorisations for activities that can harm the environment. The authorisations must include necessary regulations and conditions.



In 2002 the EGA appointed a special committee for the development of environmental standards. However, this committee suspended its work one year after formation for administrative reasons (EGA 2002). One of the national long-term goals of the EGA is to adopt an effective policy for the development of science and technology into the future, together with the protection and the improvement of the local environment.

### **2.5.3 OIL AND CEMENT INDUSTRIES WITHIN ENVIRONMENTAL LEGISLATION**

Environmental governance of industry was virtually non-existent until the enactment of Law No. 7 (1982) and the effects of this are clearly visible today. While the situation has improved significantly over the last few years, major challenges remain in the areas of project development and impact assessment, improving the operations of older facilities, and, most importantly, changing attitudes at the higher levels of government.

Environmental issues have rarely been considered in the development of major industrial projects in Libya over the last forty years. This was the case throughout Libya for all aspects of project implementation: design, feasibility, site selection, and facility construction and operation. As a result, a number of large projects such as oil and cement have had very negative impacts on the environment. Unfortunately, some new projects are still being implemented without environmental consideration today. Further, development in Libya has historically been driven by a series of previously mentioned national plans and mega-projects. These schemes tend to have high-level political power and rapidly progress towards construction, without an opportunity to assess the environmental impact.

The first report published by the Libyan environmental body (EGA) (EGA 2002), states bluntly that present environmental conditions on the Libyan coast and some other parts are unacceptable for the following reasons: the presence of major industrial plants, especially oil refineries, cement, steel and iron factories, in addition to the yarn and textile factories;

concentration of oil and commercial ports in the coastal strip; the existence of many sewage and industrial waste sites along the coastline; and high population density in the coastal regions.

The Libyan environmental legislations are not adequate to drive the oil and cement sectors to be cleaner industries (UNEP 1997). The EGA's role is complicated by the confusing legal and regulatory framework. New decrees and amendments to existing laws are often adopted without repealing earlier legislation. In Libya's system, there is no effective mechanism for reconciling new legislation with previously existing statutes (Otman and Karlberg, 2007).

Libyan environmental laws lack sufficient specificity to offer useful guidance for the entire manufacturing sector, particularly oil sector which is the key polluter in the state, in addition to cement sector. The GP Congress Law No. 15 (2003) regarding the protection and improvement of the environment, is the most comprehensive and widely-implemented Libyan environmental law. However, Law No. 7 (1982), regarding environmental protection and Law No. 8 (1973), regarding the prevention of oil pollution in the sea remain on the books and have discrete sets of implementing regulations.

Despite the increase in environmental-related legislation, the level of regulation is still developing and, furthermore, this legislation has no direct implications for monitoring and providing information. However, it is worth mentioning that the executive regulation of Law No. 7 (1982), which was issued in 1998, requires companies to arrange with EGA about the necessary information that they should provide on the environment. Unfortunately, the EGA has not acted in this way.

Although there exists in Libya a body for law to deal with the environment, environmental health, and pollution issues, it is apparent that for many reasons, some related to administrative and legal impasses, these existing environmental laws are not being applied rigorously, although without having access to actual court proceedings and decisions it is

difficult to determine how poor the enforcement of existing environmental legislation really is (Bruch 2002).

Because of the severe shortage of baseline data, it is difficult to discuss with precision what actually needs to be done to bring Libya in line with twentieth-century environmental legislation, as well as environmental best practices, which are key features in virtually every modern nation or developing nation that aspires to modernity. One very serious gap in Libyan environmental legislation is the absence of any requirement for conducting the Environmental Impact Assessments (EIAs) for development projects of any type.

The involvement of the government of Libya and concern about the environmental issues remain marginal. Significant shortcomings in the regulatory framework and legal system remain; spotty enforcement and a lack of environmental remediation facilities are key issues. In addition, the absence of both environmental standards for industrial activities, including oil and cement activities, and the EIA system is considered a major barrier for improvements in environmental performance. Serious efforts should be made to provide constant monitoring, measurement and control equipment and to use clean energy in such industries.

To a certain extent, it can be seen that there is a negligent environmental regime surrounding Libya's hydrocarbon industry (a natural polluter), as well as the cement, steel and iron industries, that has already led to many problems such as emissions, dust, spilling and solid waste. Clearly however, the multitude and the magnitude of environmental problems should make it clear to Libyan policy makers that a major overhaul of the country's environmental legislation is urgently required to address the main issues related to the environmental degradation.

#### **2.5.4 FUTURE ENVIRONMENTAL CHALLENGES**

At the beginning of the 21<sup>st</sup> century, it is clear that the most salient issue facing the world today is the environmental challenge. Environmental problems have featured heavily in

scientific warnings, political agendas, public concern and media attention. Libya is not isolated from the rest of the world when it comes to this topic. This section seeks to highlight in a holistic manner the most important environmental challenges facing Libya.

Libya is facing distinctive environmental circumstances and challenges. Although the state is endowed with unique and rich natural resources, there is insufficient awareness of the importance of the environment in fuelling and sustaining economic growth and human welfare (Tolba & Saab 2008). Environmental considerations are insufficiently integrated in national development plans and policies, resulting in unsustainable use of natural resources for development programs.

It is apparent that the major environmental and sustainability issues are fundamentally associated with the petroleum industry, a polluter by nature, in Libya. In a legal context it is also crucial for the role of judiciary in the enforcement of the environmental legislation to be appreciated in the most Arab countries, including Libya, where its key role has not perhaps yet been fully understood from the point of view of long-term environmental protection (Selim 2004). In future years Libya will face serious environmental challenges, the most important challenges those which are associated with the oil industry, such as gas flaring, marine and groundwater pollution, in addition to the emitted dusts from several industrial factories including cement, steel, and iron industries (air pollution). Furthermore, the declining water resources per capita and the loss of arable land must be included.

In the Arab regions, countries such as Libya, United Arab Emirates, Qatar, Oman and Saudi Arabia have per capita emissions higher than the world average, while the rest of the Arab countries are approximately equal or fall below it (Tolba & Saab 2008). Together it is clear that combined with weak environmental institutions and legal frameworks, environmental and sustainability problems can only become greater if not addressed comprehensively. For example, within the series of the EU policy initiatives such as the UE Emissions Trading

Scheme, or any other initiatives, whether they are governmental or non-governmental initiatives, that would reduce the risk of environmental deterioration.

The North African region in general is threatened by the loss of arable land and increased coastal degradation, which are caused principally by unsustainable agriculture practices and unmanaged competition for land and marine resources, in addition to the huge amount of dusts and gas emissions that are released from the industrial plants adjacent to these lands. In the Middle East and North Africa (MENA) countries as a whole, permanent cropland, currently less than 6 per cent of the total land area and less than 1 per cent in Libya, is shrinking due to serious land degradation and recurrent droughts (Tolba & Saab 2008; UNDP 2004). Another example in relation to the environmental pollution is that water is in short supply with the situation deteriorating. Countries of the MENA region are home to 5 per cent of the world's population but have less than 1 per cent of the world's renewable fresh water. The region's per capita supply stands at only one-third of its 1960 level, with water availability anticipated to be cut by 50 per cent over the next 30 years (Otman & Karlberg 2007).

Managing water as an economic resource and looking into the regional dimension of the water challenge are crucial for human welfare and economic growth and stability in the region. As Libya industrialises and diversifies in line with economic policy, pollution-related health problems particularly in urban and industrial areas such as Tripoli, Benghazi, Zawia, Al-Khums and Misuratah are bound to increase, with causes related to open municipal waste dumps and the use of leaded gasoline in vehicles and fossil fuels for power generation and other industrial operation (UNEP 2005).

Moreover, hazardous wastes have been a general environmental problem across Libyan regions. This is due to low environmental awareness of the damage such substances could inflict on people and environment, in addition to inactivation of legislation and controls on

hazardous material, whether medical or industrial. Besides, the lack of documentation for all liquid or solid wastes – save at limited level – has led to the spread of numerous hazardous substances, especially in garbage dumps, mixed with other solid waste (UNEP 2005).

Air pollution is the most important environmental challenge facing Libyan regions particularly, both in urban and coastal areas. There are almost nine cement plants located across inhabitant regions. The cement industry is one of the main contributors to gases and dust air pollution, in particular with the absence of special equipment to filter and reduce emission levels of such pollutants (UNEP 2005). In this regard, these pollutants of dust and gas emissions have a considerable negative impact on the surrounding marine areas, agriculture lands, urban and rural areas. The oil seaports existing on the Libyan coast are the only outlets for export operations. The coast contains three main oil refineries in Zawia, Ras Lanuf, and Tobruk. There has been clear correlation between fuel consumption and atmospheric air pollution, whether such fuel is consumed for electric power production or transport or plant operation purposes.

## **2.6 SUMMARY**

This chapter has covered the particular socio-political, economic and environmental regulations in which this study is undertaken. In section three a country overview, including location, religion, language, and history of the country, in addition to its population and political environment, were comprehensively introduced. It concluded that Libya is a developing country with a small population and a vast area which comprises desert and semi-desert lands. A very small area of land is irrigated and many natural factors have to be overcome in order for the country to be developed. Islam is only the religion. Arabic is the only basic language, in addition to Italian and English which are widely understood in some major cities.

The discussion then moved to describe the political context. The alteration from a monarchy to the present system began when it became the Libyan Arabic Republic following the revolution on the 1st of September 1969. After the 1969 revolution, a number of actions (for example, nationalising foreign companies that were operating in Libya, and establishing public-owned enterprises) were taken by the new administration to structure the economy.

As a result, the private sector and foreign companies disappeared and a wide range of public-owned enterprises were formed. In the economic context section, the country's pre-oil and post-oil discovery economic progress was described. It is confirmed that, the country is classified as an oil-based economy and its overall performance is determined by oil production and its prices in international markets. In addition, fluctuation and instability have been the most important key features of the Libyan economy over the past three decades. It was confirmed that, since the mid-1970s, Libya's economy has been based on socialist principles and as a result the public sector has been dominant in social and economic life. It was also found that Libya's economy experienced a period of drastic stagnation between 1983 and 1999 because of the influence of the slump in oil prices, international sanctions and dominance of the public sector.

The section of the current economic picture confirms that the Libyan economy has been making significant progress towards economic development, as reforms affecting the corporate, financial, and foreign direct investment sectors begin to make their mark. In particular, major investment has been undertaken by the government in two key sectors, the hydrocarbon sector and the industrial sector, where these industries have changed from the command economy to the market economy.

The final section in this chapter focused on the regulatory and institutional context, particularly the Libyan environmental legislations. It was found that the level of environmental regulation in Libya is still low when compared to developed countries and,

furthermore, this legislation has no direct implications for monitoring and providing information. Moreover, combined with weak environmental institutions and legal frameworks, environmental and sustainability problems can only become greater if not addressed comprehensively. It was also found that over the last forty years environmental matters have rarely been considered in the development of major industrial projects in Libya. This was the case throughout Libya for all aspects of project implementation including design, feasibility, site selection and facility construction and operation. As a result, a number of large projects such as oil and cement have had very negative impacts on the environment.

The section demonstrates that air pollution is the most important environmental challenge facing Libyan regions, particularly both urban and coastal areas. This challenge is completely associated with the oil industry as well as the cement, steel and iron industries, which are closely located to the major cities where the majority of Libyan population is living.

To conclude, the involvement of Libya in and the concern about environmental issues remain marginal. The chapter also argued that the key role of the Libyan government has not perhaps yet been fully understood from the point of view of long-term environmental protection. Significant shortcomings in the regulatory framework and legal system remain, spotty enforcement and a lack of environmental remediation facilities are key issues. In addition, the absence of both environmental standards for industrial activities and the EIA system are considered major barriers for improvements in environmental performance. Therefore, serious efforts should be made to provide constant monitoring, measurement and control equipment, and to use clean energy in such industries.

Chapter five will provide more details on the situation of applying the Libyan environmental law, and how companies comply with these legislations. The next chapter of this thesis presents, discusses and reviews the related literature of this study.



## **CHAPTER THREE: REVIEW OF THE RELATED LITERATURE**

### **3.1 INTRODUCTION**

The two key elements that this chapter focuses on are sustainable development and emissions trading policy. On one hand, limiting climate change and increasing the use of clean energy is one of the biggest challenges to sustainable development, and reducing Greenhouse Gas (GHG) emissions is one of the key concerns in many international organisations in attaining sustainable development. On the other hand, integrating the three features of economic, social and environmental aspects is necessary to achieve sustainable development. This will be illustrated in this chapter.

The increase in GHG emissions, particularly CO<sub>2</sub> emissions, has led to the so-called global warming phenomenon and climate change. GHG emissions are the fastest growing in developing countries. This is due to the lack of effective climate policy actions. Emissions trading or tradable emissions permits are one of the key emissions reduction policies which have been introduced since the establishment of the Kyoto Protocol in 1997. In this regard, Emissions trading to GHG emissions reduction is considered to be one of the most beneficial tools in relation to CO<sub>2</sub> emissions trading. In developing countries, the Emissions Trading Scheme will set the scene of the necessary required policies that could cut down the environmental damage which has been caused by the increase of GHG emissions in the atmosphere.

Politically, it is important to understand the response to climate change from Non-Government Organisations (NGOs) and developed and less developed countries' point of view. In addition, Libya's and the Middle East countries' response to environmental degradation is considered to be a prominent subject in order to understand what has been done regarding tackling the problem of environmental pollution.

## **3.2 OVERVIEW OF THE CHAPTER**

In this chapter the literature reviewed falls into seven main sections. The first and second sections describe the introduction and overview of the chapter. The third section sheds light on the literature concerning emissions trading policy and its contribution to GHG emissions reduction. This includes emissions trading or “tradable emissions permits”, taxes, market-based approach to GHG emissions reduction and the environmental Kuznets curve framework. The fourth section, Political Economy Literature, reviews themes such as the sustainable development literature, sustainability and climate change, the response of NGOs, the response of governments in developed countries, and the response of governments in developing countries. The fifth section describes Libya and the Middle East in terms of their oil and cement industries, comprising of specific government policy and industry activities (response). The sixth section displays some gaps that have been found in the literature. The final section describes the summary of the chapter.

## **3.3 THE ECONOMICS LITERATURE**

### **3.3.1 EMISSIONS TRADING (TRADABLE PERMITS), AND TAXES**

#### **3.3.1.1 EMISSIONS TRADING (TRADABLE PERMITS)**

Rapid economic growth and increasing demand on goods and services have led to the so-called global warming phenomenon and climate change which is caused by the increase in GHG emissions, particularly CO<sub>2</sub> emissions (IPCC 2001b). Numerous prior researchers have argued that the worldwide emissions of GHG and atmospheric concentrations have steeply increased since the industrial revolution, with the largest absolute increase in CO<sub>2</sub> emissions occurring in the present time (Baumert et al. 2005; Marquette 2000; Onishi 2007; Raymond & Shively 2008). Baumert, Herzog and Pershing (2005, p. ix) point out that ‘GHG emissions will increase by 50 per cent by 2025 compared to present levels, with emissions in

developing countries growing the fastest'. This is due to the lack of effective climate policy actions.

Onishi (2007) argues that there are, in fact, several kinds of possibilities for energising the global economy, increasing its growth rate, greatly reducing CO<sub>2</sub> emissions and promoting technological innovations. Thus, one of the three most efficient policies that have been mentioned earlier is the emissions trading or tradable emissions permits to reduce GHG emissions, particularly CO<sub>2</sub> emissions since the establishment of the Kyoto Protocol in 1997 (Crettez 2004; Ekins & Barker 2001; Marquette 2000; Raymond & Shively 2008). In addition to this, previous studies by Crettez (2004) and Marquette (2000) have found that the only way to ensure the amount of reduction is through a permit system. The conclusion drawn about the emissions trading by Marquette (2000) is that an emissions trading system has been considered as the best option for meeting the Kyoto Protocol requirements. This is because it is more flexible, more feasible administratively, less regressive, politically feasible, and it guarantees specific emissions reductions.

Several prior studies have found that one of the most beneficial tools in relation to CO<sub>2</sub> emissions trading is MBIs to GHG emissions reduction (Andersen & Sprenger 2000; Sonnebron 2005; Sterner 1999). The argument is that MBIs are policy instruments which use price or other economic variables to provide economic incentives for polluters to reduce or mitigate their harmful emissions. Also, Sonnebron (2005) points out that, MBI seeks to reduce environmental damage and encourage emissions reductions by those who can achieve them at lower cost and higher benefits. In the case of reducing GHG emissions, the EU Emissions Trading Scheme is an example of a MBI that achieves better environmental outcomes. In addition to this, Andersen and Sprenger (2000) argued that the use of MBIs, such as an emissions trading provided more room for technological innovation.

Many European countries have ratified the Kyoto Protocol and some have national emissions trading schemes. A European Union-wide emissions trading scheme is being implemented and the EU has been central to the ratification of the Kyoto Protocol. European governments have given clear signals to industry that market-based mechanisms are an important area.

Policymakers increasingly invoke the power of markets to address environmental problems. This is indeed the case with global climate change. Many analysts and government officials have promoted international emissions trading as the most feasible way to manage global atmospheric commons (Bertram 1992; Braun 2009; Kuik & Mulder 2004; Zhang 1998). The allure of international emissions trading stems mainly from its potential to cost-effectively reduce GHG emissions. If implemented successfully, international emissions trading would represent an unprecedented achievement in international regulatory cooperation.

A GHG emissions trading system as a proposed way to control CO<sub>2</sub> emissions is built on prior experience with tradable permits in other environmental contexts. The first emissions trading programs were implemented in the United States following the Clean Air Act amendments of 1977. In the ensuing years, several other emissions trading programmes were implemented (UNEP/UNCTAD 2002). The first major environmental success of such trading was demonstrated in the 1980s through a US program to phase out lead from fuel. Provisions for international emissions trading for GHG emissions were then included in the 1997 Kyoto Protocol, since then interest in GHG emissions trading has spread.

The basic rationale for trading is straightforward. By giving firms the flexibility to relocate (trade) emissions credits or allowances among themselves, trading can reduce the overall compliance cost of achieving the emissions target (see Box 3.1). By giving an economic value to each unit of emissions reduced, an emissions trading system creates an incentive to find ways to lower the cost of emission control technologies and to implement measures that reduce emissions. For example, initial estimates of the cost of compliance with the sulphur

dioxide (SO<sub>2</sub>) cap for electric utilities imposed in the United States were based on the installation of ‘scrubbers’ (i.e. devices that clean flue gas) as the lowest cost-control option (UNEP 1997). However, in practice most of the reduction has been achieved by switching to low sulphur coal.

**Box 3.1:** Simplified model of an emissions trading system

Consider two companies, A and B, both of which emit significant quantities of a given pollutant. Their emissions may damage air quality, and the relevant authorities may decide that emissions should be reduced by a given amount, say 10 per cent. At the first glance, the solution seems simple: both A and B cut their emissions by 10 per cent. But in the real world, this may impose very different burdens on the two companies. For example, company A may, by the nature of its activities, be able to reduce its emissions by 10 per cent or even more at relatively low cost. Company B, on the other hand, may find this a difficult and costly process. It is this potential difference in reduction cost between A and B that creates a market opportunity. It works as follows.

Once the authority has decided how much of the pollutant is allowed to be emitted in a given area or region in a given time, it divides this quantity into a number of emission rights that are distributed equally among the various sources of the pollutant. It is here that the market comes into play.

Company A can reduce its emissions by the required amount at a relatively low cost and can then make further affordable reductions. For company B, the cost of reduction is far greater, and it would welcome a way of avoiding some of the outlay. Now, what if company A agrees to make those additional reductions instead of company B, provided company B, is prepared to pay for them at a price that is above the cost to A but below what it would cost B? In this situation, emissions are cut, overall, by the required amount, company B saves money, company A earns a profit for its additional reductions and the total cost is reduced. In this simplified model of a trading system, it makes no difference whether the cuts are made at company A or company B, it is the overall amount that counts.

Source: Adapted from the United Nations Environment Programme, and the United Nations Conference on Trade and Development, 2002, pp. 4-5.

The experience from several emissions trading programs indicates that they have successfully stimulated the search for the lowest-cost emission reduction measures and this has reduced compliance costs substantially (UNEP/UNCTAD 2002).

An emissions trading system is the economist's preferred instrument for handling CO<sub>2</sub> emissions (Antes et al. 2008). It is described as an efficient and effective instrument which motivates corporations to redesign their internal decision-making processes and innovative management. In theory, an emissions trading system is an effective and efficient instrument of environmental policy (Antes et al. 2008). In practice, its effectiveness has been shown in various applications. For instance, the US RECLAIM programme<sup>23</sup>, the US Environmental Protection Agency SO<sub>2</sub> emissions trading programme, Water Quality Permit Trading programme and some other programmes.

The total amount of emissions allowed in the market is set by the government and is typically less than or equal to the previous year's overall market emission allowances. According to the US Environmental Protection Agency (USEPA), by using a tradable permits program, SO<sub>2</sub> emissions went down from an annualised amount of 9.7 million tons in 1980 to 4.7 million tons in 1998. The emissions trading system (tradable permits) policy, to some extent, guarantees a specific amount of emissions reduction.

### **3.3.1.2 TAXES**

An important instrument in many of the programs is the taxation of energy or, in some cases, the taxation of energy according to its carbon content, which is known as a carbon tax<sup>24</sup> (Ekins & Barker 2001). Since carbon makes up the vast bulk of GHG emissions, a tax on GHG emissions is generally referred to as a carbon tax (Metcalf 2009). A carbon tax is an environmental tax that is levied on the carbon content of fuels. It is a form of carbon pricing (Litman 2008). In addition, carbon atoms are present in energy fossil fuel (petroleum, natural gas and coal), and are released as CO<sub>2</sub> when they are burnt.

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<sup>23</sup> The US RECLAIM programme is one of the prominent cap-and-trade programs. It was launched in 1994 by the South Coast Air Quality Management District in Los Angeles, Orange, Riverside, and San Bernardino Counties in California. It aims to bring the Los Angeles Basin into compliance with National Ambient Air Quality Standards.

<sup>24</sup> To conform to popular usage, the researcher refers to a tax on GHG emissions as a carbon tax. The tax is imposed on GHGs according to CO<sub>2</sub> equivalent content of the covered gases.

As previously mentioned, a number of countries are preparing schemes for trading of carbon emissions permits. The Kyoto Protocol envisages that such schemes will in due course be introduced at the international level in order to help countries meet their carbon reduction commitments at the least cost (UNFCCC 2003). However, proposals to introduce carbon or energy taxes have met with substantial resistance. Carbon taxes have so far only been introduced in a few European countries, at relatively low levels and with exemptions for many energy-intensive industries (Ekins & Barker 2001).

The first component of the carbon tax reform proposal is the carbon tax itself<sup>25</sup> (Pezzey 2003). A starting point for thinking about the optimal tax rate is an estimate of the social marginal damages of GHG emissions denominated in dollars per metric tonne of CO<sub>2</sub> equivalent (CO<sub>2</sub>e). Unfortunately, precise estimates of these social marginal damages do not exist (Metcalf & Weisbach 2009). The IPCC's Working Group II estimates a mean cost for 2005 of US\$12 per metric ton of CO<sub>2</sub>, but notes that social cost estimates range from US\$3 to US\$95 per ton in a survey of 100 estimates (IPCC 2007c).

The IPCC report goes on to note that these costs are likely to underestimate the social costs of carbon because of the difficulty in quantifying many impacts. This report attributes its higher estimate to its explicit treatment of risk and newer evidence on which it relies. Despite the uncertainties, the report suggests that the 'net damage costs of climate change are likely to be significant and to increase over time' (IPCC 2007c, p. 16). Stern (2007) estimates the social cost of CO<sub>2</sub> at US\$85 per tonne. In addition, Nordhaus (2007), using his dynamic integrated model of climate and the economy model, estimates an optimal tax rate of just over US\$11 per tonne CO<sub>2</sub>e in 2015 (in year 2005 dollars). Simply put, the literature does not provide a consensus view on the marginal damages of GHG emissions and the optimal tax rate.

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<sup>25</sup> A carbon tax can be levied in units of carbon (C) or CO<sub>2</sub>. One can convert a tax rate denominated in units of CO<sub>2</sub> to a rate in units of C by multiplying by 44/12. Thus a US\$15 per tonne CO<sub>2</sub> tax is equivalent to a tax rate of US\$55 per ton C.

Theoretically, the objective of a carbon tax is to slow global warming, usually in the context of agreed targets for limiting or reducing GHG emissions, taking into account the scientific evidence, the risks of inaction and the possibility that some carbon reduction may be achieved at no net cost (policies to achieve which are sometimes referred to as ‘no-regrets’ policies) (Ekins & Barker 2001). In addition, the two instruments (carbon tax, tradeable permits) share many similarities, and on balance, neither seems preferable to the other (Norregaard & Reppelin-Hill 2000). Both a carbon tax and carbon emissions trading are MBIs that depend fundamentally on the efficient working of the market system for their success. This efficiency has many requirements and implications. First, the legal and institutional structure needs to ensure that contracts are available, freely entered into by the relevant parties, and enforceable under clear and widely accepted laws and rules (Metcalf 2007). Thus, countries beset by bribery and corruption may not be able to use taxation because the taxes will be evaded or become an excuse for further corruption (as it is the case in many developing countries).

Second, prices should reflect costs to some degree, so that the carbon tax will increase the price of carbon-intensive production. Third, buyers and sellers should be well informed as to the costs and availability of alternatives, such that future outcomes (even if not known) should at least be considered. In some cases, especially amongst disadvantaged groups such as the elderly, there may be an unwillingness to consider alternatives, so extra taxation may of itself (and before possible compensation measures are taken into account) have very inequitable effects. The main difference between taxation and trading concerns price/quantity adjustment. With a carbon tax it is the tax on, and subsequently an increase in the price of, carbon that is fixed and the quantity of carbon emitted as CO<sub>2</sub> that adjusts. With emissions trading, it is the quantity of carbon emitted as CO<sub>2</sub> that is fixed, and the price of the emission permits that adjusts.



It is in many cases argued that a permit system is to be preferred to a tax because its outcome is more certain in terms of achieving an emissions reduction target (Ekins & Barker 2001). This extra certainty is dependent on the permit regime having clear, enforceable and enforced rules. However, there is no real dichotomy between taxes and permits. An effective scheme to abate carbon emissions would be likely to combine taxes, permits and regulation, with each instrument supporting the others depending on the country, sector and institution concerned. Since carbon abatement does not require a precise abatement by a definite date, the aim of policy must be to achieve significant reductions over a number of years, with policies adjusting to outcomes repeatedly.

It is argued that a major advantage of a cap-and-trade (tradable permits) over an emissions tax is its political feasibility (Matsumoto & Fukuda 2006). It is noted for example, that the UE Emissions Trading Scheme is a demonstration that a cap-and-trade system can be implemented whereas an effort in the 1990s to implement an EU-wide GHG tax was a failure (Raymond & Shively 2008). A factor in this EU experience was the fact that a decision to implement a tax required unanimity among EU members whereas the Emissions Trading Scheme required only majority approval.

Stern (2007) identifies three defects in the way that most countries have implemented carbon taxes to date. Firstly, numerous exemptions have been provided to industry, which add significant complexity to the tax and weaken the incentives to reduce carbon emissions. Secondly, tax rates across different fuels typically do not reflect the carbon emissions arising from their use. Thirdly, countries imposing a carbon tax have not attempted to harmonise their tax rate. Clearly, the early steps toward a carbon tax have been tentative and limited in nature. Therefore, most carbon taxes are not comprehensive in coverage (Metcalf 2009).

Metcalf and others (2008) stated that US experience also appears to support the argument that a cap-and-trade system is the more likely to be politically feasible, whereas the proposed

emissions tax ultimately failed. The analysis of why the proposed emissions tax failed indicated one factor that the tax is not an efficient penalty on CO<sub>2</sub> or GHGs because of the differences in emissions among fuels per heat unit. In addition, the lack of a focus and the fundamental compromises embedded in the tax design made it difficult to fend off requests for exemptions and other loopholes.

A concern with carbon taxes that has been frequently raised is that industry concessions will be required to obtain political support for carbon pricing and that providing free permits is more efficient than excluding industries from a tax (Crals & Vereeck 2005). Moreover, emissions tax is considered to be high in terms of the administration cost (Metcalf 2007). However, the economic and environmental effects of an emissions tax depend on its features within a particular country, and also on activities in other countries through the influence of trade in energy, non-energy goods and emissions allowances.

A conventional wisdom holds that a carbon tax is not a politically viable option for controlling GHG emissions, because the tax makes overly explicit the costs associated with controlling GHG emissions particularly CO<sub>2</sub> emissions (Metcalf 2009). Therefore, this makes the system of tradable permits (emissions trading) more effective in terms of achieving the quantities of emissions reduction target and politically assist the governments in implementing their commitment to combating the problem of environmental pollution.

Numerous prior studies have found that a key element of any efficient policy to reduce GHG emissions is an increase in the price of GHG-emitting activities (Crals & Vereeck 2005; Norregaard & Reppelin-Hill 2000). This could be done by implementing a GHG cap-and-trade or through a tax on GHG emissions. In this regard, many researches argue that carbon taxes are not only way to raise the price of carbon emissions (Marquette 2000; Metcalf 2007; Starkey & Anderson 2005). Alternatively, an efficient way to do this is through a cap-and-trade system similar to the EU Emissions Trading Scheme for carbon.

A number of commentators have raised concerns pertaining specifically to a carbon tax (Ekins & Barker 2001; Metcalf 2009). One objection to a carbon charge through a carbon tax is that it will hurt economic growth. Research suggests, however, that most industry groups would not be appreciably affected by a carbon tax swap for two reasons. Firstly, the price impacts for most industries are small<sup>26</sup>. Secondly, using carbon revenues to lower other taxes ensures that the overall burdens will not rise. Another concern is that no certainty of emission reductions with a carbon tax (Ekins & Barker 2001). A common criticism of carbon taxes is that they do not provide any certainty of emission reductions (Metcalf 2009). A carbon tax provides certainty over the price of emissions but no certainty over emissions. In this regard, Guest (2010) argued that against some advantages, taxes have a big disadvantage. Tax could represent a big cost to business which could make it politically impossible. In addition, it can also be shown that if uncertainty is with the social marginal benefit rather than the social marginal cost, a permit system can be a better instrument rather than a tax (Cullis & Jones 1998).

Developing countries must participate in the international agreement of reducing GHG emissions particularly CO<sub>2</sub> emissions. If for example, China and other major emitting developing nations—particularly oil producer countries—do not commit to significant emission reductions within the next 15 years, the US and other developed countries could even promise to remove their tax or trading system (Metcalf 2009). A number of opponents of this point argue that this would have either positive or negative effect on the policy of climate change.

Nonetheless, it is time for less developed nations and the advanced countries to enact a policy to reduce GHG emissions. Without the participation and leadership of the world's richest country and one of the leading emitters of GHGs, it is difficult to imagine meaningful

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<sup>26</sup> See Metcalf (2007).

progress on slowing and eventually stopping global warming. Moreover, the scientific case that climate change is a serious threat has become much more compelling in the past decade. Therefore, an immediate action should be taken, particularly by less developed oil producer nations, in order to treat the problem of environmental degradation. This can be achieved by implementing emissions reduction policies such as emissions trading.

### **3.3.2 MARKET-BASED APPROACH TO GHG EMISSIONS REDUCTION**

MBIs are advocated in reducing GHG emissions because of the use of prices and other economic variables to provide economic incentives for polluters to reduce or mitigate their harmful emissions (Andersen & Sprenger 2000; Sonnebron 2005). Furthermore, MBIs seek to reduce environmental damage and encourage emissions reductions by those who can achieve them at lower costs and higher benefits (Sheila & Nathaniel 2007). As mentioned earlier, Andersen and Sprenger (2000) stated that through MBIs, such as taxes or a system of tradable pollution rights (emissions trading), a financial incentive will be established in order to steer the polluting behaviour of industries. Therefore, this is significantly different from the Command and Control (CAC) approach. Through the MBI approach, an emission trading provides more room for technological innovation. In this regard, Sterner (1999) has argued that a market-based transferable permit sets a minimum level of pollution, but is likely to achieve that level at a lower cost than other means and, importantly, may reduce below that level of emission due to technological innovation.

Theoretically, MBIs have some appealing properties and, if properly designed and effectively implemented, they have a number of advantages over the traditional CAC approach. Andersen and Sprenger (2000) summarise these benefits as follows: 1) MBIs allow the producers themselves to choose the best way to reduce pollution, as only they have full information regarding their cost functions (cost-effectiveness); 2) MBIs provide permanent

incentives for technological improvements, while CAC usually provide few incentives for reducing pollution; 3) MBIs are more flexible than the CAC because they provide a freedom of choice for polluters to choose the solution that best suits their interest (opt to pollute and pay for it or invest in pollution abatement or reduce pollution in some other cost-effective way); 4) MBIs provide revenue in order to reinforce the incentive effects or to reduce other distortions in the economic system.

The debate has until now rested largely on theory. According to Hahn and Stavins (1992), economists frequently split policy instruments for achieving environmental goals into two categories: those CAC approaches which provide firms with little flexibility in achieving goals; and market-based or incentive-based mechanisms that provide firms with greater flexibility and incentives to look for more effective ways of making sustained environmental progress. As a result, Hahn and Stavins (1992, p. 466) state that:

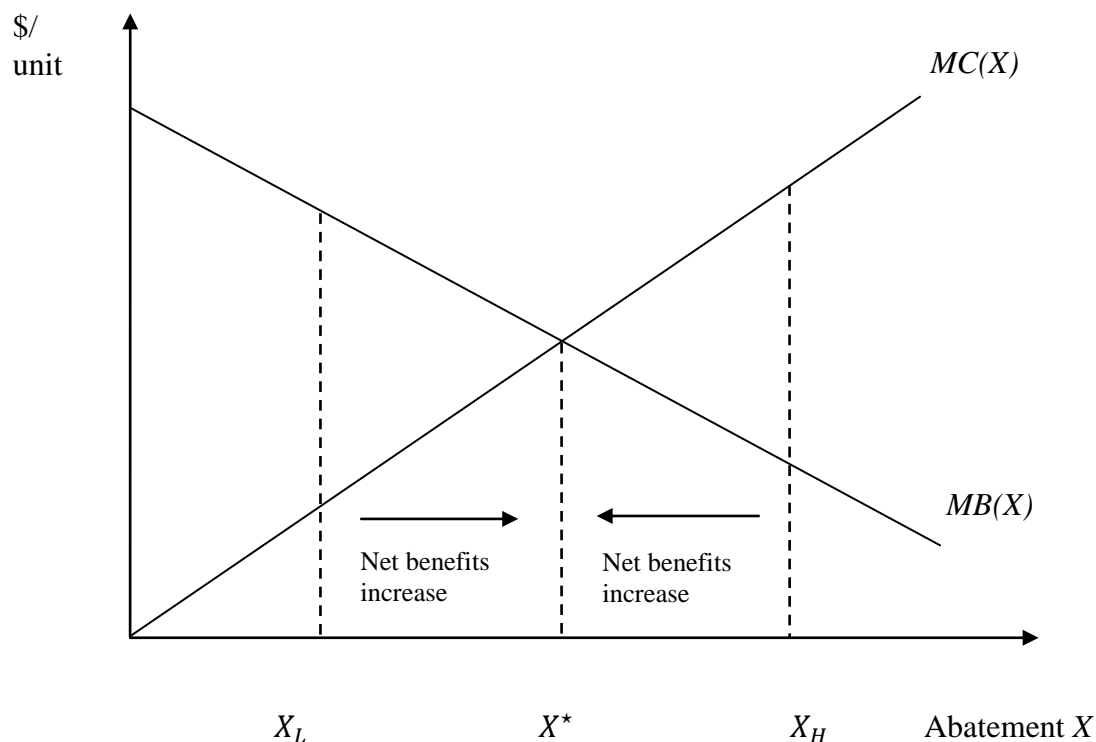
‘Economists continue to claim that market-based policies will not only be cost-effective (in a static sense), but will also provide dynamic incentives for the development and adoption of improved pollution- control technologies’.

In relation to market-based policies for environmental improvement, environmentalists contend that achieving a target of zero pollution is complicated, but would accept markets where a substantial reduction can be taking place and thereby offer significant improvement in environmental quality (Svendsen 1999). In addition to this, Sharp (2002) has pointed out that there is a sufficient evidence showing that MBIs can accomplish the same environmental outcome at considerably less cost relative to CAC approach. The author also concludes that some evidence indicates that MBIs receive a high score in terms of sustainable development. Moreover, by using market-based policies for environmental protection, Svendsen (1999) has argued that emissions trading offers an opportunity to blend environmental and economic objectives in ways that benefit the environment substantially.

Market-based policies continue to be favoured and are considered to be central policy instruments under the Kyoto Protocol (Sheila & Nathaniel 2007; Sonnebron 2005; UNFCCC 2003). MBI has also been broadly accepted by commercial concerns, as this method can give more flexibility and economic efficiency to how GHG emissions reduction is achieved. In this regard, the EU Emissions Trading Scheme is an example of how MBI can achieve better environmental outcomes. Another example is that some states in the USA adopted MBIs to assist with GHG emissions reduction (Sonnebron 2005). Further to this, MBI for environmental quality improvement has used the idea of property rights (emissions trading) to successfully ameliorate several environmental problems. Also, by the use of environmental regulation such as MBI, 'the acid rain program (ARP) contains substantial emissions reduction and has therefore in general been approved and promoted by environmentalists' (Svendsen 1999, p. 121).

The overall idea of using MBI is to achieve the 'equilibrium condition' of both marginal costs of polluting abatement and marginal benefits (Sheila & Nathaniel 2007). This can be illustrated in Figure 3.1 which shows the efficient level of abatement  $X^*$  occurs where marginal benefit equals marginal cost: that is  $MB(X^*) = MC(X^*)$ . It can be seen that at  $X_L$  efficiency increases with more abatement, as indicated by the arrow on the figure. In contrast, at point  $X_H$  there is an increase in abatement to a high level. Therefore,  $MB$  lies below  $MC$ . Here, one ton of abatement increases costs by more than it increases benefits; the incremental benefit, therefore, is negative. The optimal point  $X^*$ , where  $MB = MC$ , is the difference between benefits and costs at its maximum (Sheila & Nathaniel 2007). The net benefits of controlling air pollution are the difference between the total benefits of cleaner air and the total costs of reducing emissions.

**Figure 3.1:** The efficient level of abatement represented in terms of both marginal costs and benefits.



Source: Sheila and Nathaniel (2007, p. 24).

In the near future, companies that are significant emitters may be required – or choose – to reduce their GHG emissions significantly. Thus, many such companies (oil production companies as well as cement companies) are looking for ways to ‘get up to speed’ and integrate market-based approaches to GHG emissions reduction, such as emissions trading, into their operations. It is the aim of the research to identify the obstacles and propose methods to companies so that they can easily integrate market-based approaches to GHG emissions reduction into their operations. In this regard, and in relation to GHG emissions reduction policies, many companies operating in Libya are looking for guidance<sup>27</sup>. There are still many internal and external imperatives for action on GHG emissions reduction policies, making this research timely for companies that are operating in Libya.

<sup>27</sup> For more details regarding this point see the analysis of qualitative data in chapter five.

### **3.3.3 THE ENVIRONMENTAL KUZNETS CURVE FRAMEWORK**

The research problem associated with the case of Libya illustrates the fact that the country is in a stage of rapid industrialisation, especially in the oil manufacturing sector, which has led to a higher economic growth and changes in the structure of economic activities and higher investments (UNDP 2007). This issue is explained by the EKC concept. The EKC hypothesis states that pollution levels increase as the country develops, but begin to decrease as rising incomes pass beyond a turning point (Grossman & Krueger 1995). This is reflected in an inverted-U curve, expressing the relationship between pollution levels and income. This hypothesis was first proposed by Grossman and Krueger (1991), and restated by them again in 1995. In addition, Grossman and Krueger (1991) were the first to articulate the concept of the environmental degradation and economic growth relationship which became popular by the name of Environmental Kuznets Curve.

Many authors have undertaken empirical studies on a large scale sample. For instance, Shafik and Bandyopadhyay (1992) examined the relationship between the environmental degradation and economic growth using cross section time series data. Their findings were consistent with Grossman and Krueger (1992) at approximately \$5000 per capita income to indicate the turning point. Several contributions to the existing literature on the relationship between environmental quality and economic development concentrate on the EKC approach, according to which environmental damage starts to decrease as the country prospers (AkboostancI et al. 2009). It is hypothesised that environmental–income relationship might be similar to that suggested by Kuznets for income inequality in relation to economic development, namely of an inverted-U shape in 1950s. The EKC hypothesis states that pollution levels increase as the country develops, but begin to decrease as rising income passes beyond a turning point (Grossman & Krueger 1995). This is reflected in an inverted-U



curve, expressing the relationship between pollution levels and income per capita GDP. This hypothesis first proposed by Grossman and Krueger (1991), and restated by them in 1995<sup>28</sup>.

Grossman and Krueger (1991) estimated the relationship between concentrations of several pollutants and GDP using a cubic functional form. They hypothesised that for certain pollutants, concentrations would increase at low levels of per capita income, but decrease with GDP growth at higher income levels. Their model has since been duplicated using other measures of environmental quality and additional explanatory variables. The common thread that runs through all these models is estimating the quadratic relationship between per capita income and some measures of environmental quality to generate the inverted-U shape of the EKC.

Shafik and Bandyopadhyay (1992), used Grossman and Krueger's original measures of environmental quality. They conclude that income has the most significant effect of all the indicators of environmental quality that they tested. Selden and Song (1994) examined the relationship between income growth and pollution. They used Grossman and Krueger's model, their results indicate that the turning point can be found at over US \$8,500. Tucker (1995) selected the period 1971-1991 and looked at changes in CO<sub>2</sub> emissions versus income in a yearly cross-sectional analysis. The findings of this study show that there is a positive relationship between CO<sub>2</sub> emissions and income. The results also indicate that the changes in CO<sub>2</sub> emissions are clearly related to changes in oil prices, but do not incorporate them into the analysis. A study by Agras and Chapman (1999) took into account the price of energy and highlighted the importance of it, and included it in the EKC framework.

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<sup>28</sup> The first mention of the Environmental Kuznets Curve can be traced to a paper by T. Panayotou (1993) written for the World Employment Programme Research Working Paper Series. The first use of it in an academic journal was by Selden and Song (1994). The original Kuznets "Inverted-U" hypothesis refers to the relationship between income inequality and per capita income— that in early stages of economic growth the distribution of income worsens, while at later stages improves (Kuznets 1955).

### Chapter Three: Review of the Related Literature

Previous work on the EKC perspective has been done by Grossman and Krueger (1995) who provide a systematic explanation for the relationship between the environment and economic growth. In this regard, and according to the EKC literature Akbostanci et al. (2009), Grossman & Krueger (1995), Selden & Song (1994) and others argue that income growth has three effects on the existing amount of the pollution emissions. These effects are: scale effect, composition effect and technique effect.

Firstly, scale effect asserts that even if the structure of the economy and technology does not change, an increase in production will result in increased pollution and environmental degradation. This means that greater economic activities raises demand for all inputs, increasing emissions.

Secondly, composition effect may have a positive impact on the environment. Income growth increases demand for relatively cleaner goods. This causes the share of pollution-intensive goods in output to fall, reducing emissions. This means that in the earlier stages of development, pollution increases as the economic structure changes from agriculture to more resource intensive heavy manufacturing industries; while in the later stages of development, pollution decreases as the structure moves towards services and light manufacturing industries. Therefore, composition effect could lower the harmful effects of growth on the environment through this change in the production structure.

Finally, technique effect captures improvements in productivity and adaptation of cleaner technologies, which will lead to an increase in environmental quality. Therefore, a turning point is considered to be an important factor to emphasise the positive relationship between environmental quality, particularly CO<sub>2</sub> emissions and economic development.

There is a vast literature of cross-section and panel data EKC studies. However, single country studies are fewer in comparison. As an example, Carson and others (1997) find a negative relationship between emissions of seven air pollutants (CO<sub>2</sub>, air toxic, CO, NOX,

SO<sub>2</sub>, VOC, PM<sub>10</sub>) and income per capita GDP for US states between 1988 and 1994. Although the income level in the US is higher than any income of the EKC turning points found in cross country studies, the findings are in harmony with the EKC hypothesis. Another study was undertaken by Vincent (1997) in Malaysia for the period 1970-1990. The researcher states that the relationship between one air and five water pollution indicators and income per capita GDP does not fit the EKC form for Malaysian states. In this model, per capita GDP, its square, cube, and their interaction with population density are used as independent variables in the regression. While income cannot be related significantly to emissions of some pollutants in any way, a positive relationship is found between these two variables for some other pollutants.

In relation to GHG emissions, particularly CO<sub>2</sub> emissions integrated with economic development patterns, a number of prior studies examined the relationship between CO<sub>2</sub> emissions and economic growth (Andreoni & Levinson 2001; Annicchiarico et al. 2009; Atici, C. 2009; de Bruyn et al. 1998; Dinda 2004; Galeotti et al. 2006; Grossman & Krueger 1995; Sobhee 2004). The majority of these studies have argued that, as long as the economic growth increases, the environmental effect will decrease, therefore achieving the objective of GHG emissions reduction. The results of these studies indicate that there is an inverted U-shape curve relationship between environmental degradation and income per capita, so that, eventually, growth reduces the environmental impact of the economic activity. As one economic and environmental point of view, Dinda (2004, p. 431) argued that 'environmental pressure increases faster than income at early stages of development and slows down relative to GDP growth at higher income levels'. This relationship will be applied in Libya to set the scene for the analysis of the organisational context.

### **3.3.4 SCENARIO OF EMISSIONS TRADING**

The global initiative of emissions trading has been introduced to reduce GHG emissions and then protect the environment from those gases that mainly affect the earth's climate, particularly CO<sub>2</sub> emissions (UNFCCC 2003). In this regard, global and domestic policy scenarios for GHG emissions reductions are taking place in this argument (FE 2009). For example, under the Kyoto protocol mechanisms, the EU GHG Emissions Trading Scheme is 'the largest cap-and-trade system worldwide and the most important European climate change mitigation policy in place' (Demailly & Quirion 2008, p. 2010). Its environmental effectiveness depends on the stringency of the overall emissions cap. Another example is an Australian Carbon Pollution Reduction Scheme (ACPRS). 'The effect of the ACPRS CPRS is to add a cost to as many goods and services as possible to reflect the damage that GHGs are doing to the environment' (FE 2009, p. 1). This is likely to induce people to produce and use goods and services that involve lower production of GHG emissions. The ACPRS seeks to lower the economic costs and, consequently, potentially tighten the emissions target.

The key objective of such an emissions trading scenario is to reduce the level of GHG emissions both domestically and globally. By creating a market for carbon commodity, the benefits from pricing and reducing emissions are dependent on global action, and how a country manages the interaction between its efforts and the efforts of its international partners (FE 2009). The reduction in permits sold result from the increase in abatement targets, this is due to the absence of an international permit trade. In this regard alternative policies are required (UNFCCC 2007a).

Policy-makers should be focusing on alternative mechanisms to achieve their objectives. Many developed countries have policies in place to reduce emissions (Garnaut 2008). These include: emissions trading schemes, providing incentives for renewable energy targets, fuel efficiency targets, and the capture and storage of carbon dioxide. In addition to their

emissions trading schemes, many nations have put forward emissions reduction goals to reduce climate change damage. For instance, the EU seeks to achieve a target of 20 per cent reduction of 1990 levels by 2020; the Canadian Government announced new targets to reduce GHG emissions to 20 per cent below the 2006 level by 2020 and to 60-70 per cent below 2006 by 2050; the Japanese Government announced a target of a 60-80 per cent cut in emissions by 2050; and the Australian Government has committed to an emissions reduction of 60 per cent below 2000 levels by 2050 (Garnaut 2008). Other nations also seek to achieve their reduction targets, such as the United States, Korea, New Zealand, India and China. Although Libya has not been required to achieve a certain reduction target, it is more likely to seek and to put forward a target level in order to tackle its emissions problems.

As mentioned above, the key expected outcome of the ETS is to reduce GHG emissions by recognising domestic and international offsets. The projected trend in emissions makes clear that reducing global GHG emissions will require both advanced industrialised nations and non-advanced industrialised countries to adopt emissions commitments. At the same time, however, developing nations rightly expect to have a complete chance to attain economic growth. 'The challenge, then, is to establish an international climate change policy that fully accommodates a developing country's economic growth but requires that this growth be achieved in a carbon-efficient manner' (CCAP 1998, p. 1). Therefore, Libya has a great opportunity to implement such an ETS both in the oil and cement industries so that their potential for economic growth will provide a major contribution to sustainable development, while protecting the environment from degradation.

## **3.4 THE POLITICAL ECONOMY LITERATURE**

### **3.4.1 SUSTAINABLE DEVELOPMENT**

Sustainable development is an increasingly popular term and the concept of sustainable development has witnessed a considerable change over the past few decades (Mitlin 1992). Several prior studies have identified and developed the concept of sustainable development, which basically relied on the description of the World Commission on Environment and Development (WCED) from 1987. As identified by Brundtland, sustainable development is ‘development that meets the needs of the present without compromising the ability of the future generations to meet their own needs’ (cited in Harris 2000, p. 5). This concept is based on a two-pillar model which reflects environment and development concerns (Harris 2000; Pope et al. 2004). In regards to the above WCED definition, Hinterberger and Zacherl (2003, p. 14) state that:

‘A broad international agreement has emerged that its goals should be to foster a transition towards development paths that meet human needs while preserving the earth’s life support systems and alleviating hunger and poverty – i.e. that integrate the three pillars of environmental, social and economic sustainability’.

Since the Brundtland’s concept, many alternative definitions of sustainable development have been discussed (Pope et al. 2004) and a concept of critical sustainability has been proposed, particularly with respect to the problem of climate change (Jahnke & Nutzinger 2003). Many of these definitions are based upon a three-pillars of sustainable development model, which addresses the integration of environmental, social and economic issues of sustainability concerns (Hodge 1997).

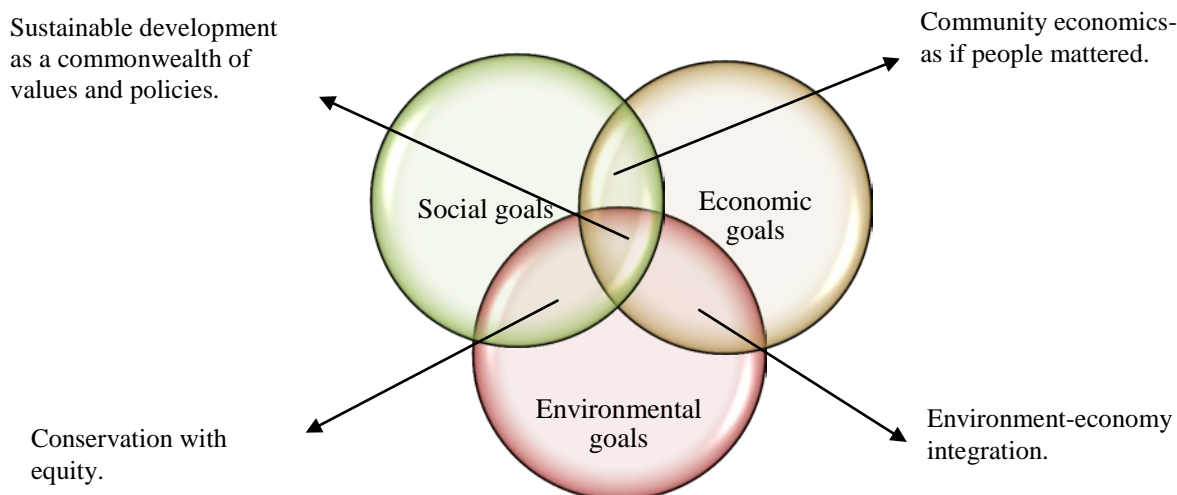
The interaction between the three dimensions of sustainable development can be illustrated in Figure 3.2, which indicates one of the common theoretical frameworks of sustainable development (Hodge 1997). In this framework, it is argued that sustainable development is a commonwealth of values and policies lying at the intersection of environmental, economic

and social goals to present environment-economy integration, conservation with equity, and community economics as if people mattered. Several studies have found that limiting climate change and increasing the use of clean energy is one of the biggest challenges to sustainable development. This has been identified by the commission communication on the European Union Sustainable Development Strategies (Hinterberger & Zacherl 2003).

Previous studies have found that one of several aspects to sustainable development is the impact of environmental aspect (Berke 2002; Rosenberg 1994). The suggestion is that environment impact assessment itself contributes to sustainability, which reflects the view that 'environmental impacts are at the core of sustainability concerns' (Pope et al. 2004, p. 598). Hence, this can be measured by tradeable emissions allowances, which are considered as one of the economic policy instruments that has become an increasingly important environmental policy tool that can enable society to achieve environmental goals (Driesen 2006). This can reflect the view that carbon impact is a potential tool which can be added to the common integrating model of sustainable development.

Reducing GHG emissions is one of the key concerns in many international organisations for the purpose of attaining sustainable development (Hinterberger & Zacherl 2003). A particular issue is CO<sub>2</sub> emissions trading for environmental protection and its contribution towards sustainable development. A previous study by Taiyab (2005) argued that a carbon market can be developed as a tool for sustainable development. In this regard, numerous prior studies have found that economic theory illustrates that the economic incentive of MBIs is more cost-effective to GHG emissions reduction than the traditional regulation of CAC approach (Andersen & Sprenger 2000; Driesen 2006; Rauffer 1996; Sonnebron 2005; Sterner 1999), and they argue that achieving sustainable development requires an emphasis on transformative technological innovation which can be attained by the use of MBIs.

**Figure 3.2:** The common economic, social and environmental sustainable development model.



Source: Adapted from Hodge (1997, p. 14).

### **3.4.2 HISTORY OF CLIMATE CHANGE DEBATE**

Climate change is now established as a major problem for governments and the international community to address. The bulk of this section is devoted to properly explaining the phenomenon of climate change and its historical debate, including an overview of climate change science, identifying the key stakeholders, facets of the debate, and the politics of climate change (Peeters & Deketelaere 2006). A ‘controversy analysis’ of climate change, an approach commonly applied within the field of science and technology studies, completes this brief history of the climate change debate. The aim is to illuminate not only what has happened but also why it has happened from a sociological perspective.

Climate change is a relatively new phrase in day-to-day language. It joins a number of others in the same field—‘the greenhouse effect’, ‘global warming’, ‘carbon’, ‘carbon dioxide’ and ‘greenhouse gases’ to name a few (Brohé et al. 2009). Scientifically, the Greenhouse effect is a natural phenomenon that maintains an average temperature of 15 °C on Earth, allowing life to exist. It is caused by the natural presence of gases, the so-called GHGs, which trap part of the sun’s heat in the atmosphere (Faure et al. 2003). CO<sub>2</sub> is the primary cause of the human-



induced GHG effect. Its average lifetime in the atmosphere is approximately 125 years, which means that the effect of emissions reduction measures taken today on future concentrations are slowed by this significant inertia. Those released by human activities (83 per cent of emissions of the EU in 2005) comes mainly from burning fossil fuels and deforestation (Brohé et al. 2009; IPCC 2007c).

The development of human activities has significantly altered the concentration of GHGs in the atmosphere. This change in the concentration is a phenomenon that has been identified for a long time. In 1896, chemist 'Svante Arrhenius' (1896) had already found that the concentration of CO<sub>2</sub> in the atmosphere had increased considerably since the beginning of the Industrial Revolution. Understanding that this increase would grow in parallel with the growth in consumption of fossil energy, and knowing the role of CO<sub>2</sub> in the augmentation of temperature, the Swedish scholar concluded that if the concentration of CO<sub>2</sub> doubled, the temperature would rise by several degrees Celsius (Brohé et al. 2009).

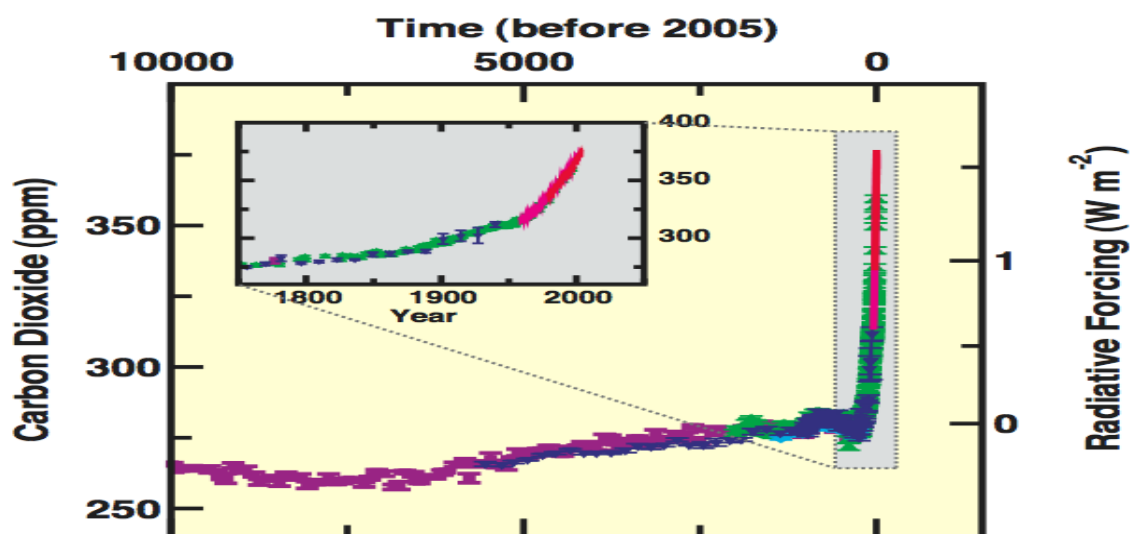
The strong growth of our fossil fuel consumption is inevitably accompanied by release of GHG emissions into the atmosphere. Indeed by burning oil, natural gas and coal that are the results of slow decomposition of plant residue layers that had captured atmospheric carbon for millions of years, the world emits into the atmosphere an additional quantity of GHG emissions that disturbs the carbon cycle through photosynthesis and respiration in the natural world (Buckley 2002). Although the quantity of CO<sub>2</sub> emissions resulting from anthropogenic activities is small compared with those in the natural carbon cycle (involving forests, soils and oceans), these additional quantities are not completely recycled by the ecosystems.

The IPCC estimates, of the 7 billion tonnes of carbon equivalents (7 GtCe, roughly 26 GtCO<sub>2</sub>e) released yearly by human activities, about 4 GtCe remain in the atmosphere without being recycled, causing an increase in GHG concentration from 280 parts per million (ppm) in pre-industrial times to 430 ppm today (including all GHG emissions) (IPCC 2007c). At the

current level of anthropogenic emissions, the concentration increases by about 4 ppm each and every year. This increasing concentration is consistent with the observed average atmospheric warming of  $+0.7^{\circ}\text{C}$  since the pre-industrial era, with significant spatial variability—greater warming at the poles with less warming at the equator and mid-latitudes (IPCC 2007c).

Today, the concentration of GHGs is higher than at any time during the last 450,000 years and the IPCC projections indicate that it will continue to increase. The concentration of  $\text{CO}_2$  alone has already increased by 35 per cent (from 280 ppm to 380 ppm) in the atmosphere since the Industrial Revolution and, given its current progress, the IPCC predicts that this concentration could double by 2100 if no action is taken (IPCC 2000), see Figure 3.3 that illustrates the concentration of  $\text{CO}_2$  over the last 10,000 years.

**Figure 3.3:** The Atmospheric Concentration of  $\text{CO}_2$ .



Source: IPCC 2007: WGI-AR4.

In its Fourth Assessment Report (2007), the IPCC felt it was ‘very likely’<sup>29</sup> (90 per cent chance of occurrence) that man is responsible for the warming observed in the 20<sup>th</sup> century (IPCC 2007b). The IPCC considered it ‘very likely’ that the continuation of anthropogenic

<sup>29</sup> It is the likelihood ranges which are used by the IPCC to express the assessed probability of occurrence: virtually certain > 99%; extremely likely > 95%; very likely > 90%; likely > 66%; more likely than not > 50%; about as likely as not 33% to 66%; unlikely < 33%; very unlikely < 10%; extremely unlikely < 5%; exceptionally unlikely < 1% (IPCC 2007c).

emissions will, in the 21<sup>st</sup> century, lead to further warming, greater than that of the 20<sup>th</sup> century. Moreover, the climate sensitivity (i.e. the equilibrium change in global mean surface temperature following a doubling of the atmospheric equivalent CO<sub>2</sub> concentration) is probably between 2 and 4.5°C, with a best estimate of about 3°C.

Consideration of the global warming problem must not distract attention from the central issue of global climate change and emission of GHGs attributable to the burning of fossil fuels by developed countries. Developing nations in addition can play a significant role in increasing the quantity of the GHGs if there is no action taken.

### **3.4.3 SUSTAINABILITY AND CLIMATE CHANGE**

The subject of sustainability and climate change goes far beyond issues of mere academic or scientific interest. Climate change would affect the lives of all citizens on planet earth, in both Annex I and non-Annex I countries<sup>30</sup>, with the impacts on the poorest sections of society being the most severe. The very fact that the effect of climate change on poor societies would tend to widen the gap between rich and poor and reduce the opportunities for the poor to improve their lives strikes at the very root of sustainable development.

If sustainability is to be an objective that can be operationalised, it must be defined and it must be measured. Solow<sup>31</sup> (1993, p. 163) stated about sustainability that ‘talk without measurement is cheap’. Therefore, sustainability is about living and working in ways that meet and integrate existing environmental, economic and social needs without compromising the well-being of future generations. The transition of sustainable development in today’s society builds a more secure future for our children (Pezzey 2004). The economics literature on sustainability and climate change has grown over decades into a substantial field of study (Fischer et al. 2011; Guest 2010; Pezzey 2004; Solow 1993; Stahel 2008). Sustainability is

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<sup>30</sup> For further information regarding the Annex I economies and Non-Annex I economies, see chapter one.

<sup>31</sup> Robert Solow is institute Professor of Economics, and Noble Laureate for Economic Science.

about intergenerational equity. It is about how to allocate resources over time to ensure that generations are treated equally—that no generation is favoured over another (Guest 2010).

The policy dilemma is which path is better when planning from the beginning of the time horizon? Do we favour current generations and therefore not abate damages, or do we favour future generations and commence an abatement program now? The wide range potential impacts of climate change on sustainability and vice versa, suggest that the linkages between these two topics need to be critically analysed. Such an analysis was attempted in the IPCC Third Assessment Report (2000) and, while some progress was made, the work was incomplete. The Third Assessment Report of the IPCC did take into account the nexus between sustainability and climate change and attempted to access the linkages between these two (IPCC 2001a). However, much more remains to be done in providing a comprehensive assessment of this relationship and how it will affect civilizations in the decades ahead. It is for this reason sustainability must be incorporated as a major theme in studying the phenomena of climate change.

Climate change and increased variability will have substantial implications on water resources and related activities including, food, livelihood and environment (air pollution). The global development community is looking for new solutions to traditional development issues such as economic stagnation, persistent poverty, hunger, malnutrition and illness; as well as the newer challenge which is environmental degradation. In this regard, Fischer and others (2011) have studied energy use, climate change, sustainability and folk psychology. In particular, the concentration was on the behaviours and policies in the context of energy use, climate change and sustainability. The researchers argue that understanding people's ideas helps to improve the understanding of (lack of) public responses to environmental policies and sheds light on the attitude-behaviour gap.

The environmental dimension of sustainability is a more recent concern, arising from the realisation that human welfare ultimately depends on ecological services. It seeks to manage scarce natural resources in a prudent manner, reduce pollution, and protect biodiversity, because ignoring safe ecological limits will increase the risk of undermining long-run prospects for development. Dasgupta and others (2002) point out that until the 1990s, the mainstream development literature hardly mentioned the topic of environment<sup>32</sup>. Growing literature has emerged on the theme of climate change and sustainability, describing and addressing the links between this nexus.

Climate change makes it even harder for less developed countries to attain sustainable development as it threatens resources, deepens existing problems, poses new problems and makes solutions more difficult and more expensive. The poor nations are always more vulnerable as the rich can spend more on hedging (IPCC 2001a). For example, an earthquake can kill 10,000 in India but only 100 in California. Netherlands can build a wall against sea level rise but Bangladesh may not be able to do so (Guest 2010). From the developing world point of view sustainability is needed, desirable and environmentally beneficial (Munasinghe 2000). The key environmental concerns of less developed nations relating to air quality, water resources, land degradation, biodiversity and habitat protection can be addressed while pursuing development (Stahel 2008). Hence, global co-operation is more important for dealing with climate change and advanced nations should assist developing countries and provide them with the latest techniques that would tackle the problem of environmental degradation.

CO<sub>2</sub> emissions are not likely to be reduced by mere political and regulatory instruments but needs incentives to move away from fossil fuels (Jahnke & Nutzinger 2003). In this regard, developed nations can adopt energy efficient technologies to reduce CO<sub>2</sub> emissions. Clean

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<sup>32</sup> See also for example, Stern (1989).

Development Mechanisms, Joint Implementation projects and Emissions Trading (Tradable Emissions Permits) can be established in consonance to help the transition to the latter project in the future. For this reason, less developed countries have to consolidate their international negotiating positions to derive fairer benefits from these initiatives. It can be seen in developing countries that there are some encouraging trends in education and child mortality but the rates of improvement are not yet sufficient to bring the millennium development goals into reach (UN 2007). On the environmental dimension, significant progress has been made in some areas but there are problems in some others. For instance, areas that need urgent attention include GHG emissions, climate change, forestry and transport.

The key issues are the optimal quantum of environmental damage abatement, the best policy instruments to use, and the way which the global mitigation effort should be shared between poor and rich countries. One of the key issues of studying the nexus between both sustainability and climate change is sharing a global burden of abatement. Guest (2010) has stated that, having determined the optimal quantum of damage abatement at the global level, an assessment is required about the appropriate sharing of the burden of abatement among both developed and less developed countries that are in very different stages of economic development. Another argument is based on equality of opportunity. It says that developing countries should be given the opportunity to achieve industrialisation, just as the developed nations did. In order to achieve industrialisation the developing countries should have somewhat more controls on environmental damage that is caused by industrialisation.

A consensus is emerging in many developed and less developed nations that global warming is an urgent problem requiring prompt attention. The majority of those who are living in both types of nations think that governments should do more about global warming. This consensus is driven by a number of factors including trends in temperature (IPCC 2007c).

### **3.4.4 THE RESPONSE STRATEGY DEBATE**

Policy responses to climate change fall into two broad categories: adaptive strategies, in which people migrate and/or change their living conditions to deal with a new environment; or abatement (mitigation) strategies, in which measures are taken to minimise human-induced climate change by removing its causes. Global warming poses one of the most challenging threats to our planet. As the IPCC (IPCC 2007a) points out, societies can respond to climate change by adapting to its impacts and by reducing GHG emissions (mitigation), thereby reducing the rate and the magnitude of change. Accordingly, climate policy analytically comprises two different pillars: the adaptation to climate change; and the abatement (mitigation) of climate change (IPCC 2007a).

The key players in the debate fall on two sides of a wide divide. On one side are those interests concerned with disruption to industry and economies by a switch away from high fossil fuel consumption. These interests argue for a slow, cautious approach to change. They promote adaptive strategies in preference to abatement strategies. On the other side fall those interests concerned with the disruption to the biosphere and society that climate change has the potential to cause. These interests argue for rapid action to reduce GHGs by the adoption of fossil fuel alternatives and energy efficiency. They promote abatement strategies in preference to adaptive ones.

#### **3.4.4.1 ADAPTATION**

Adaptation to climate change is the adjustment of a system to moderate the impacts of climate change, to take advantage of new opportunities or to cope with the consequences. Also, adaptation to climate change has increasingly become a focus of policy debates. A number of articles in the UNFCCC and the Kyoto Protocol refer to adaptation. The IPCC recognises different forms of adaptation, but also states that there is little evidence that efficient or effective adaptations to climate change risks will be taken autonomously (Adger

2003; Smit & Pilifosova 2003). Thus, intervention is necessary to enhance adaptive capacity or the ability to adapt to new or changing conditions without becoming more vulnerable or shifting towards mal-adaptation.

An obvious example of adaptive strategies would be to build dikes to protect coastal areas from sea-level rise. The construction of coastal dikes, such as the one on the Netherlands, is one approach to climate change mitigation. This project has been done by the Netherlands over the centuries to reclaim land. Such techniques could be applied to other countries such as Bangladesh, where land is not too much above sea level at present. The location of fertile lands and viability of particular crops might change drastically. Thus, agriculture would need to plan for major shifting of crops to other areas as temperatures rise.

It has been said that climate change will not be a great problem to humans as we are very adaptable as a species and have enormous technological resources at our disposal. A strategy that relies largely on adaptation is wholly anthropocentric—it does not take into account the impacts of climate change on plant and animal communities that cannot easily relocate or adapt (Leggett 1990).

The geopolitical consequences of extensive relocation of populations must also be considered, including the prospect of increased regional conflicts as burgeoning populations vie for habitable land (Leggett 1990). Lomborg (2001), for example, emphasises the cost of rapid cuts to CO<sub>2</sub>. Estimates of the costs of such adaptive strategies range between a total of US \$ 500 to US \$ 1,000 billion in the next thirty years if no abatement strategies are adopted in parallel (Leggett 1990). Adaptation strategies would have to cover a wide range of impacts, including the effects of climate change on water resources, land use and ecosystem, food security and sea-level rise. It is by no means an easy option.

Some adaptation costs are already inevitable. In light of this, some commentators emphasise that the cost of adaptation may be less than ‘heroic CO<sub>2</sub> cuts’ (Lomborg 2001). Thus the



decision should be one of ‘whether stabilization of the climate and business-as-usual there can be found a solution that does not upset present society too much but does not result in too high climate costs in the future either’ (Lomborg 2001, p. 305).

#### **3.4.4.2 ABATEMENT**

Abatement strategies hinge on a good understanding of the causes of the GHG effect and of the actions necessary to eliminate the causes. This is knowledge that is still being refined. However, at present we know that the enhanced GHG effect is due to energy production, deforestation, agriculture and industrial non-energy activities. If we can reduce emissions in these areas, the risks of an adaptation-only future can be reduced.

Abatement strategies in the form of energy-efficient technologies have other benefits in addition to the reduction of CO<sub>2</sub> emissions: reducing the dependence on oil imports in many countries; avoiding reliance on nuclear reactors with all their security and environmental problems; and greater self-reliance on domestic energy sources, technologies and job creation (Leggett 1990).

Abatement strategies would have to address human activities in the areas of transportation, electricity generation, energy efficiency of buildings, energy efficiency of industry and reduction of methane emissions from agriculture and forestry. The loss of carbon sinks through deforestation and the creation of carbon sinks through plantation forestry is also a feature of abatement measures.

Many people acknowledge that global warming is occurring and do not fundamentally disagree with climate change science. In many ways, the climate change controversy is now the climate change response controversy. Though the science—or perceived lack of conclusive science—is still occasionally used as a ‘club’ to hit proponents of action over the head with, the economic and political arguments have moved into the foreground and are

overshadowing the scientific questions. Some mix of adaptation and abatement strategies may be the best way to proceed.

The economic abatement (mitigation) potential, which is generally greater than the market abatement potential, can only be achieved when adequate policies are in place and barriers removed. Several studies suggest that abatement opportunities with net negative costs have the potential to reduce emissions by approximately 6 GtCO<sub>2</sub> equivalent per a year in 2030, realising which requires dealing with implementation barriers (IPCC 2007a). There is substantial evidence that abatement (mitigation) actions can result in near-term co-benefits (e.g. improved health due to reduced air pollution) that may offset a substantial fraction of abatement costs. There is also evidence that changes in lifestyle, behaviour patterns and management practices can contribute to climate change abatement across all sectors (IPCC 2007a; Mori 2006).

A wide range of mitigation options will be available by 2030 in all sectors, with the economic mitigation potential at costs that range from net negative up to 100 US\$/t CO<sub>2</sub> equivalent, sufficient to offset the projected growth of global emissions or to reduce emissions to below current levels in 2030 (IPCC 2007b). Delayed emissions reductions significantly constrain the opportunities to achieve lower stabilisation levels and increase the risk of more severe climate changes impacts. Making development more sustainable by integrating climate change adaptation and mitigation measures into a sustainable development strategy, can make a major contribution towards addressing climate change. Although the problems are complex, climate change data today leads societies to take the first effective steps on adaptation and mitigation.

### **3.4.5 THE RESPONS OF NON-GOVERNMENT ORGANIZATIONS**

NGOs have acquired an increasingly relevant status in the international policy arena. This prominence can be seen in the expanded role of NGOs in preparing and executing

development projects, and in negotiating international legal agreements (Vormedal 2008). NGOs also command influence at most levels of the international legal system, participate in the implementation and monitoring of international conventions and serve as experts in governmental delegations.

The issue of climate change is a relatively recent development in the long history of international environmental negotiations. Between the 1950s and 1980s, awareness of the threats and dangers of climate change began to emerge in the scientific community. However, it was only in the latter half of the 1980s that public and political interest in the dangers of climate change arose. In the 1990s, the threat of climate change became one of the most discussed global environmental concerns<sup>33</sup>.

The IPCC is an international panel of scientists and researchers that provides advice on climate change to the international community. The role of the IPCC is to assess scientific, technical and socio-economic information to determine the risks of human-induced climate change. The IPCC also provides technical and policy-relevant advice to inform the international negotiations on the climate change issue (Gulbrandsen & Andresen 2004).

The IPCC provides periodic assessment reports on climate change and has completed four to date (1990, 1995, 2001 and 2007), with the most recent being the Fourth Assessment Report (FAR)<sup>34</sup>. The key finding of the IPCC's FAR is that warming of the climate system is unequivocal. In addition, most of the warming in the past 50 years is 'very likely'<sup>35</sup> caused by the GHG emissions from human activities, such as burning fossil fuels for energy and transport. Moreover, it is 'very likely' that change in the global climate system will continue

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<sup>33</sup> Climate change is the consequence of increased concentration of CO<sub>2</sub> and other GHGs in the atmosphere. GHGs trap the sun's heat and keep it from escaping beyond the atmosphere of the earth. Since the beginning of this century and the onset of the industrial revolution, CO<sub>2</sub> levels have been rising at the rate of four per cent per decade. Many scientists think this increase is largely due to human activities, as it coincides with the beginning consistent and considerable CO<sub>2</sub> emissions from human-controlled sources.

<sup>34</sup> The FAR, is a consensus document produced by 450 lead authors, 800 contributing authors, and 2500 scientific expert reviewers representing 130 countries (IPCC, 2007b).

<sup>35</sup> In the IPCC reports 'very likely' means more than 90 per cent probability.

well into the future from emissions already in the atmosphere. These climate shifts will be larger than those seen in the recent past. Also, recent climate change has had an observed influence on many physical and biological systems. Furthermore, some large-scale climate events have the potential to cause very large impacts, for example, more severe cyclones. Besides, some adaptation is occurring now and will need to continue into the future to address impacts from the changing climate.

What is more, the report concludes that if global emissions peak by 2015 and decline sharply thereafter, warming can be kept to 2.5 degrees Celsius above pre-industrial levels, potentially avoiding some of the worst impacts. The report also states that many options exist for reducing global GHG emissions through international cooperation and existing technology. Research since the FAR indicates that GHG emissions and climate change impacts, such as sea-level rise, are occurring faster than the climate models have so far indicated.

In 1995 the IPCC, a group of approximately 1000 scientists working under the aegis of the UNEP and the World Health Organization (WHO), concluded in their Second Assessment Report (SAR)<sup>36</sup> that the balance of evidence suggests a discernible human influence on global climate. The SAR also concluded that in the last century the mean temperature of the Earth rose by between 0.3 and 0.6 degrees Celsius and that the global sea level rose between 10 and 20 centimetres. For the end of the twenty-first century, the SAR forecasted a sea level rise of between 15 and 95 centimetres and an average temperature increase of 2 degrees Celsius.

The SAR also addressed the consequences of climate change. The report concluded that the projected increase in mean temperatures would have a significant impact on physical and ecological systems, human health and socio-economic sectors. It projected that the change in temperature will occur at such a rapid rate that many ecosystems may not have time to date.

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<sup>36</sup> See Intergovernmental Panel on Climate Change, *Second Assessment Report*.

Rising in temperatures will also lead to a rise in mortality and illness due to the increased number and intensity of heat waves and increased potential for the transmission of tropical diseases.

To control the consequences of climate change, the climate system requires the adoption of long-term solutions. Many believe that, in conformity with the precautionary principle, actions should be taken to prevent the hazardous effects of climate change. The likely effects on biosphere of climate change are now familiar (IPCC 2001b). Changing temperatures and rainfall patterns may harm agriculture and stress ecosystems. Rising sea levels and severe storms may erode and inundate coastal zones. Especially worrisome is mounting evidence that nasty surprises, such as an abrupt shift in climate, become more likely as CO<sub>2</sub> and other GHGs accumulate in the atmosphere (IPCC 2001b). Although uncertainties still exist, the dangers of the build-up of GHGs are increasingly being recognised and there is a growing consensus for action.

Equally concerning to governments and industry internationally is the cost of reducing GHG emissions and the complexity of this task. The GHG emissions issue is one that cuts to the basis of industrialised economies—the ability to harness large quantities of energy via the burning of fossil fuels. This is threatening both to wealthy, developed nations and less developed countries that aspire to the same standard of living. Reducing GHG emissions while maintaining economic competitiveness is a multifaceted problem that has made the debate on the climate change a hot political topic (IPCC 2007a).

Developing nations are interested in the policy debate since some developed countries point out that only a truly global response can reverse climate change, suggesting that developing countries should restrict or control their pursuit of industrialisation (King 2004). Countries with fossil fuel dependent economies (nations, whether developed or developing, whose primary export is in the form of coal or oil) are concerned about the economic impacts of a

climate change future. They argue that they will bear an unfair portion of the global burden in adjusting to climate change (Raouf 2007). If large-scale reductions are mandated by law, manufacturers will have to dramatically change the way they operate. They will also have to contend with shifts in demand, as low-emission, energy-efficient products overtake those that have long been dominant. If such nations fail to diversify their industrial base in anticipation of a drop in fossil fuel consumption, their economies will indeed suffer (Gulbrandsen & Andresen 2004). For instance, Australia (coal) and some other Arab nations such as Libya (oil) are examples of wealthy nations that describe themselves as a having ‘fossil fuel dependent economies’.

The Kyoto Protocol aims to stabilise and reduce GHG emissions in the atmosphere, in addition to response to climate change, policy options, technologies and practices to reduce emissions that have been taken into account since the Kyoto establishment in 1997 (IPCC 2007c). Current policies, technologies and practices in forestry, agriculture and waste disposal are likely to be only partially effective in reducing the predicted growth in emissions, unless they are coupled with emissions reductions in the heavily industrial sector (Corell & Betsill 2001).

However, many practices and technologies are available today that, if utilised, could modify the rate of growth in emissions and that also appear to make sense for economic and environmental reasons. Other options have been identified that require additional research and demonstration. Policies should address not only technical options but also instrumental (economic, regulatory, information, etc.) and institutional options in order to become effective. The overall response to climate change is that all countries should make a contribution to the solution of the global warming problem; this contribution must include all sectors.

### **3.4.6 THE RESPONSE OF GOVERNMENTS (DEVELOPED COUNTRIES)**

Climate change is a global issue that requires an urgent international response. Governments, industries, communities and organisations across the globe are working together to develop and implement measures to reduce GHG emissions and avoid dangerous climate change (Mendelsohn, Dinar & Williams, 2006).

Climate change is a global pollution problem and therefore regulation of this public bad requires international institutions. Since there is no government at the level of the world as a whole, it is necessary to rely on the voluntary cooperation between states. The literature on the environmental agreements is usually very pessimistic to sustain large coalitions and the Kyoto Protocol proves this in practice (Ruis & Zeeuw 2010).

Ruis and de Zeeuw (2010) argue that if the research and development costs of investments in green capital can be shared among the signatories, the size of the stable coalition can get larger. Furthermore, if asymmetries are considered and the coalition consists of countries or regions with different characteristics, again the result can be improved, especially if transfers between signatories are possible.

Divisions exist over climate change science, prediction of the effects of the climate change, the appropriate policy response to climate change and the economic and social impacts of such policies. Nonetheless the world now faces the challenge of designing an effective response at the government, community and corporate levels. Governments may plan and enact policies, but it is industry—and the community—that will have much of the responsibility for implementing and enduring the transition to a greenhouse-friendly economy and society.

The EU is at the forefront of international efforts to combat climate change and is committed to the UNFCCC (agreed in Rio in 1992) and its Kyoto Protocol (UNFCCC 2003). However,

Kyoto was only a first step. Far more ambitious action to reduce global emissions is needed after 2012, when the first phase of the commitment under the Kyoto Protocol ends. One of the EU objectives is to ensure that global average temperature does not rise by more than 2°C above pre-industrial levels and it is committed to working at a global level to achieve this (IPCC 2007a, 2007c; UN 2007). The fifteen countries that made up the EU when the Kyoto Protocol was adopted in 1997 have a joint commitment to reduce their combined emissions of GHGs by 8 per cent from 1990 levels in the Kyoto Protocol's first commitment period (2008–2012). Since the signing of the Protocol, 12 more countries have become members of the EU. These new Member States are not covered by the EU 15 target, but have their own (IPCC 2007a) target of minus 6 per cent and minus 8 per cent under the Protocol<sup>37</sup>. However, all Member States are full participants in the EU Emissions Trading Scheme (EC 2006).

The contributions of each Member State towards achieving the 8 per cent reduction target set down in the EU Law and are legally binding. It is therefore appropriate to assess the EU's overall Kyoto Protocol performance on the basis of the performance of all, and not a few, individual Member States. The report concludes that, several years on and after a strong push to develop the policies and measures needed, monitoring data and projections indicate that the EU is on track to meet its Kyoto commitment (EC 2006). This is achieved through the use of policies and measures already in place. With some new measures now being discussed and to be put in place at European and national levels, it also takes into account the use of carbon sinks and the Kyoto Protocol's flexible mechanisms (Joint Implementation and Clean Development Mechanism).

The EU has been taking steps to address its own GHG emissions since the early 1990s. In March 2000, the European Commission launched the first phase of the European Climate Change Programme (ECCP), which led to the adoption of a wide range of new policies and

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<sup>37</sup> Except for Cyprus and Malta which have no targets (EU Commission Report, 2006).



measures designed to help the EU meet its target for reducing emissions under the Kyoto Protocol. The first ECCP ran from 2000 to 2004 and helped identify the most environmentally-effective and most cost-effective policies and measures that could be taken at European level to cut emissions (EC 2008).

The ECCP builds on existing emissions-related activities at EU level, for instance, in the field of renewable energy and energy demand management. The ECCP is a multi-stakeholder consultative process that has brought together all relevant players, including the European Commission, national experts, industry and NGOs (EC 2009). Stakeholder involvement is an essential element of the ECCP because it enables the program to draw on a broad spectrum of expertise and helps to build consensus, which facilitates the successful implementation of the resulting policies and measures.

The first ECCP examined an extensive range of policy sectors and instruments with the potential to reduce GHG emissions. Eleven working groups were established in the following areas, each identifying options and potential for reducing emissions based on cost-effectiveness: emissions trading; flexible mechanism under the Joint Implementation and Clean Development Mechanism initiatives; energy supply; energy demand; energy efficiency in end-use equipment and industrial processes; transport; industry (with sub-groups on fluorinated gases, renewable raw materials and voluntary agreements); research; agriculture; sinks in agriculture soils; and forest-related sinks (OECD 2006, 2008).

One of the most important and innovative initiatives to have resulted from the first ECCP is the EU Emissions Trading Scheme, launched on the 1st of January 2005, which has become the cornerstone of the EU effort to reduce emissions cost-effectively. Each of the 27 EU Member States has also put in place its own domestic actions that build on the ECCP measures and complement them (OECD 2006). However, the second phase of the European Climate Change Programme, ECCP II, was launched in October 2005. New working groups

were established covering carbon capture and geological storage, CO<sub>2</sub> emissions from light-duty vehicles, emissions from aviation, and adaptation to effects of climate change (OECD 2006). In addition, there were two further working groups: one to assess the implementation of the ECCP I policies and measures, and their effects in terms of emissions reductions; and another to undertake a review of the EU ETS. These have resulted in a number of proposals now being developed and implemented (Rose & McCarl 2008).

The consequences of climate change response actions are mitigation, adaptation and vulnerability reduction (Garnaut 2008). The effectiveness of an international agreement does not depend on the means chosen for emissions reductions in each country. However, costs will be much lower if means are chosen that allow emissions reductions to occur where it can be achieved at the lowest cost.

Some developed countries and past economies have responded dynamically to environmental change rather than simply constrained deterministically by the climate and the ecological events that have engulfed them (Bassino & van der Eng 2010). Historical climatological data has informed predictions of future climate change, but the debate on the possible consequences of climate change has hardly assessed the economic responses that may abate these consequences. Therefore, this raises the question of how the economic system in the developed nations responded to environmental change (climate change).

Overall, the study of past episodes of economic system responses to environmental change will help to understand the processes of adaptation and abatement (mitigation) that currently appear elusive (Garnaut 2008). However, if developed nations could stabilise the atmosphere's CO<sub>2</sub> concentration at some realistically achievable and relatively low level, there is still a good chance of mitigating the worst effects of climate change. For instance, current models suggest that stabilising CO<sub>2</sub> levels at around 550 parts per million by 2100

could reduce flooding frequency by some 80 to 90 per cent along the most vulnerable parts of the Indian and Bangladesh coastlines (IPCC 2001b).

In January 2007, the European Commission set out proposals and options for keeping climate change to manageable levels on its communication (Limiting Global Climate Change to 2 Degree Celsius: The way ahead for 2020 and beyond) (EC 2008). The communication proposes a set of actions for the EU and proposal for global action to enable the world to limit global warming to more than 2°C above pre-industrial temperatures. To meet this objective, global GHG emissions would need to peak before 2025 and then fall by up to 50 per cent by 2050, compared to 1990 levels (OECD 2006).

The European Commission believes that this ambitious goal is both technically feasible and economically affordable (EC 2006). The benefits of achieving this will far outweigh the costs. But to meet this goal, developed countries as a group would need to reduce their GHG emissions by 30 per cent, relative to 1990 levels, by 2020 and by 60-80 per cent by 2050. However, in March 2007, EU Heads of State Government made an independent commitment to reduce their emissions by at least 20 per cent by 2020 and will raise this to 30 per cent if other developed countries commit to comparable efforts. This commitment ensures that the carbon market will continue beyond 2012 and encourages investment in emission reduction technologies and low carbon alternatives. In addition, the European Commission has estimated that, to meet the 2°C global target, developing countries would need to reduce their emissions growth now.

Delaying action for decades, or even just years, is not a serious option. In this regard, many researchers are firmly convinced that if actions do not begin now, more substantial, more disruptive and more expensive change will be needed later on. Hence, societies need early, well-planned action, for example, to allow businesses to plan to act in the course of normal capital replacement cycles and to encourage the development of new energy technologies. In

addition, it is a myth that reducing carbon emissions necessarily makes us poorer. Instead, taking action to tackle climate change can create economic opportunities and higher living standards.

### **3.4.7 THE RESPONSE OF GOVERNMENTS (DEVELOPING COUNTRIES)**

The world's climate is changing and will continue to change into the coming century at rates projected to be unprecedented in recent human history (UNFCCC 2007b). The risks associated with these changes are real but highly uncertain (Adger et al. 2003). Societal vulnerability to the risks associated with climate change may exacerbate ongoing social and economic challenges, particularly for those parts of less developed nations and those societies dependent on resources that are sensitive to changes in climate. Risks are apparent in air pollution, agriculture, fisheries and many other components that constitute the livelihood of rural and urban populations in developing countries.

Developing countries, to varying degrees, lack social, technical and financial resources to cope with the impacts of climate change. At the 2009 United Nations Climate Change Conference in Copenhagen, there was broad agreement that an effective response to climate change will require new investments and other expenditures on a massive scale for decades to come. It was also agreed that developing countries will require substantial additional assistance to meet the challenges they face.

In the medium term, new and expanded carbon taxation and carbon-trading schemes have a central role to play in addressing climate change<sup>38</sup>. These instruments will directly help to reduce the emission of GHGs (IMF 2010). In addition, they have the potential to trigger large-scale, cross-border flows of private financing for developing nations and to provide substantial new sources of revenue for governments in developed countries that can be used to finance climate-related expenditures.

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<sup>38</sup> See also for example the IMF (2008).

However, the prospects for scaling up carbon taxation and carbon-trading mechanisms are uncertain and implementation could take several years (UN 2009). The political obstacles to appropriating new aid funds in the current fiscal environment—even if additional revenues are available to cover them—are considerable and may take time to overcome (Adger 2003). By contrast, measures to address climate change and, hence, credible long-term financing commitments are needed now.

International law prescribes international transfers from the developed to the developing world. According to Article 4.3 of the UNFCCC (UNFCCC 2003), developed countries shall provide new and additional financial resources and transfer of technology needed by developing countries to meet the agreed full incremental costs of measuring undertaken by developing countries in favour of the global environment. Furthermore, according to Article 4.4 of the UNFCCC (UNFCCC 2003), industrialised countries also have to assist developing countries that are particularly vulnerable to the adverse effects of climate change in meeting the costs of adaptation to change.

The Copenhagen Accord envisages annual financing for developing countries (from both official and private sources) as rising to around US \$100 billion per year by 2020, in support of strong policy actions by developing countries to mitigate and adapt to climate change (Richardson et al. 2009). Resources for adaptation would go primarily to low-income countries and, since they may not generate returns to service additional debt, would likely be disbursed almost entirely as grants (IMF 2010). By contrast, resources for mitigation can be expected to yield some positive return and, hence, the related financing could take the form of loans.

Launching a scheme (Green Fund) to tackle the problem of air pollution in a developing nation would require a major political effort upfront by all countries (Tolba & Saab 2008). The creation of a Green Fund could also help move the world closer to a binding global

agreement on reducing GHG emissions. The scheme could allow less developed countries to begin scaling up their adaptation and mitigation efforts sooner (perhaps years sooner) than might otherwise be possible, to the benefit of the entire world (IMF 2010).

The majority of developing countries are in tropical and sub-tropical regions, areas predicted to be seriously affected by the impacts of climate change. Africa, Asia and Latin America have all been identified as regions of concern. This is compounded by the fact that developing countries are often less able to cope with adverse climate impacts (Al-Shihri 2001; Schelling 1997). For instance, between 1990 and 1998, 97 per cent of all natural disaster-related deaths occurred in developing countries (IPCC 2001b).

The scale of action needed to tackle climate change is unprecedented and involves two concurrent approaches: the mitigation approach, with actions that tackle the causes of climate change, such as reducing GHG emissions; and the adaptation approach, with actions that minimise the consequences of actual and expected changes in the climate (Erickson et al. 2009; Francisco 2008). Therefore, this raises the question of how can governments in developing countries enhance their capacity to adapt or mitigate to changes in climate that are now both more persistent and more extensive.

Adaptation policies had been largely disregarded until the mid-1990s. Only since then a sharply increasing research interest in adaptation activities developed<sup>39</sup>. The IPCC (2001b, p. 188) defines adaptation as an “adjustment in ecological, social, or economic systems in response to actual or expected climate stimuli and their effects or impacts”. These adjustments encompass changes in processes, practices and structures to reduce potential damages or to take advantage of opportunities associated with climate change<sup>40</sup>.

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<sup>39</sup> Smit et al. (1999, p199) stress the concept of adaptation “is now a fundamental concern, and is receiving increasing attention”. Notwithstanding the “increase in attention, the science of adaptation to climate change is still in its infancy” (Klein et al., 2005, p580).

<sup>40</sup> See for example Stern (2007), and IPCC (2007b).

Adaptation options will evolve as knowledge relating to climate change increases and information is gathered on the success or failure of adaptation options. There is not a 'one size fits all' solution, but policy frameworks to facilitate capacity building and environmental awareness encourage appropriate adaptations to be implemented (POST 2006). Although adaptation activity is beginning to take place in many developing nations, further efforts may be stimulated by increasing awareness and education of the potential impacts of climate change.

Increasing scientific capacity by improving access to climate data, development of modelling capabilities and having mechanisms in place to process and disseminate data for users, helps promote awareness of potential climate change impacts (Adger 2003). It also equips nations with climate information necessary for national impact assessments, and adaptation and development planning, hence, increasing their capacity to adapt (Adger et al. 2003). In addition, increasing awareness through education, aid agencies, such as Red Cross, find that people in developing countries are aware of change taking place and have begun to adjust through long and short-term coping methods (Reid & Goldemberg 1998). However, there is a lack of awareness of climate change behind these observations and actions (Mirza 2003).

Developing countries are vulnerable to extremes of normal climate variability and climate change is likely to increase the frequency and magnitude of some extreme weather events and disasters. Investments in developing countries are more focused on recovery from disaster than on the creation of adaptive capacity (Adger et al. 2003). Extreme climate events create a spiral of debt burden on developing countries. Increased capacity to manage extreme weather events can reduce the magnitude of economic, social and human damage and, eventually, investments, in terms of borrowing money from lending agencies. Vulnerability to extreme weather events, disaster management and adaptation must be part of long-run sustainable development in developing countries (Mirza 2003).

International negotiations have been dominated by the interests of developed countries, focusing on mitigation issues (UNFCCC 2003). Climate change presents both constraints and opportunities for developing countries. The current debates could result in new forms and approaches of co-operation and strategic short, medium and long-term vision (Chandler et al. 2002). The reduction of GHG emissions or the enhancement of those sinks that absorb GHGs is a crucial part of the overall climate change debate. Climate change mitigation has received considerable attention since the adoption of the UNFCCC Convention (UNFCCC 2003). However, as a first step towards the implementation of the Kyoto Protocol, a great deal of effort has been directed toward emissions reduction opportunities.

In some current African countries, emissions of GHGs are negligible in global terms, due to the low level of development and industrialisation (Reid & Goldemberg 1998). As a result, emission reduction opportunities remain few and are mainly to be found in lessening the negative impact on the climate from land use change and deforestation.

However, climate change mitigation offers a unique opportunity to revisit development strategies from a fresh prospective (Chandler et al. 2002). In this regard, Rong (2010) finds that mitigation capability is a crucial factor. Therefore, the challenge is to ensure that actions taken within the climate change framework will help, and not hinder, local and regional development and will seek out a new dynamic in which the synergies between environmental and development issues can be properly understood and exploited (Denton et al. 2002).

Many of the required measures concern protection against damage. However, changing conditions can also bring benefits for different regions and sectors. Good planning and investment in sustainable infrastructure and more efficient resource use will prepare them for long-run changes. Individual responses to climate change depend on local conditions. But in all areas, action should strengthen natural defence and the earlier it starts the better.



Many researchers concluded that GHG emissions from developing countries certainly will increase in the future due to economic development needs (Elasha 2010; Tolba & Saab 2008). There is, however, a large and relatively cheap potential for emission reductions connected to efficiency improvements in industrial production and general energy efficiency improvements in these countries. The implementation of GHG mitigation strategies is interrelated with general national economic development policies (Halsnaes 1996).

The role of developing countries in helping to solve the problem of climate change is increasingly a focus of political controversy. With levels of GHG emissions projected to exceed those of developed countries by 2020, some industrialised countries are calling on developing countries to take stronger actions to meet the commitments they have made in the Framework Convention on Climate Change (Reid & Goldemberg 1998). The review of recent policy changes in developing countries, however, suggests that they are already taking little appreciated steps that reduce rate of growth in carbon emissions.

Many studies have focused strongly on mitigation strategies. It is largely acknowledged that significant GHG emission reductions have to be achieved in order to effectively combat the threat of global warming. According to Edenhofer and others (2011), such reductions require a comprehensive global effort which includes both a complete change in the energy supply of industrialised countries and the establishment of low-carbon systems in developing nations and emerging markets.

Industrialised and developing countries face the same challenge, this leads to support the mitigation efforts in both developed and less developed nations (Erickson et al. 2009). It has been argued that welfare threatening global warming and the risks attached can only be prevented if both groups of countries participate in international mitigation efforts (Rübelke 2011).

There is a delay in the reaction of the climatic system to GHG emission changes, such that the positive effects of today's activities to mitigate climate change will be first perceived in about half a century. In contrast, the ancillary effects of climate change mitigation, like the reduction in local air pollution, arise almost immediately and provide so-called ancillary benefits nearly without delay<sup>41</sup>. In contrast, adaptation has in general only local/regional direct impacts, which are not delayed. A dike immediately protects a region after its construction is completed. Furthermore, the dike protects this region also against such flooding that would have occurred without climate change and this protection can be regarded as an ancillary effect of the adaptation measure in the shape of dike construction.

Adaptation in the shape of the establishment of a trans-boundary information dissemination system on the occurrence of extreme events could help to prevent major damage to people and the uncontrolled migration of people fleeing the affected regions. The positive effects of this system are attainable immediately after its build-up. The effects of this system are partly indirect and partly direct. On the one hand, the system prevents some of the direct damage caused by global warming— for example, the death of people in the course of extreme weather events<sup>42</sup> — by warning the people and, hence, allowing them to be better prepared. On the other hand, because the early warning allows people to organise shelter in advance of the incidence, conflicts and unrest—which are more indirect effects of climate change (follow-up effects)—can be prevented which would otherwise be caused by crowds of people fleeing to other regions in an uncoordinated way.

A similar argument applies to climate change mitigation activities, since in these cases the occurrence of damages can be more easily prevented, and consequently the positive indirect

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<sup>41</sup> As Ekins (1996, p21) stresses, “Aggressive CO<sub>2</sub> abatement would not only avoid these serious risks for the future; it is also clear that it would yield substantial benefits through the reduction of other pollution damages here and now”.

<sup>42</sup> For classification of direct and indirect health impacts of extreme weather events caused by climate change, see Markandya and Chiaba (2009, p762). As Campbell-Lendrum and Woodruff (2007, p18) stress, “Ideally, all health outcomes which are directly and indirectly linked to climate vulnerability and climate change should be considered”.

impacts observable in the adaptation policy case arise in the mitigation policy case. Yet the indirect mitigation-related impacts are occurring with a delay, like the direct global effects of the direct ancillary effects of mitigation policy exhibit almost no delay. Reforestation, for example, does not only sequester carbon and consequently mitigate climate change, it can also preserve regional water availability (which is an ancillary effect of the mitigation policy). The prevention in water scarcity may in turn prevent people from fleeing to other regions and from potentially causing unrest there.

International transfers supporting adaptation and mitigation projects in developing countries are an intensely disputed topic in responding to climate change, not only in the ongoing international negotiations on climate change, but also in the scientific arena (Chedid & Chaaban 2003; Doukas et al. 2006). Since climate protection is a global public good, its benefits from projects in the developing world can be enjoyed by industrialised nations in the same way as respective benefits of domestic protection activities. Yet the mitigation activities tend to be less expensive in developing countries than in the industrialised countries.

### **3.5 LIBYA AND THE MIDDLE EAST (OIL AND CEMENT INDUSTRIES)**

#### **3.5.1 SPECIFIC GOVERNMENT POLICY**

With regard to the Middle East specific government policy, there is a considerable lack of literature regarding the policies which are used to combat the problem of environmental damage. It has been argued recently that none of the Mediterranean or Middle East countries has officially announced its emission reduction target (UNEP 2005). Therefore, the majority of these countries are currently studying the policy options that would reduce the risk of climate change.

The MENA region is particularly vulnerable to climate change. It is one of the world's most water-scarce and dry regions; it has a high dependency on climate-sensitive agriculture and a

large share of its population and economic activity is in flood-prone, urban coastal zones (WDI 2008). On the other hand, societies of this region have been under pressure to adapt to water scarcity and heat for thousands of years and have developed various technical solutions and institutional mechanisms to deal with these environmental constraints.

In a submission to the international summit, the report of the National Action Plan for the Libyan Coastal Area (UNEP 2005) points out that contributing to global efforts on climate change, erosion control and protection of water resources are high on the list of topics on the Libyan Environmental Authority's agenda. In addition, the report also contended that crafting policies to increase energy efficiency and clean production in some particular industries—such as the oil and gas industries, cement industry and iron and steel industries—is the most important role that should be taken in combating the problem of climate change.

Other countries in the Middle East are starting to make changing as well (UNFCCC 2007b). Although, Libya and Jordan, for instance, do contribute a mere 0.2 per cent and 0.1 per cent respectively to global carbon emissions, they maintain a strong commitment to the objectives developed by the international community for the integrated environmental and economic response to the threat of climate change (UNEP 2005).

Global climate scenarios developed by the IPCC have indicated that Mediterranean and Middle East countries will suffer from reduced agriculture productivity and water availability, among other negative impacts that are resulting from the increased emissions into the atmosphere (IPCC 2007c). To help address the problem, Mediterranean and Middle East nations must aim to increase their share of renewable energy resources while maintaining and reducing the share of energy produced from oil and other heavy industries. The question is what Middle East and Mediterranean regions are doing in response to vulnerability to climate change. As such, the MENA region is a valuable repository of

traditional and institutional knowledge which, if preserved and made accessible, could prove to be an important global contribution to efforts to address climate change.

Oil and gas revenues for the MENA countries have enabled exceptional and accelerated development in all aspects of life (Al-Moneef 2006). These regions have, to some extent, become a hub of intense activity in many spheres—geopolitical, military, economic, industrial, construction and tourism, to name a few. However, the scale of oil production and use has also led to severe environmental problems (Hassan 2001; Raouf 2007). Contribution of MENA countries to climate change is significant. In this regard, the region's emissions of GHG are generally small in absolute terms (less than 5 per cent of the world's total) and in per capita terms. However, the amounts of these emissions and consequent contribution of the region to climate change varies between countries, with the oil producing countries (Algeria, Egypt, Iraq, Libya, Qatar, Saudi Arabia and the United Arab Emirates UAE) shouldering the biggest share (74 per cent of the region's total) (Raouf 2007; UNSD 2008). Moreover, the growth of MENA countries' CO<sub>2</sub> emissions from fuel combustion was the third largest in the world in 1990–2004 (+88 per cent), at roughly the same level as India, and well above Latin America and Caribbean (+43 per cent) or Africa (+39 per cent), and more than three times faster than the world's average (UNSD 2008; WDI 2008).

The MENA countries face a multitude of environmental challenges, such as: air pollution; desertification; biodiversity loss; pollution in marine and coastal areas; and water scarcity and quality. Prominent among these emerging environmental problems faced by the region is climate change, the focus of this section. It is worth mentioning that environmental challenges and emerging environmental threats are all interlinked. For instance: desertification leads to biodiversity loss; livestock increase and overgrazing leads to desertification; waste-dumping releases CO<sub>2</sub> and methane emissions, which adds to the global

warming problem, which in turn leads to desertification, water scarcity, and many other ecological disasters (Raouf 2007).

In addition, the IPCC (2007c) projects an increase in the frequency and intensity of extreme climate events, such as floods and drought. This, in turn, could lead to mass migration in the Arab region. In this regard, scenarios conducted by the UNEP and other organisations indicate that a 0.5 metre (approximately 19 inches) rise in sea level, which, for instance, could displace 2–4 million Egyptians by 2050. Thus, climate change presents a great challenge for the region and calls for more regional cooperation to mitigate its impact and protect people's livelihoods.

The MENA countries face a difficult situation as the majority of them depend mainly on fossil fuels—the main cause of CO<sub>2</sub> emissions—and their economies are dependent on the oil, gas and petrochemical industries, as well as other industries such as cement, iron and steel (Al-Moneef 2006; Al-Shihri 2001). Though the rate of development is high, the lack of arable land and water resources prevents the development of carbon sinks, forests and green areas. Hence, an emissions reduction policy such as emissions trading is considered to be more feasible to be used in this region.

According to the World Resources Institute and besides being the world's main petroleum exporters, Middle East and some North African countries have been under fire for carbon emissions from the large-scale use of fossil fuels. The UAE, Saudi Arabia, Kuwait, Libya, Algeria and Iraq figure among the world's top 50 CO<sub>2</sub> emitter (Raouf 2007; WRI 2007). Even though the region's total carbon emissions are very low (only 2.4 per cent) compared to other regions, per capita emissions are very high. Therefore, there is no doubt that Middle East and some other North African regions share responsibility with the rest of the world for climate change and must work to diversify the energy pie and look for more environment-friendly energy sources.

Yet, while it is a common responsibility, different obligations must be charted out for different countries. Giant emitters, for example, should shoulder more burdens. The Gulf and some other Middle East countries recognise the problem and are trying to come up with innovative solutions in the renewable energy field to offset this. This is very clear in recent initiatives such as Abu Dhabi's initiative for a carbon-neutral city in 2009. The Kyoto Protocol to the UNFCCC has called for, and is now trying to ensure that, of the 166 countries that ratified it, 40 industrialised countries should turn back to the level of emissions in 1990 and reduce their overall emissions of GHGs by at least 5 per cent below 1990 levels in the commitment period from 2008 to 2012 (UNFCCC 2003). Arab countries, including the MENA countries, are either signatories or have acceded to many of these international environmental agreements (UNFCCC 2007b). In addition, changes in environmental legislation are being made to cope with the requirements of these agreements or to close the gaps in the current environmental laws.

The entire Arab region under the UNFCCC pact is in the Non-Annex I Parties category. Only some countries from the Middle East region have submitted their reports to the convention secretariat (see Table 3.1). Even though the Middle East countries joined the UNFCCC in the mid-1990s, some of them only submitted their reports in the last couple of years (UNFCCC 2007b). Yet, other countries, such as Libya, have not taken any action regarding the National Communication Reports (UNFCCC 2007b).

As a result, adaptation to the various impacts of climate change has so far been very low (Kazem 2011). Information acquisition, public awareness, mainstreaming impacts into policies, monitoring, evaluation, and implementation measures were almost non-existent (Doukas et al. 2006). However, mitigation initiatives have gained a lot of attention in the last couple of years. Many pioneering initiatives in terms of renewable energy, energy efficiency,

clean production and technology, especially under the clean development mechanisms, have been undertaken (Patlitzianas et al. 2006).

**Table 3.1:** Initial National Communication and Date of Submission of Country Report

Countries	Country Reports, Date	
	Initial Report	Second Report
Algeria	April 30, 2001	November 25, 2010
Bahrain	April 20, 2005	---
Egypt	July 19, 1999	June 7, 2010
Iraq	---	---
Jordan	March 6, 1997	December 8, 2009
Kuwait	---	---
Lebanon	March 16, 2011	---
Libya	---	---
Morocco	November 1, 2001	November 3, 2010
Oman	---	---
Saudi Arabia	November 29, 2005	---
Sudan	June 7, 2003	---
Syria	December 29, 2010	---
Qatar	June 20, 2011	---
Tunisia	October 27, 2001	---
United Arab Emirates	January 2, 2007	April 7, 2010
Yemen	October 29, 2001	---

Source: UNFCCC, 2007.

Nevertheless, MENA countries lack clear targets to reduce GHG intensity (IPCC 2007c; Raouf 2007). Hence, much work needs to be done in establishing, maintaining and improving registry. In addition, there is a need to implement a comprehensive range of new and expanded domestic policies, such as emissions trading, tax incentives for renewable energy and clean technology. Moreover, cross-sectoral policies to fight climate change must be developed and integrated, especially in sectors like energy, agriculture and transportation.

It has previously been mentioned that the Kyoto Protocol established three flexible mechanisms to assist Annex I Parties in meeting their national targets cost-effectively: Emissions Trading System (ET); Joint Implementation (JI) of emissions reduction projects between Annex I Parties; and the Clean Development Mechanism (CDM), that allows for emission reduction projects to be implemented in Non-Annex I Parties (developing



countries). While countries such as India and China, in addition to many others in Latin America, were prepared to follow this path when the Convention and Protocol were signed in 1997, the Middle East region (including all Arabic countries) only started to think about emissions trading in 2006 and began implementing projects in 2007 (Tolba & Saab 2008). Currently, there are many CDM projects in progress in the Middle East, in countries such as Egypt, Jordan, Bahrain, Morocco and Tunisia. But given that in 2006 the global emissions trading market was worth US \$30 billion and that this is an emerging new market in all Arab petroleum countries, there is a huge potential for Arab companies to reduce emissions and earn money from generated credits.

There are examples of emissions reduction projects in some of the Middle East countries regarding the oil and cement industries. The good news is that projects are now moving fast, as awareness is raised on all levels (Erickson et al. 2009). Doha Bank, for instance, was planning to launch the Arabian Gulf's first carbon credits exchange in 2009 to tap into an emerging market for emissions trading. Moreover, CDM projects in the Gulf countries are being considered in various fields such as the oil industry, cement industry, renewable energy, waste, et cetera (Tolba & Saab 2008).

It has been argued that the political will is very weak in some of the Middle East countries (Koch & Stenberg 2010). In addition, there is a lack of education and awareness on all aspects related to Kyoto's mechanisms. Moreover, there is a lack of infrastructure and capacity (expertise) in private and public sectors in some of the environmental fields such as ET, JI, CDM and other environmental regulations (Tolba & Saab 2008). Consequently, until recently, not much attention was given to environmental issues at the policy level; instead, the focus has been primarily on the economy security and development (Raouf 2007).

The petroleum industry cannot stop or change production easily, unlike other industries, such as cement, where overnight changes are possible (Worrell et al. 2001). As a result, while

development in the Middle East region is rapid, political support and funds are available for development and environment activities, and environmental awareness is growing. As such, emissions trading policy is now considered an additional revenue source based on carbon credits sales. Potential emissions trading activities could thus be initiated in areas such as cement, landfills, industrial efficiency, waste management, industrial processes, agriculture, land use change and forestry inventory (Raouf 2007).

The energy efficiency projects in the Middle East region, for instance, can save millions and reduce tons of CO<sub>2</sub> emissions (Al-Badi et al. 2011). In addition, renewable energy—in particular solar energy—holds great potential for the region, similar to biomass in Asia. In the long term, the region in fact could export clean energy to the whole world (MEI 2011). In the meantime, while environmental laws exist, some executive regulations may be required to implement these laws and promote emissions reduction projects in the Middle East region. Hence, all concerned stakeholders (Libya and Middle East countries) should be involved.

Several contributions to the literature have confirmed that it is unlikely that countries in the Middle East region will try to solve the carbon emission problem by imposing carbon taxes (Doukas et al. 2006; Patlitzianas et al. 2006; Raouf 2007; Tolba & Saab 2008). These countries depend heavily on the petroleum industry as the main source of revenue for their development plans and any carbon taxes might hamper this process (IPCC 2007c; Tolba & Saab 2008). In addition the potential of carbon capture and storage is very limited as a safe way of disposal (Doukas et al. 2006). From the environmental point of view in relation to climate change, it is not the best solution as it will only postpone the problem and encourage more release and storage of CO<sub>2</sub> (IPCC 2007c). Leakage of huge quantities of CO<sub>2</sub> might then turn this into an environmental disaster. Hence, moving towards emissions reduction policies, such as emissions trading, has great potential to tackle the problem of air pollution.

On environmental issues, the Middle East countries operate through a number of international and regional bodies that coordinate activities and set the framework for regional efforts (MEI 2011). At the state level, environmental ministries, agencies and councils, which are still fairly new, are struggling to play a significant role in the decision-making processes to address priority environmental challenges, problems and threats facing the Middle East region (See Table 3.2).

In relation to policy options, there is no doubt that renewable energy projects and other clean technology for mitigating climate change will enable Middle East countries to align their GHG reduction and human development efforts, and promote mitigation activities that do not slow down, but rather, accelerate socioeconomic progress (Al-Badi et al. 2009). The Arab region is not only granted an enormous supply of oil and natural gas but also a perfect geopolitical positioning wherein it receives maximum exposure to sunlight and in many areas wind, which would provide endless renewable energy (IPCC 2007c).

**Table 3.2:** Governmental Environmental Institutions and Agencies in the Middle East Countries

<b>Countries</b>	<b>Policy Institution</b>	<b>Executive Agencies</b>
<b>Bahrain</b>	Environment and Wildlife Affairs	Public Commission for the Protection of Marine, Environment and Wildlife
<b>Egypt</b>	Ministry of Environment	Ministry of Environment
<b>Kuwait</b>	Environment Public Authority	Environment Public Authority
<b>Libya</b>	Environmental General Authority	Environmental General Authority
<b>Oman</b>	Council of Ministries	Ministry Environment and Climate Change
<b>Qatar</b>	Council of Ministries (Permanent Commission for Environmental Protection)	Supreme Council for the Environment and Natural Reserves
<b>Saudi Arabia</b>	Ministerial Committee on Environment	Presidency of Meteorology and Environment (PME)
<b>Tunisia</b>	Ministry of Environment	Ministry of Environment
<b>UAE</b>	Council of Federation	Federal Environment Agency/Ministry of Environmental and Water Resources

Source: Compiled by the author from the Gulf Cooperation Council 2011.

According to a regional expert, the region is exposed to direct sunlight, as well as a reduction in the percentage of clouds (Tolba & Saab 2008). The usual direct natural exposure in the Arab region is about 1800 kilowatt/h per square metre and this makes the adoption of solar energy in the region technically and economically feasible. Statistics show that both the Middle East and North African Arabic countries are equipped to deal with this technology (Al-Yousafy & Alkorah 2007). Hence, the most important direct benefit is the ability to help cut emissions and therefore set an example for others to follow.

Middle East countries face numerous environmental challenges and will have to reconcile the many conflicting priorities, from economic diversification, environmental protection, water supply, food security and conservation to the newly hazardous impacts of global warming. These countries have continued to play an increasingly important role in the climate change field; they are at once the producers and exporters as well as victims of climate change. Thus, they must be fully backed and supported by the international community. There is no room for unilateral efforts that ignore other players. There is a very good opportunity for Middle East countries to garner financial and technical support from the industrial world to help them combat the negative impact of climate change.

### **3.5.2 INDUSTRY ACTIVITIES (RESPONSE)**

The focus must be on what can and what should be done, not because it has been certain that climate change is happening, but because the possibility cannot be ignored (Sonnebron 2005). In the last two decades the response to global warming concerns by fossil fuel-based industry has evolved from denial of the science to actively embracing responsibility for addressing the issue with their own operations (Packard & Reinhardt 2000). It continues to range between these two extremes and examples of both approaches can be given. Many companies now accept that a carbon-constrained future is inevitable and are preparing themselves to be active players in this future (Bassino & van der Eng 2010).

However, until recently the Global Climate Coalition<sup>43</sup> in the United States and some other developed countries has actively sought to prevent any meaningful agreement to reduce carbon emissions nationally and internationally. In the late 1990s, the Global Climate Coalition started losing major members such as DuPont, British Petroleum (BP), Royal Dutch Shell and Ford. Many of these companies joined a new group, the Business Environmental Leadership Council, founded by the not-for-profit Pew Centre on Global Climate Change, which supports industry in taking action to address climate change (Brown 2000).

The overriding policy challenge for the industrialised economies is to promote the positive impacts of industrial development while limiting or eliminating its negative impacts throughout the world (Francisco 2008). In this regard, the current response in some industries to global warming can be illustrated with a few examples: 1) DuPont, the largest transitional in the chemicals sector, has committed to cut its emissions by nearly two-thirds (compared with its 1990 level) within a decade, while holding its total energy consumption level, and using renewable resources for one-tenth of its energy worldwide; 2) BP has established an internal emissions trading system among its national divisions, and is committed to investing in the development of clean and renewable energy sources; and 3) The Royal Dutch/Shell Group have decreed that all large projects must take into account the likely future cost of carbon emissions. This is adding to cost calculations a figure of US \$5 per tonne of carbon between 2005 and 2009, rising to \$20 per tonne from 2010. Shell reports that this 'is not altruism' but is 'giving us a competitive advantage' (Grayson & Hodges 2002, p. 103).

Industrial activities play an important role in the economic well-being of Europe and other industrialised economies, contributing to sustainable growth (Brohé et al. 2009). However, industrial activities also have a significant impact on the environment. The largest industrial installations account for a considerable share of total emissions of key atmospheric pollutants

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<sup>43</sup> Global Climate Coalition is a group of US companies and trade opposing immediate action to reduce GHG emissions.

and also have other important environmental impacts, including emissions to water and soil, generation of waste and the use of energy (IPCC 2007c).

In general, a company's sense of urgency for action with respect to GHG reduction in their domestic activities is heavily influenced by the government's stance on ratification (or non-ratification) of the Kyoto Protocol. Companies within the European community are taking a clear lead in supporting GHG reduction efforts, no doubt in response to EU support for the Kyoto Protocol (Ruis & Zeeuw 2010).

Many of the key operating parameters of the Kyoto Protocol have been hotly debated, leaving industry to face further uncertainty with regard to the methods that may be used to acceptably reduce GHGs (Webster et al. 2003). In particular, the extent that carbon sequestration and 'flexibility mechanisms' (emissions trading, clean development mechanisms and joint implementation) may be used to fulfil national CO<sub>2</sub> reduction targets has been a key issue (UNFCCC 2003).

Several contributions to the literature have emphasised that industrial processes play a major role in the degradation of the global environment (Bassino & van der Eng 2010; IPCC 2007c). In industrialised countries, environmental regulation and new technologies are reducing the environmental impact per unit produced, but industrial activities and growing demand are still putting pressures on the environment and the nature resource base (Klein et al. 2005). In contrast, in developing countries a double environmental effect is occurring; old environmental problems, such as deforestation and soil degradation, in addition to new problems linked to industrialisation, are emerging. For example, rising GHG emissions, air and water pollution, growing volumes of waste, desertification and chemicals pollution, remain largely unsolved.

The existing industries (oil, gas, cement, iron, steel, etc.) in the MENA region were not designed to cope with the effects of climate change (Elasha 2010). As a result, this can

negatively yield a very bad impact on the environment of this region. According to Sowers and Weinthal (2010), pressure on the available production capacity makes critical the need for MENA countries to examine options such as energy efficiency, shifting away from the current centralised energy production models and allowing more players from the private sector to participate in energy production in order to mitigate GHG emissions. However, the present status of the industrial activities in this region needs an urgent action to deal with and tackle the problem of air pollution.

In addition, the existing infrastructure of both the oil and cement sectors in the MENA region is currently not designed to address the challenges of climate change. To some extent the cement industry is not adequate to meet the expected increasing needs in some countries, such as Libya, because of the increased development (Al-Moneef 2006; Hokoma et al. 2007; Ngab 2007; Pillet 2005). Hence, environmental and air pollution-related issues, which are also at the centre of these concerns, have received little or no attention.

Numerous studies have concluded that human-induced climate change exacerbates already existing problems affecting urban and rural development, human health and economic productivity in the MENA region (Sowers & Weinthal 2010; Tolba & Saab 2008). As a result, many proactive measures to adapt to climate change can be encompassed within existing policies for the oil and cement sectors, as they are the leading sources for air pollution (Sowers & Weinthal 2010). These include implementing emissions reduction policies such as: emissions trading; upgrading and installing new technologies and storage infrastructures; and improving demand management of oil and cement efficiencies.

One proposed solution is to establish a Carbon Mitigation Fund<sup>44</sup> to promote low-carbon technology transfer to the high-emitting developing countries, funded by the leading cumulative per capita emitters (Gallagher 2009). In this regard, Sowers and Weinthal (2010)

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<sup>44</sup> For more details (see Gallagher, 2009).

have stated that significant gains from mitigation—that is, reducing the rate of emissions of GHGs to the global atmosphere—would be achieved even if only a few large emitting countries take action. These countries can set new standards, stimulate innovation of new technologies and provide assistance for other countries in coping with the problem of environmental degradation.

Countries in the MENA region will also face adaptation challenges whether or not they contributed to creating the problem of climate change (WDI 2008). They should not wait for external financial assistance or technology transfers, which may not be forthcoming from industrialised nations, before taking action. Given the lack of political will in the industrialised countries to seriously pursue mitigation at this point in time, impacts from climate change in the MENA region are unavoidable (Sowers & Weinthal 2010; WDI 2008). For policy makers, whether or not these challenges are caused by human-induced climate change is immaterial (Elasha 2010). What matters is adopting proactive strategies to minimise vulnerability for communities and ecosystems. Thus, it has become necessary to plan for extreme events that are increasingly common (Chedid & Chaaban 2003).

While the MENA region faces shared environmental threats, states will be impacted differently by climate change through variations in exposure to climate risks (MEI 2011). For example, sea-level rise will differentially impact coastal states with significant populations in low-lying areas, with some previously mentioned examples, including Egypt, Tunisia, Libya and the small Gulf States, being the most exposed (Michel & Pandya 2010; Sowers & Weinthal 2010). Therefore, climate change requires that immediate action must be taken to strengthen coping capacity and to reduce the vulnerability of sensitive sectors, such as the oil and cement sectors, and promote the diversification of productive livelihoods in both rural and urban areas. Also, in recent time and among the underlying causes of the revolutions that have been spread throughout the MENA region. If that is the case, perhaps the Arab Spring



will yield a political order that is not only more transparent and accountable but more responsive to popular demand for responsible stewardship of the environment (MEI 2011). This is the very outcome that the international community should help its regional partners to achieve.

From an ethical point of view, it seems clear that developed countries should take action and assist developing countries by transferring technology (Sowers & Weinthal 2010). ). From a practical point of view, action by developed countries alone may not make sense (WDI 2008). For this reason the governments of developed countries have argued for the inclusion of developing countries in any international GHG reduction protocol. Therefore, industry activities response in developing countries should seriously contribute and participate in those policies that can minimise and reduce the risk of environmental degradation.

### **3.6 THE GAP IN THE LITERATURE**

There are a number of previous research studies conducted in the area of sustainability which examine its three dimensions of economic, social and environmental concerns. However, examination of the environmental impact appears more effective with regard to CO<sub>2</sub> emissions and its impact on sustainable development. In the Libyan context, no known research has investigated organisational context with reference to environmental quality and economic development. Moreover, in relation to GHG emissions reduction, particularly CO<sub>2</sub> emissions, little or limited literature of this type has been produced in the area of developing countries. To date, there has been no study conducted in the area of a developing country such as Libya, which examines the organisational context of the potential implementation of emissions trading policy to effect GHG emissions reductions. Therefore, this study will make a major contribution in providing information for practice and decision-makers. Although Libya has not been required to achieve a certain reduction target, it is more likely to seek and to put forward a target level in order to tackle its emissions problem. In addition, it has a great

opportunity to implement such an Emissions Trading System both in the oil and cement industries so that their potential for economic growth will provide a major contribution to sustainable development, while protecting the environment from degradation.

### **3.7 SUMMARY**

This chapter has demonstrated the relevant literature to provide a background and understanding into the dynamic of the current study. It has covered three issues. The first issue is the economic literature, which includes: important topics about emissions trading (tradable permits) and taxes; a market-based approach to GHG emissions reduction; the environmental Kuznets curve framework; and scenario of emissions trading. The second issue is related to the political economy literature, which comprises: prominent themes about sustainable development; history of the climate change debate; sustainability and climate change; the response strategy debate; the response of non-government organisations; the response of governments in developed countries; and the response of governments in developing countries. The final issue is about Libya and the Middle East (oil and cement industries), which contains themes about the specific government policy regarding climate change and environmental degradation, and the industry activities (response to climate change).

The literature of this chapter has indicated that, due to the lack and the absence of climate policy action, GHG emissions will rise by 50 per cent by 2025 compared to present levels, with emissions in developing countries growing the fastest. Therefore, the chapter has displayed and concentrated on some emissions reduction policies, particularly the emissions trading policy (tradable emissions permits). This policy was described as one of the three most efficient policies since the establishment of the Kyoto Protocol in 1997, which would reduce GHG emissions, in particular CO<sub>2</sub> emissions, and tackle the problem of climate change. In this regard, MBI to GHG emissions reduction is considered to be one of the most

beneficial tools in relation to CO<sub>2</sub> emissions trading. The conclusion drawn about emissions trading policy is that it is the best option for meeting the Kyoto requirements because it is more flexible, more feasible administratively, less regressive, politically feasible and it guarantees a specific amount of emissions reduction.

In contrast, the literature has shown that carbon taxes have so far been introduced in a few European countries, at relatively low levels and with exemptions for many energy-intensive industries. In addition, the literature does not provide a consensus view on the marginal damages of GHG emissions and the optimal tax rate. More specifically, the literature has confirmed that it is unlikely that the Middle East countries will try to solve the carbon emissions problem by imposing carbon taxes. These countries depend heavily on the petroleum industry as the main source of revenue for their development plans and any carbon taxes might hamper this process. Moreover, countries beset by bribery and corruption may not be able to use taxation because the taxes will be evaded or become an excuse for further corruption (as is the case in many developing countries). It is in many cases argued that a tradable permit system is preferable to a tax because its outcome is more certain in terms of achieving an emissions reduction target.

The research problem associated with the case of Libya illustrates the fact that the country is in the stage of rapid industrialisation, especially in the oil manufacturing sector, which has led to a higher economic growth and changes in the structure of economic activities and higher investments. This issue has been explained by the EKC concept. A systematic explanation for the relation between environment and economic growth has been provided by the EKC perspective. In this regard, the literature has demonstrated that the income has three effects on the existing amount of pollution emissions. These effects are scale effect, composition effect and the technique effect. The latter captures improvements in productivity and adaptation of cleaner technologies, which will lead to increase in environmental quality.

Therefore, a turning point is considered to be an important factor to emphasise the positive nexus between environmental—particularly CO<sub>2</sub> emissions—and economic development. In addition, there is vast literature regarding cross-section and panel data EKC studies. However, single country studies are fewer in comparison.

In terms of achieving sustainable development, the literature has emphasised that reducing GHG emissions is one of the key concerns in many international organisations for the purpose of attaining sustainable development. Recently, numerous literature has argued that environmental impacts are at the core of sustainability concerns. Hence, this can be measured by tradable emissions allowances, which are considered one of the economic policy instruments that have become an increasingly important environmental policy tool that can enable society to achieve its environmental goals.

Regarding response to climate change, there was a growing debate on the climate change and environmental degradation response particularly from both sides of NGOs and developed countries, this was by supporting both aspects of adaptation and mitigation efforts. However, Libya and the Middle East countries' response to environmental degradation was very limited. In addition, the projections indicate that the concentrations of GHGs, particularly CO<sub>2</sub> emissions, will continue to increase. Therefore, consideration of the global warming problem must not distract attention from the central issue of global climate change and emission of GHGs attributable to the burning of the fossil fuels by developed countries. Developing nations, particularly oil producer countries, in addition can play a significant role in increasing the quantity of GHGs if there is no action taken.

The next chapter of this thesis describes and explains the key methods adopted in order to accomplish the objective of this study and attempt to answer the research questions.

## **CHAPTER FOUR: RESEARCH METHODOLOGY AND PROCESS**

### **4.1 INTRODUCTION**

The aim of this chapter is to describe and to discuss in detail the research methodology of this study and the research process. In this context, the chapter includes detailed discussions and descriptions of the process of designing the methodology of this research. In order to understand the real causes behind natural phenomenon and events, many researchers have developed a number of methods. In addition, a number of techniques and equipment have been developed to improve the accuracy and depth of the information gathered, however, the type and the nature of the information acquired depends upon the type of methods used.

The research method used in this study was based on a combination of quantitative and qualitative techniques, in response to the objective of the research and questions to be answered. In this regard, a mixed research approach was adopted. Firstly, a regression analysis was conducted to analyse the proposed hypothesis. The quantitative data was collected from the annual reports of the Central Bank of Libya, the World Bank, National Oil Corporation in Libya, the General Information Authority in Libya, in addition to annual reports (long-term movement in time series data) from both Ministries of Libyan Oil and Industry. Then the quantitative data was processed and analysed using SPSS package (Statistical Package for Social Science) and Excel software—this was used in the first stage of the study in order to present the study's findings in regard to the proposed hypothesis.

Secondly, to gain in-depth understanding of the phenomenon that has been investigated, the target population included both Libyan and foreign companies operating in the oil sector, as well as Libyan cement companies operating in the cement sector. It was aimed to conduct 40 semi-structured interviews with the selected oil and cement companies. However, for administrative reasons 37 interviews were conducted. These interviews involved senior

decision-makers (general managers) and managers of several functional departments such as production, environment, energy, sales and finance. In addition, experts and consultants working for the companies were involved in the interviews. This chapter also defines the interview sample and data analysis, which involved the use of computerised software packages such as NVivo and Excel to store and organise the data gathered.

## **4.2 OVERVIEW OF THE CHAPTER**

This remainder of this chapter is divided into five further sections. The next section provides brief information about the research design of this study. The research method and the measures of this study are outlined in the fourth section, which explains in detail the methods and the measurement means that have been utilised in this study. The fifth section provides detailed information regarding the mechanism and the process of collecting the quantitative and the qualitative data. This section also gives details about the sample size of the target population of this study, in addition to a concise description about each company that has been chosen in this research. The sixth section clarifies the way in which the data was analysed. Finally, the seventh section summarises the entire chapter of this research.

## **4.3 RESEARCH DESIGN**

The literature identifies a number of interpretations of research design. Set out below are the most significant and recognised views. Research design is the science of planning procedures for conducting studies so as to get the most valid findings (Cooper 2003). Saunders and others (2007) referred to this stage as the general plan that determines how a researcher will attempt to achieve the research objective. In other words, the research design is the plan or strategy adopted for linking the theoretical research problem to relevant and practical empirical research that is conducted in order to achieve the research goal.

Research design is concerned with enabling a problem to be researchable by setting up a study in a way that will produce specific answers to specific questions. In this regard, researchers need to assess their specific research design before they start their research. However, it is argued that researchers often fail to give adequate attention to research design issues, possibly because of their inability to identify design as their first, or as their most important, step in developing a research proposal (Hakim 1987). In this context, Collis and Hussey (2003) suggest that the first step in research design is to identify a research problem or issue. Identifying the research problem is always an exploratory and iterative phase in the research.

There are two significant research methods that need to be distinguished, the deductive method and the inductive method. Deductive research is a study in which a conceptual and theoretical structure is developed and then tested by empirical observation; thus particular instances are deduced from general inferences. For this reason, the deductive method is referred to as moving from the general to particular (Johnson & Christensen 2004). Whereas inductive research is a study in which theory is developed from the observation of empirical reality; thus general inferences are induced from particular instances, which is the reverse of the deductive method. Since it involves moving from individual observation to statement of general patterns or laws, it is referred to as moving from the specific to general (Collis & Hussey 2003).

More specifically Ghauri and Gronhaug (2005) argue that the deductive approach as a method is based on logic, while induction is based on empirical evidence. They further explain the difference between these two approaches. Deduction is drawing conclusion out of logical steps and reasons, regardless of whether it is true in reality or not. Induction, on the other hand, does the opposite—it moves from assumptions to a conclusion. Hence, the

important underlying step is to decide which approach best identifies the most appropriate solutions from which to draw suitable conclusions relating to the issues under investigation.

Therefore, this research is completely an exploratory study that has both quantitative and qualitative research design. Both methods were employed to develop more understanding of the proposed research problem. Although quantitative methods have been used in collecting and analysing the data, the fundamental part of the current study is qualitative. Leedy and Ormrod (2005) argue that qualitative research provides a means through which the researcher can judge the effectiveness of particular policies, practices or innovations. Regarding the qualitative approach, more detailed information will be provided in both the data collection and data analysis sections.

## **4.4 RESEARCH METHODS AND MEASURES**

### **4.4.1 RESEARCH METHODS**

#### **4.4.1.1 QUANTITATIVE AND QUALITATIVE METHODS**

The quantitative approach may be defined as an interdisciplinary field that uses a multi-method approach to research. It refers to the understanding of human experience using numbers and statistics, examples, experiments, correlation studies by surveys and standardised observational protocols, simulations, and supportive materials (Corbetta 2003; Janesick 1998). Johnson and Christensen (2004) argue that the quantitative research approach focuses on the deductive component of the scientific method by focusing generally on hypothesis testing and theory testing. Quantitative data is not usually abstract, but hard and reliable; it measures tangible, countable, sensate features of the world (Bouma & Atkinson 1995; Naoum 2007).

This can be compared to qualitative research that Creswell (1994) argued is an inquiry process of understanding a social and human problem. It is based on building a complex, holistic picture formed with words, reporting detailed views of informants, and conducted in



a natural setting. Qualitative research is described as ‘subjective’ in nature, emphasising the meanings, experiences, descriptions, and so on (Naoum 1999).

The differences between qualitative and quantitative research have been explained by number of authors (Corbetta 2003; Maxwell 2005; Thomas 2003). Corbetta (2003) demonstrated that qualitative research is open and interactive and observation precedes theory; whereas quantitative research is structured and theory precedes observation. Corbetta (2003) ) has also identified issues between the qualitative and quantitative research in the nature of data. He argued that data in quantitative research is hard, objective and standardised, while on the other hand, data in qualitative research is soft, rich and deep. In addition, several authors have attempted to distinguish between the nature of qualitative and quantitative research. Bryman (1992) provided a summary of the fundamental dimensions in which quantitative and qualitative research differ (see Table 4.1).

**Table 4.1:** Some differences between quantitative and qualitative research

Dimension	Quantitative	Qualitative
Relationship between research and subject	Distant	Close
Stance of the researcher in relation to subject	Outsider	Insider
Relationship between theory, concepts and research	Confirmation	Emergent
Research strategy	Structured	Unstructured
Scope of findings	Nomothetic	Ideographic
Image of social reality	Static and external to actor	Processual and social constructed by actor

Source: Bryman (1992, p. 94)

The above table shows that the relationship between the qualitative researcher and the subject is close and the researcher is considered an insider. Bryman (1992) recommended that qualitative researchers can better view the world by getting close to their subjects, thus becoming an insider within the research setting. In contrast, the relationship between the quantitative researcher and the subject is usually brief or non-existent, where the researcher is seen as an outsider.

The function of theory and concepts within the two approaches is disparate. Theories are the initial objectives for investigations within the quantitative approach, whereas formulating a theory is the interest of qualitative research (Bryman, 1992). Research methods used in quantitative research tend to be more structured than those used in qualitative research. Quantitative research is structured, in that sampling determination and data taking instruments are created prior to the data collection process (Bryman, 1992). In respect to research findings, a differentiation is made between quantitative and qualitative methodologies with regard to nomothetic and ideographic modes of reasoning. This is clarified by Bryman (1992, p.100) who stated that:

‘A nomothetic approach tries to establish general law-like conclusions which can be deemed to exist irrespective of time and place; an ideographic approach obtains its results in specific time-periods and locales.’

The reality quantitative researchers convey is static and exists independently of the researcher. It is based on the notion that there is only one social reality in existence. On the other hand, qualitative researchers are of the opinion that social reality is constructed by the actor and can be changed. Qualitative researchers try to maintain the multiple realities that may exist. More recently however, the competing paradigms of quantitative and qualitative research have become almost working partners in some social research. Many researchers advocate a pragmatic position, as it is recognised that both quantitative and qualitative research are very important and can often be mixed in single research studies (Naoum 1999; Patton 1990). The exact mixture that is considered appropriate will depend on the research questions and the situational and practical issues facing a researcher (Johnson & Christensen 2004). Thus, this research study aims to collect multiple sets of data using different research methods in such a way that the resulting mixture or combination has complementary strengths and non-overlapping weaknesses.

#### **4.4.1.2 THE ADOPTED RESEARCH METHODOLOGY**

There is no fast rule to selecting a research method, nor a best research method, as the use of each research method depends on the form of the research objective, the research questions and the contextual situation (Yin 2003). The selection of the most suitable research method depends largely on the intention of the research objective and the type of data needed for the research. Combining both quantitative and qualitative research methods has proven to be more powerful than a single approach (Stewart & Cash 2006) and very effective (Saunders et al. 2007).

A mixed approach is the process of using more than one form of research method to test a hypothesis and/or a proposition (Thomas 2003). However, due to the context of the research study, this approach offers researchers a great deal of flexibility, whereby theories can be developed qualitatively and tested quantitatively or vice versa. The main aim of using a mixed method is to improve the reliability and validity of the research outcomes. Due to the broad scope of this study and the organisational context of the research, a wide range of research techniques was adopted to achieve the research objective.

For this research study a mixed research approach was adopted in order to maximise the benefit of both methods, achieve the study's goal and answer the research questions. From a qualitative stand point the research conducted semi-structured interviews with open-ended questions, while published and non-published reports were used for the quantitative aspect. In other words, a qualitative research study and a quantitative research study were conducted either concurrently or sequentially. Both of these methods require data collection involving primary and secondary data collection methods.

On one hand, and according to Saunders and others (2007), secondary data is information that has been previously gathered for some purpose other than the current research project. (Saunders et al. 2007). In addition, Saunders and others (2007) stated that few researchers

consider the possibility of re-analysing data that has already been collected for some other purpose. They also explained that secondary data includes both raw data and unpublished summaries. For example, it involves published and non-published reports from government departments and official statistics covering social, demographic and economic topics.

There are two types of secondary data: internal and external. With regard to internal secondary data, Chisnall (1997) maintained that the answers to many problems lie within organisational documents; he added that many companies do not make full use of the information that they regularly generate. External sources of data include statistics and reports issued by governments, trade associations and other reputable organisations. Additionally, information is frequently circulated from other sources, such as economic directories, to provide further information. In this regard, Chisnall (1997) further states that electronic access to data has revolutionised secondary sourcing, for instance online services and CD-ROMs provide practically instant access to sophisticated information from across the world.

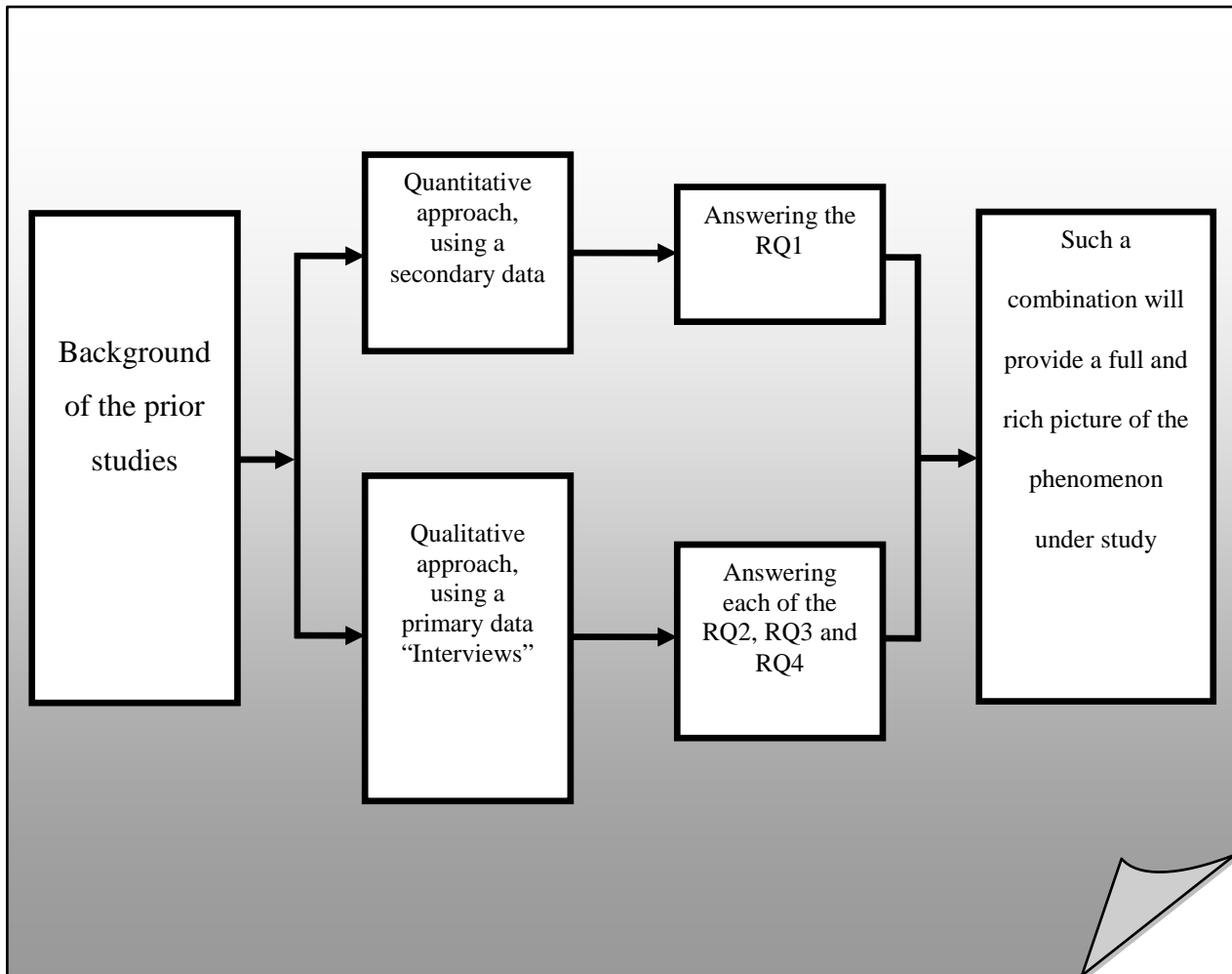
Many authors argue that the main advantages of using secondary data are the cost and time economies they offer the researcher (Creswell 1998; Leedy & Ormrod 2005). The collection of secondary data enables researchers to interpret primary data with more insight that might lead to other discoveries and provides a source of comparative data to check on the reliability of data gathered from primary research. In this regard, secondary data in this research enables the researcher to compare the existing theories and views on environmental quality and economic development and place these in relation to the content of the interviews. In addition, Bell (2006) states that secondary research assists the researcher in developing questions to be answered as part of a project. Through analysis of the acquired literature, the researcher was able to develop particular questions where clarification would be required and through which answers would be sought through primary research.

On the other hand, according to Collis and Hussey (2003), original and primary data can be obtained and collected through a variety of ways. These may include interviews, observations and questionnaires, conversation and discovery relative to a specific research study. Thus, collecting primary data in this research has relied totally on conducting interviews. In this regard, Ghauri and Gronhaug (2005) described interviews as an effective tool to gather opinions, attitudes and descriptions. Additionally, they generate real reaction and/or cause-and-effect relationships. In addition, they maintained that a significant advantage of primary data being collected is that it enables a focus on the specific requirements of the research. For example, for questions requiring particular responses (such as opinions and attitudes) or observed behaviours, questions should be answered by the chosen sample of people who are actually involved in the issue that the researcher is working on. For this research study, the chosen sample of people will reflect senior decision-makers (general managers) and directors of several departments such as environment, production, energy, sales and finance. In addition, experts and consultants who are working in the study field (oil and cement industries) have been involved.

This study has employed both quantitative and qualitative approaches in collecting and analysing data. Data has been collected from both primary and secondary sources. The latter, for instance, has included annual reports from Libyan oil and cement companies, Central Bank of Libya, National Oil Corporation, Ministries of Libyan oil and industry, as well as World Bank reports. This gathered data has been utilised to examine the hypothesis drawn. In addition, interviews have been conducted in order to examine the proposed proposition and to answer each of RQ2, RQ3 and RQ4. This helps to gain in-depth insights and understanding of the phenomenon that has been investigated.

The two methodological approaches (quantitative and qualitative) were utilised in this study (see Figure 4.1). Figure 4.1 illustrates the flow of the research methodology and the process of this study.

**Figure 4.1:** Illustration Flow of Research Methodology and Process.



#### **4.4.2 MEASURES**

The measurement procedures in this study have taken two phases as outlined below:

**Phase one:** a regression analysis has been conducted in order to test the proposed hypothesis.

As mentioned earlier, the hypothesis studies the relationship between environmental quality and economic development, which is based upon the EKC hypothesis (Akboştaoı, Türüt-Asık & Tunç, 2009; Annicchiarico, Bennato & Costa, 2009; Atici, 2009; De Bruyn, van den

Bergh & Opschoor, 1998; Grossman & Krueger, 1995; Koop, 1998; Panayotou, 1993; Selden & Song, 1994) that can be formulated as follows:

$$E = f(Y, Y^2, Y^3, Z) \dots \dots \dots (1)$$

Where  $E$  is the dependent variable which denotes one of the environmental indicators, that is CO<sub>2</sub> emissions,  $Y$  is the income (per capita GDP) and  $Z$  could be other explanatory variables (such as population density) that are known to influence environmental degradation. Most of the empirical tests of the EKC hypothesis use either panel or time-series estimation because of the belief that pollution–income relationship is a long-run phenomenon. The timeframe of the present research is confined to the period 1975–2009. Data for oil and cement production is relatively easier to collect. Therefore, the following model indicates the use of time series analyses for the estimated period of 1975–2009 in the case of Libya.

$$E_t = \alpha + \beta_1 Y_t + \beta_2 Y_t^2 + \beta_3 Y_t^3 + \beta_4 Z + \varepsilon_t \dots \dots \dots (2)$$

**Phase two:** qualitative method (conducting interviews) has undertaken in order to investigate the proposed proposition and to answer each of RQ2, RQ3 and RQ4, and also to gain in-depth understanding of the phenomenon that has been researched. The following sections will give detailed information on how qualitative approach works in this research.

## **4.5 DATA COLLECTION**

In social sciences there have been several methods that can be used to collect the required data. These methods mainly follow either: the inductive approach (qualitative or exploratory research), in which one would define the problem, collect data and develop a theory as a result of data analysis; or the deductive approach (quantitative data collection, secondary data), in which the researcher develops a theory and hypothesis (or hypotheses) and designs a research methodology to test the hypothesis.

The inductive approach to research tends to proceed from data to theory, while the deductive approach tends to proceed from theory to data. In other words, an inductive approach

involves moving from observation of the empirical world to the construction of explanations and theories about what has been observed (Gill & Johnson 1997). In contrast, a deductive approach entails the development of conceptual and theoretical structure prior to its testing through empirical observation.

Deciding on the right approach, whether it be quantitative or qualitative, is a complicated and hard task and it is not straightforward to say which one is the best in absolute terms as a general approach to conduct research (Kinnear & Taylor 1991). O'Leary (2004), for instance, comments that collecting credible data is tough task and it is worth remembering that one method of data collection is not essentially better than another. Therefore, deciding on which approach should be used would depend upon the research goals, advantages and disadvantages of each approach (O'Leary 2004). It would also depend on the research paradigm and its epistemological and methodological assumptions.

It is worth distinguishing between two words when discussing data collection methods: research method and research methodology. Research methods, tools and techniques are deemed to be the way that data can be collected (Collis & Hussey 2003; Silverman 2006). On the other hand, research methodology and research strategy are seen to be synonymous with reference to the overall research approach adopted (Collis & Hussey 2003; Remenyi et al. 1998; Saunders et al. 2007).

From what has been mentioned above, research data can be collected in different ways and from different sources. Data collection in this study has been divided into two categories: quantitative data collection and qualitative data collection. The next two sections provide more detailed information about how data has been collected in terms of both quantitative and qualitative data collection.

#### **4.5.1 QUANTITATIVE DATA COLLECTION**



In terms of data collection in quantitative method, the socioeconomic and environment data (GDP per capita, CO<sub>2</sub> emissions per tonne and the population density) presented for this study are drawn from the secondary data (quantitative data). This was obtained from: archival records of federal and state government; annual reports from the Central Bank of Libya, the World Bank (CD-ROMs and hard copies), the National Oil Corporation in Libya, and the General Information Authority in Libya; and annual reports (long-term movement in time series data) from both Ministries of Libyan oil and industry, in relation to CO<sub>2</sub> emissions per capita GDP.

Data was also acquired from oil and cement industry records, the Organization of Petroleum Exporting Countries (OPEC) and Arab Oil Petroleum Exporter's Countries, as well as the Ministry of Planning in Libya. Furthermore, to make certain that there is no shortfall in the collection of required data, the researcher has utilised books, journals, documentation and information corporation, information from statistical publications, various research institutes, and international organisations—such as the Organisation for Economic Co-operation and Development (OECD) and the International Monetary Fund (IMF). Archives, the documentation, the published and unpublished writings of previous researchers in the oil and cement industries. However, when actual figures were not available, estimates were derived from the available raw data.

As a result of collecting data from the above sources, several comparisons were undertaken in order to make certain that all data has standardised and categorised in the same criteria.

#### **4.5.2 QUALITATIVE DATA COLLECTION**

Qualitative data collection strategy in this study comprises planning and designing the interviews and other supportive techniques. These included: written documents; descriptions; formal and informal interviews; meetings; and a broad range of written materials, reports and photographs. Hence, this strengthens the validity of the data and helps in overcoming

problems of bias (Kane 1995). An important objective in qualitative social research is to gather the most meaningful data possible. This involves collecting a wide and diverse range of data over a relatively lengthy period of time. The most useful qualitative data collection technique in this study is the use of interviews, which will be discussed in the next section.

Interviewing is an extensively used technique for the collection of data in sociology (Burgess 1984). As such, the most suitable qualitative method in studying perception of participants under ethnography would be by means of personal interviews, a conversational skill of asking questions and listening to the answers to bring forth the perceptions and attitudes of participants (Morse 1994). Interviews offer ethnographers a fantastic chance to learn about different points of view and to acquire a personal understanding of the interviewee's social world. Personal interviews allow both the interviewer and the interviewee to instantly clarify any misunderstandings, misconceptions or confusion that may exist, thus enabling the former to ensure that all required data is collected accordingly.

It is worth mentioning that this study has employed interviews to gather a great deal of information about the phenomenon of the research topic. The qualitative data collection in this study has taken a semi-structured interview approach with open-ended questions. The semi-structured interviews provide a unique opportunity for the interviewer to uncover rich and complex information from the interviewee. In addition, it provides opportunity for the interviewees to speak frankly about what they believe. Also, it provides and fosters flexibility, thus enhancing the reliability of the study (Bryman 2001). Furthermore, it will allow the researcher to use supplementary questions to explore and clarify specific issues about the research problem (Cavana et al. 2001). More detailed information regarding the interviews will be provided in the following section.

#### **4.5.2.1 INTERVIEWS**

The interview is one of the key methods widely used in information gathering. This tool is most appropriate when exploratory work is required (Cavana et al. 2001). It involves a process of interviewing respondents to acquire data on the issues of interest to the researcher. Interviews can yield rich sources of data on people's experiences, opinions, aspirations and feelings. In order to achieve this end, May (2001) argued that researchers need to understand the dynamics of the interview and sharpen their own use and understanding of the different methods of interviewing, together with an awareness of their strengths and limitations.

According to Peattie (1983, p. 233):

‘The easiest way to understand how an industry works – the market in which it operates, the kinds of people who are active in it, the interconnections between firms, the difficulties of its operation, its connection to the political process – is through qualitative interviewing’.

Many researchers argue that interviews are valuable methods for collecting data from the real world (Cavana et al. 2001; Creswell 1998; Leedy & Ormrod 2005; Silverman & Seale 2005). In addition, they argue that interview in qualitative research is concerned with individuals' own accounts of their attitudes, motivations and behaviours. It also offers richly descriptive reports on individuals' perceptions, attitudes, beliefs, views and feelings. Creswell (1998) sees an interview as an attempt to extract information, opinions, or beliefs from a person. Interviews can be conducted by two main methods: individuals (face-to-face) and/or in group discussions. In this study, individual (face-to-face) interviews were employed.

Byrne (2004, p. 182) for instance, emphasised the significant role of interviews when he stated that:

‘Qualitative interviews are particularly useful as a research method for accessing individuals' attitudes and values – things that cannot necessarily be observed or accommodated in a formal questionnaire. Open-ended and flexible questions are likely to get a more considered response than closed questions and therefore provide better access to interviewees' views, interpretation of events, understandings, experiences and opinions... qualitative interviewing is

that, when done well, it is able to achieve a level of depth and complexity that is not available to other, particularly survey-based approaches’.

In this regard, there are several advantages of using the interview approach. One advantage is that interviews are flexible; the interviewer can adapt the situation to each subject. Another advantage is the interview may also result in more accurate and honest responses since the interviewer can explain and clarify both the purpose of the research and individual questions. A third advantage is that the interviewer can follow up on incomplete or unclear responses by asking additional probing questions (Peattie 1983; Silverman & Seale 2005).

A fourth advantage is that the interviews methods to be used depend on the nature of questions. Where the questions are large in number, a number of complex or open-ended and where the order and logic of questioning may need to be varied. The fifth advantage is that participants are more likely to agree to be interviewed, rather than complete a questionnaire, especially where the interview topic is seen to be interesting and relevant to their current work. An interview provides them with an opportunity to reflect on events without needing to write anything down. This situation also provides an opportunity for interviewees to receive feedback and personal assurance about the way in which information will be used. Therefore, the use of personal interview, where appropriate, may achieve a higher response rate than using questionnaires (Burns 2000; Gillham 2005; Miller & Brewer 2003).

The sixth advantage is that the time needed to obtain the required data may mean that an interview is, in any case, the best or only alternative—apart from the difficulty of trying to design a viable questionnaire schedule to cope with questions that are complex, open-ended, or large in numbers (Silverman 2006).

A further advantage is depth of information. Interviews are good for producing data which deals with topics in depth, or in detail. Subjects can be probed, issues pursued and lines of investigation followed over a relatively lengthy period. The researcher is likely to gain valuable insights based on the depth of the information gathered and the wisdom of “the key

informant”. Also, in terms of equipment, interviews require only simple equipment and build on conversation skills, which researchers already have. In addition, an interview is a good method for producing data based on informants’ priorities, opinions and ideas. Informants have the opportunity to expand their ideas, explain their views and identify what they regard as the crucial factors.

As a method for data collection, interviews are probably the most flexible. Adjustment to the lines of enquiry can be made during the interview itself. Interviewing allows for a developing line of enquiry. Moreover, in terms of validity, direct contact at the point of the interview means that data can be checked for accuracy and reliance as it is collected. Furthermore, and as it has mentioned above, interviews have a high response rate. Interviews are generally prearranged and scheduled for a convenient time and location. Therefore, this ensures a relatively high response rate.

Finally, interviews can be a rewarding and therapeutic experience for an informant, compared with questionnaires, observation and experiments. There is a more personal element to the method, and people tend to enjoy the rather rare chance to talk about their ideas at length to a person whose purpose is to listen and note the ideas without being critical (Martyn 2003).

Interviews can be classified into three main types: unstructured, semi-structured and structured interviews. Formats of interviews vary, from the highly-structured type, where questions are presented and asked in a fixed form and sequence, to the open or non-directed interview (Saunders et al. 2007). These approaches are discussed below.

Unstructured interviews are a form of interview that use open-ended, or open, questions so that the researcher can see in what direction the interviewees take things in their response (Naoum 2007). Stewart and Cash (2006) suggest that an unstructured interview is most appropriate when the information area is extremely broad. This means that an unstructured interview gives the interviewer unlimited freedom to probe into answers and to adapt to

different interviewees and situations. However, unstructured interviews require considerable interviewer skill and are difficult to replicate from one interview to another. The highly-scheduled, structured interview is the most thoroughly planned and structured. All questions and answer options are stated identically to each interviewee, who then picks answers from those provided. There is no straying from the schedule by either party. Highly-scheduled, structured interviews are the easiest to conduct, record, tabulate and replicate, however, respondents have no chance to explain, amplify, qualify, or question answer options (Stewart & Cash 2006).

A semi-structured interview is more formal than an unstructured interview, in that there are a number of specific topics around which to build the interview (Naoum, 1999). Semi-structured interviews start by asking indirect questions in order to build up a rapport with the respondent and then explore the specific issues that the interviewer has in mind. In addition, in the semi-structured interview, the interviewer has a great deal of freedom to probe various areas and to raise specific queries during the course of the interview. Semi-structured interviews, or focused interviews, as Merton and Kendal (1946) named them, have four distinguishing characteristics:

- 1) They take place with respondents known to have been involved in a particular experience.
- 2) They refer to situations that have been analysed prior to the interview.
- 3) They proceed on the basis of an interview guide specifying topics related to the research hypothesis.
- 4) They are focused on the respondents' experience regarding the situations under study.

In this research, a semi-structured interview approach that consisted of both structured and unstructured techniques was employed. Interviews were conducted on a one-on-one basis with a single participant. Such interviews are most commonly conducted between researcher

and participant face-to-face. Interviews were conducted to gather valid and reliable data that is relevant to the research questions and objectives.

An interview guide to be used during the interviews was developed. An interview guide should be clearly defined, because it allows the researcher to make certain that the key topics are explored with the respondents (Taylor & Bogdan 1998). The interview guide is a list of themes and questions to be covered with each respondent or informant, although this may vary from interview to interview. Thus, the researcher may omit some questions in a particular interview given the specific organisational context, which is encountered in relation to the research topic. In this regard, Robson (2002, p. 90) summarised the process as:

‘The interviewer has worked out in advance the main areas he/she wishes to cover, but is free to vary the exact wording of questions as well as their ordering. So, if an interviewee starts to cover a new area in response to a question, then the interviewer keeps the flow going by asking relevant questions from his/her list of topics. Any missing topics are returned to at the end of the interview’.

Therefore, in the interview guide the researcher decides how to phrase questions and when to ask them, which reminds the interviewer what to and how to ask questions.

Based on some prior studies, the researcher prepared two drafts of the interview checklist. The first interview checklist was written in English language. The second draft of the interview checklist was written in Arabic language. The researcher prepared thirty questions on the emissions trading policy, GHG emissions and CO<sub>2</sub> emissions in particular, emissions reduction policies and sustainable development. These questions were presented to all interviewees, and were also developed as a base to answering each of the RQ2, RQ3 and RQ4. However, because of the different backgrounds of the interviewees, follow-up questions were focused on the specific contexts of individual interviewees. For example, during the interview with the general managers of both oil and cement companies, the researcher focused more on the potential adoption of emissions trading policy and its contribution towards sustainable development rather than paying attention to specific matters

that are totally related to other functional departments—such as production, environment, finance and sales—which are not the general managers' responsibilities. However, interviewees were encouraged to add their opinions on other issues that were not related to their core responsibilities.

The estimated time during the interview sessions took, on an average, one hour. During these sessions the researcher took notes and digitally recorded the conversation. However, digital recording was not used for people who preferred not to have the interviews tape-recorded, as this could reduce the quality of data. Therefore, at the commencement of each interview, interviewees were asked if they would allow the interview to be recorded in order to ensure that each interviewee would be relaxed about the use of the tape recorder, in turn ensuring the accuracy of the answers.

#### **4.5.2.2 INTERVIEW RECORDING AND TRANSCRIPTION**

Note-taking increases the interviewer's attention to what is being said. Taking notes reduces concerns the interviewer may have about any technical problems with recording equipment at a critical moment (Stewart & Cash 2006). However, note-taking has some disadvantages. The interviewer can rarely take notes fast enough to record exactly what was said, there also can be difficulties concentrating on questions and answers. Note-taking may hamper the flow of information because interviewees may become fearful or curious about what the interviewer is writing (Saunders et al. 2007). Such problems did not occur during this research because the researcher paid more attention to the interviewees' comments and relied more on the tape recording.

Additionally, the recording of interviews provides a permanent record and also allows the interviewer to concentrate on the interview. This enables the interviewer and interviewee to relax and focus on what is being said and implied. Furthermore, a tape recorder may pick up answers that were inaudible at the time (Robson 2002; Stewart & Cash 2006). However,



tapes provide permanent, undeniable records that threaten many people with unknown future consequences. It also takes a great deal of time to review a lengthy tape to locate facts, reactions and ideal quotes, while it may take only seconds to locate the same material in written notes (Stewart & Cash 2006).

The researcher used a combination of tape recording and note-taking to maximise the validity of data collection and minimise the weakness of both methods. A digital audio recorder was used through all interviews and note-taking was used to collect observable and non-verbal information. The interviewer experienced none of the problems mentioned above because the researcher checked the tape recorder before each interview and a mobile phone with a recording facility was used along with the tape recorder.

#### **4.5.2.3 INTERVIEW SAMPLE**

In terms of the sample size, the target population of this study has included both Libyan and multinational companies operating in the oil sector. The number of these companies is approximately 25 which have more than one thousand employees each. In addition there are limited numbers of cement companies operating in Libya. There are three companies having nine cement plants located in different parts of the country. Therefore, in terms of the choice of the sample, this study has included all cement companies and randomly nominated five companies from the oil sector in Libya. These companies have in details classified and described in the next section.

As mentioned above, the target population consisted of both Libyan and foreign companies operating in the oil sector as well as Libyan companies operating in the cement sector. These companies in total account for around 28 companies. In this regard, and in terms of the sample units, the researcher chose respondents who are in direct contact with the policy making, policy implementing and environmental protection functions. Therefore, the interviews included senior decision-makers (general managers) and managers of several

functional departments such as environment, production, energy, sales and finance. Also, experts and consultants working for the companies were involved in the interviews.

It is worth mentioning that a sample of Libyan general managers (decision-makers) and managers of several functional departments, as well as experts and consultants with different work experience, acted as representatives of the Libyan organisational context. The number of the sample is relatively high (37 interviewees) and this considered as one of the strengths of this study. A major advantage to be obtained from this sample is that the participants are key decision-makers from different fields in the selected companies in order to respond to the objective of this research. Table 4.2 demonstrates the sample of the interviewed companies and the percentage of the respondents.

**Table 4.2:** The sample of the interviewed companies and the percentage of the respondents

Type of Industry	Number of Companies	Number of Respondents	The Percentage of the Respondents
Oil Companies	5	22	59.5 %
Cement Companies	3	15	40.5 %
Total	8	37	100 %

The key decision-makers for the organisational context in Libya were identified. The researcher reviewed the literature of emissions trading policy and sustainable development in order to be able to make such identifications. By reviewing literature, the researcher was able to identify a number of drivers and barriers for the adoption of such emissions reduction policy. Therefore, the researcher approached the responsible authority for each issue and requested permission for the interview.

Interviews were held in person rather than by telephone, allowing more flexibility for the interviewer and interviewees, as well as better observation of the body language for certain expressions and attitudes. The interview questions were open-ended, with some yes/no

questions, to allow the opportunity to explore and obtain more detail as well as allow freedom and spontaneity in the answers. Moreover, open-ended questions have a much less biased influence on response than closed questions (Denscombe 2003). Interviewees were given a brief outline and explanation of the research and its purpose. In this way interviewees sensed their importance for the purposes of the study, which helped to achieve more interaction. Interviewees gave informed consent. Permission was obtained for using tape-recording devices before the interviews took place. The length of interviews varied according to availability and content, but as mentioned before they were of no more than hour duration. All interviewees were assured of anonymity and the confidentiality of data gathered.

#### **4.5.2.4 DESCRIPTION OF COMPANIES' PROFILE**

As previously mentioned that, both of Libyan oil and cement sectors were involved in this research. Therefore, the choice of the sample in this study has included all cement companies operating in the cement sector and randomly selected five oil companies operating in the oil sector.

##### **4.5.2.4.1 THE SAMPLE OF LIBYAN CEMENT COMPANIES**

There are limited numbers of cement companies operating in Libya. The sample of this sector has included all companies, which consists of three companies coupled with approximately nine plants located in different parts of the country. These companies are as follows:

- 1- Al-Ahlia Cement Company.
- 2- The Libyan Cement Company.
- 3- Arab Union Contracting Company.

##### **First: Al-Ahlia Cement Company:**

The company was founded in 1965, under the name Cement Company and National Building Materials, and began the establishment of El-Mergeb Cement Factory, which commenced

production in 1969 with production capacity reaching 330,000 tons<sup>45</sup>. In 1988, the Arab Cement Company was founded under the resolution of General People's Committee No. (77)<sup>46</sup>. This company has four cement plants, which are called El-Mergeb Factory, Souk El-Khamis Factory, Lebda Factory and Zliten Factory. Also, it has another three plants—Bags Paper Factory, Gypsum Soft Factory and Concrete Mixer Factory.

On 08 march 2005, the GP Committee has issued the resolution No. (45), for increasing the capital of Arab Cement Company to 600 million Libyan dinars. Based on this decision and the implementation of the expansion program of the property base, the ownership of this company has been transferred and changed its name to Al-Ahlia Cement Company. It had an annual production capacity of 1.5 million tons per year for the period from 1977 until 1980. This capacity then increased to approximately 2 million tons per year until 1999. The period from 2000–2008 witnessed a significant rise in production capacity, which grew from 2.10 million tons to around 2.5 million tons of cement production<sup>47</sup>.

**Second: Libyan Cement Company:**

The Libyan Cement Company (LCC) started production in 1972 with one factory named Benghazi Plant. The production capacity for ordinary Portland cement was 200,000 ton per year. In 1974, a new production line was established with a production capacity of 400,000 ton per year. A third production line was built in 1977 with a 400,000 ton capacity, which brought the total production capacity of ordinary Portland cement to 1 million ton per a year. However, the factory had stopped its production due to maintenance problems. Therefore, the production capacity of this factory became 800,000 ton per year. The LCC currently has three cement plants, producing around 2.8 million ton per year, and a fourth plant producing cement packaging.

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<sup>45</sup> See Al-Ahlia Cement Company, the company profile (<http://www.ahliacement.ly>).

<sup>46</sup> See the General People's Committee (<http://www.gpc.gov.ly>).

<sup>47</sup> See Al-Ahlia Cement Company, the annual production, company profile (<http://www.ahliacement.ly>).

One of the three plants named Al-Hawari, was established in 1978. Its production capacity is around 1million ton per a year. In 1987, adjustments were made to the Al-Hawari plant production lines to produce sulphate-resistant cement, which is suitable for construction of the GMRP. Another factory is called El-Fatayah, was established in 1982, with two production lines having a 1 million ton per a year capacity of ordinary Portland cement. LCC also has a plant, founded in 1975, that produces cement packaging. The factory currently produces approximately 200,000 bags per day.

In 2001, the Libyan Government proposed a number of state company projects for which joint ventures would be considered. By that time LCC had become the Joint Libyan Cement Company Incorporated (JLCCI)<sup>48</sup>. The company has undergone major internal changes with restructuring of the existing management. It has also started a huge investment program to repair, modernise and upgrade the cement plants in Benghazi, Al-Hawari and El-Fatayah in order to meet market demand and to have fair cement prices for the private consumer in the long term. The implementation of the comprehensive modernisation program started on 2 September 2008.

Since taking over the company, one of the main concerns of JLCCI management has been to improve the environmental standards and at the same time increase the quantity and the quality of the production. In this regard, therefore, plans were devised to implement environmentally friendly systems that would help maintain low dust emission at a level of 10mg/m<sup>3</sup> by replacing and constructing a new filter system in each plant. The new filter systems are being implemented as a new standard in Libya—which will be observed across the European Union by 2011<sup>49</sup> —significantly reducing the environmental impact and increasing the production quality of JLCCI products.

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<sup>48</sup> See the General People's Committee (<http://www.gpc.gov.ly>).

<sup>49</sup> Libyan Cement Company Incorporated, company profile (<http://www.lcc.ly>).

**Third: Arab Union Contracting Company:**

Arab Union Contracting Company (AUCC) is one of the most prominent and reputable incorporated companies of the Arab World. It was incorporated under the law No. (6) for the year of 1974, issued by the Presidential Council of Arabic Republics Union. Under this law, the company enjoys the nationality of Libya with body corporate personality. Since the incorporation of the company, it has executed several crucial contracting, property investment and building materials industry projects. The total value of this activity in Libya exceeds US\$1 billion, comprising residential units, hospitals, banks, educational buildings, roads and sewage and rain drainage and treatment networks.

Due to the great importance of cement manufacturing in the production of concrete and building materials necessary for architectural development in the country, as well as the urban and economic development and increasing market demand for this material and its rising prices, AUCC has decided to build a cement plant. Approval has already been obtained from the General People's Committee in this respect to sign a contract with a major firm to achieve and implement this project.

In the field of strategic industries, the company set up an ambitious plan to participate in the cement industry over several stages. Stage one was to complete line one of Al-Borj Cement Plant on 1 November 2005, and stage two was to implement line two of the same plant on 1 June 2009. The estimated production capacity of line one of Al-Borj Cement Plant is approximately 1.4 million tons per a year<sup>50</sup>, whereas the line two of this plant is around 1.435 million tons per a year. The total production capacity has reached 2.835 million tons of cement yearly, which represents one-third of the production of the rest of the plants now operating in Libya.

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<sup>50</sup> See The Report Libya 2010, (<http://www.oxfordbusinessgroup.com>).

Table 4.3 indicates that Libya owns several cement production plants in addition to the company-owned Al-Borj Cement Plant, which is now in the production phase. The total design capacity of these plants is approximately 7.5 million tons per year of sulphur resistant cement production, used by the GMRP and in special uses the existing design capacity of ordinary Portland cement is 5.1 million tons per year.

**Table 4.3:** The major plants and their design capacity in Libya

<b>Plant's Name</b>	<b>Annual Design Capacity (million tons)</b>
Zliten Cement Plant	1
Lebda Cement Plant	1
Souk El-Khamis Cement Plant	1
El-Mergeb Cement Plant	0.3
Al-Hawari Cement Plant	1
Benghazi Cement Plant	0.8
El-Fatayah Cement Plant	1
Al-Borj Cement Plant, Line one	1.4
Al-Borj Cement Plant, Line two	1.5

Source: Compiled from the booklets of all Libyan cement companies, (2009)

#### **4.5.2.4.2 THE SAMPLE OF LIBYAN OIL COMPANIES**

The number of both Libyan and multinational companies operating in oil industry is approximately 25. In terms of the sample size, this study has randomly selected five oil companies. These companies are as follows:

- 1- Waha Oil Company.
- 2- Al-Zawia Oil Refining Company.
- 3- Zueitina Oil Company.
- 4- Akakus Oil Operations.
- 5- Mellitah Oil and Gas B.V Company.

**First: Walah Oil Company:**

Waha Oil Company (WOC) is one of the major Libyan national operating companies in the hydrocarbon sector. It was originally incorporated in 1955, when the Oasis Oil Company (OOC) was formed to combine the interests of three US companies. WOC is owned by National Oil Corporation (NOC) in a joint venture with three American companies, namely ConocoPhillips, Marathon and Amerada Hess<sup>51</sup>. These companies are now back working as partners since January 2006, after having left in 1986 when it was known as OOC.

In line with the Libyan Petroleum Law No.25<sup>52</sup>, WOC had the right to explore for, lift and sell oil. The company's first commercial discovery was in July 1958, and the first oil shipment was exported from El-Sidra on 22 May 1962. WOC currently has 13 developed oilfields, with the major fields being Waha, Gialo, Dahra and Samah, as well as one terminal at El-Sidra which consists of 27 stations for oil processing and another ten stations for natural gas processing, together with four stations for power generation. The company concessions and blocks are all located in heart of the Sirte Basin, the most prolific area in the country, with considerable geological potential.

WOC started its operation on Libyan soil in 1956 and succeeded in discovering oil in commercial quantities in the area north of Bahi oilfield. Thereafter, the company maintained the impetus of its successful activities and in 1960 the Waha and Defa oilfields were discovered, followed in 1961 by the Gialo and Samah oilfields. In 1962, the company further discovered the Zaggut, Belhedan, Khalifa, Balat, Masrab, Harsha and Al-Faregh oilfields.

Presently, the company operates a number of major oil and gas producing fields and is active in both developing existing fields and in the exploration for new ones. The company's major fields now are Waha, Gialo, Dahra, Samah and Al-Faregh, in addition to El-Sidra oil terminal. During the period of 1962–2004, the average daily production of this company was

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<sup>51</sup> Waha Oil Company, see the company profile [www.http://www.wahaoil.net](http://www.wahaoil.net) .

<sup>52</sup> Libyan petroleum regulation, National Oil Corporation-Libya. (See <http://en.noclibya.com.ly> ).



approximately 493,000 barrels per day (b/d), and the current production capacity runs between 454,000 b/d and 460,000 b/d. From its inception up to 2004, the company has drilled 1,100 oil and gas wells, of which around 73 per cent are producers. Production capacity over the next 27 years is estimated to reach over 600,000 b/d<sup>53</sup>.

In terms of the future development, the company has several exploration and development projects in pipeline aimed at both increasing production and reserves. One key company objective is the reactivation of Dahra/Jofra PL-5 through a major water flooding engineering plan. Others are the development of new fields, namely the Nort Gialo 6J Area, the NC98 'A/F' structure, the Gialo 3V area, and a major drilling program scheduled over the next 28 years<sup>54</sup>. The plan also includes surface facilities upgrade and produced associated water disposal projects. The total production forecast as a result of the implementation of these development plans is expected to be 5.3 billion barrels (bbl) of oil and 5.8 trillion cubic feet of gas.

#### **Second: Al-Zawia Oil Refining Company:**

Al-Zawia Oil Refining Company was the earliest refinery built in Libya, coming on stream in 1974, at around the same time that Libyan National Oil Company was established. It became a fully owned subsidiary of NOC on 16 September 1976<sup>55</sup>. The refinery commenced with a capacity of 60,000 b/d, producing two types of gasoline, in addition to jet fuel, diesel oil, heavy fuel oil, kerosene and liquefied petroleum gas (LPG)<sup>56</sup>. Afterwards, this capacity was doubled to 120,000 b/d, when a new process was commissioned on the 9 June 1977 where crude oil was received through pipelines passing through Hawdh Murzug and El-Hamada, as well as from tankers owned and operated by the National Company for Marine Transportation.

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<sup>53</sup> Waha Oil Company, see the company profile <http://www.wahaoil.net> .

<sup>54</sup> See the future development of the company, <http://www.wahaoil.net> .

<sup>55</sup> The National Oil Corporation in Libya, see our companies, <http://www.noclibya.com.ly> .

<sup>56</sup> Al-Zawia Oil Refining Company, see the company profile <http://www.arc.com.ly> .

The impetus of future projects targets the enhancement of the refinery's production capacity in order to increase revenue by matching supply with demand, particularly in a domestic context. Additionally it is aimed at quality enhancement, enabling Al-Zawia's refined products to meet global quality and environmental specifications (Otman 2007a). It is also targeted at treatment of gas wastes and oil residues to increase environmental protection. To complement these projects, it is intended to expand port facilities to meet future import/export objectives.

Refinery development scenarios are envisaged by NOC as being implemented in two phases<sup>57</sup>. Phase one is aimed at modifying existing units to increase refining output. To achieve this, several major objectives are targeted<sup>58</sup>. One is the expansion of refining capacity and a significant increase in gasoline production. Combined with this is the modernisation of the control and measurement systems, the enhancement of diesel specifications, and the treatment of oil residues to protect the environment. All of these measurements will contribute to the economic growth and viability of Al-Zawia refinery. As for the second development phase, this is still under consideration due to capital constraints. Its aims at cracking and transforming heavy oil into very marketable white products, and also at increasing gasoline production while optimising the financial performance of the refinery to achieve an acceptable level of profits.

### **Third: Zueitina Oil Company:**

Occidental Petroleum (Oxy) started its operations in Libya under the terms laid down in Libyan Petroleum Law No. 25<sup>59</sup> through Concessions Nos. 102 and 103 that were signed on 29 April 1966. In October 1971, Oxy signed a Joint Venture Agreement with the Libyan Government for the development of the Nafora-Ajula fields. On 11 August 1973, due to the nationalisation process, 51 per cent of Oxy was taken over by NOC. However, despite the

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<sup>57</sup> See the National Oil Corporation, companies' profile, <http://en.noclibya.com.ly>.

<sup>58</sup> See the future development of the company, <http://www.arc.com.ly>.

<sup>59</sup> National Oil Corporation, the Libyan Petroleum Laws (see <http://en.noclibya.com.ly>).

nationalisation of a majority share of its assets, Oxy signed up for several new exploration blocks under EPSA-I<sup>60</sup> on 18 October 1974, in a 48,684km<sup>2</sup> block in the Sirte Basin, with a duration of 35 years. These deals gave NOC 81 per cent and Oxy production 19 per cent.

Due to an American Presidential order, Oxy has left Libya. In compliance with the regulations of the General People's Committee Decision No. 351/1986, dated 24 June 1986, Zueitina Oil Company (ZOC) was incorporated on 1 July 1986 as a 100 per cent Libyan-owned company with a mandate to carry out the whole range of oil operations of Oxy on behalf of NOC. Table 4.4 highlights of these developments.

The company has several productive oilfields. One of the key fields in ZOC is Intisar Oilfield. This field includes a number of other small fields—103A, 103D, the EPSA oilfields, Zella, Fidaa, Hakim, 29B and 29C. It was found in 1967 as a giant in a roughly circular structure about 5km wide and 1,262 ft thick, in an easterly trend in the Sirte Basin, between Sarir in the south and Amal in the north. Intisar A, found in 1967 at 9,750 ft, has 45° API61 oil. Intisar B, found in 1974 at 9,600 ft, produces 50° ABI oil. Intisar C, found in 1967 at 9,650 ft, produces 37.5° ABI oil. the test well in Intisar D, discovered in 1967 at 9,400 ft with 39° ABI oil, had a record output from a single well at 74,867 b/d in the early 1970s. Intisar E was found in 1968 at 5,300–7,100 ft, it produces 39.7° ABI oil. There are a total of 65 wells in Intisar group, of which 38 are currently producing.

Presently, the permitted production quota of the company is 60,000 b/d plus about 9,000 b/d of the company's quota in the Nafora-Ajula Plant<sup>62</sup>. ZOC also produces approximately 3,000 b/d of condensate (shared by ZOC, Agip and Wintershall companies). The company's crude oil, being the best Libyan crude, is exported through the Zueitina Oil Terminal together with

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<sup>60</sup> EPSA is Exploration and Production Sharing Agreements, signed by the National Oil Corporation and other oil exploration companies.

<sup>61</sup> API gravity is a measure of the density of petroleum. In the oil industry, quantities of crude oil are often measured in metric tons. One can calculate the approximate number of barrels per metric ton for a given crude oil based on its API gravity. (See the American Petroleum Institute, <http://www.api.org>).

<sup>62</sup> Zueitina Oil Company, see the company profile <http://www.zueitina.com.ly>.

the crude of other companies such as Agip, Wintershall and MOV Austrian company. ZOC is handling up to 20 per cent of the company's crude oil exported via Zueitina Oil Terminal. The company also supplies the local market with all its needs of liquified gas (cooking gas) through Brega Oil Company. Certain quantities of this gas are also exported outside the country. In early 2005, the number of personnel working in the company reached 2,342, of whom 2,065 were nationals.

In terms of its future developments, ZOC's production profile for the next five years is based on several factors, such as drilling four vertical wells for injecting water in field 103E, and drilling another four wells in Sabah field. These should enhance production projected for the years 2009-2013.<sup>63</sup>

**Table 4.4:** ZOC, Historical development

Year	Ownership	Operator	The event
1968	Occidental Petroleum-Libya 100%.	Occidental Petroleum-Libya.	Production started from the fields of Sharing Contract 103.
1973	NOC 51%. Occidental 49%.	Occidental Petroleum-Libya.	Occidental was nationalized.
1976	Sharing 19%-81%.	Occidental Petroleum-Libya.	Production started from field 29C- one of the first sharing agreement fields.
1985	Joint venture NOC 51%; Occidental 36.75%; OMV 12.25%.	Occidental Petroleum-Libya.	The selling of 25% from Occidental share.
1986	Joint ventures NOC 81%; Occidental 14.25%; MOV 4.75%.	Zueitina Oil Company.	Freezing the activities of occidental and establishing ZOC.
2008	Operational budget NOC 88%, Partners 12%. Capital budget NOC 50%, Partners 50%.	Zueitina Oil Company.	Signing ESPA Agreement.

Source: Adapted from (Otman 2007b).

<sup>63</sup> See the future development of ZOC <http://www.zueitina.com.ly> .

**Fourth: Akakus Oil Operations:**

Akakus Oil Operations (AOO) is one of the largest oil companies operating in Libya and has pioneered, explored and eventually developed two major blocks in the Murzuq Basin, in the south-western area of the Libyan Desert, adjacent to the famous Akakus Mountain strip and the old city of Ubari. The company was established by virtue of an exploration and production sharing agreement (EPSA) between the NOC and the European Companies Union (REPSOL, MOV and TOTAL), which was approved by the GP Committee's resolution No.802/1423, issued on 6 December 1994<sup>64</sup>. Accordingly, resolution No. 228/1424 was issued by the secretary of the General People's Committee for the Economy, Industry and Trade on 11 April 1995, Industry and Trade on the 11<sup>th</sup> of April 1995<sup>65</sup> which dictates entrusting it with operations and management on behalf of the EPSA parties, being NOC as a first party and the European Companies Union (REPSOL, OMV and TOTAL).

The company's field of activities is limited to the exploration and oil production of the National Concessions (NC-115 and NC-186), including any other unforeseen new developments for the benefits of both parties<sup>66</sup>.

This company's main oilfield is called El-Shararah (NC-115). The development of this field commenced in 1995, with agreed development expenditure of US \$1 billion divided between the NOC and the Repsol consortium. The field was originally put on stream in December 1995 from the A structure, with a capacity of around 55,000 b/d. The B structure started in 1998 and produced some 40,000 b/d, while the H structure was brought in September 1999 yielding approximately 65,000 b/d. Later, water injection facilities were installed which boosted production to 200,000 b/d, this level was maintained for several years. Block NC-186 has proven to be the second most productive block operated by the AOO in the Murzuq Basin. The field output in 2005 averaged 42,436 b/d.

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<sup>64</sup> See the General People's Committee, resolutions <http://www.gpc.gov.ly>.

<sup>65</sup> See the General People's Committee for the Economy, Industry and Trade <http://www.ect.gov.ly>.

<sup>66</sup> Akakus Oil Operation, see the company profile <http://www.akakusoil.com>.

In terms of the company reserves, El-Shararah oilfield reserves can be broken into several parts. The first block, NC-115, holds proven reserves of 782.9 million barrels of oil (mm bbl), probable of 220.2 mm bbl, and possible of 210.51 mm bbl. Taking into consideration the company's accumulate production from 1 December 1997 to 19 October 2005 of 430.286 mm bbl, this puts the remaining combined proven, probable, and possible reserves at 783.324 mm bbl.

In terms of its future developments<sup>67</sup>, AOO has put in place a plan for the next five years for the development of its producing properties. In NC-115, drilling of nine producing and six water injection wells will be undertaken, while in block NC-186, 14 development wells will be drilled, together with five water injection and one water supply wells. This is in line with the company plan for developing recent discoveries in block NC-186 and block NC-115 should the evaluation process prove the discoveries to be commercial.

**Fifth: Mellitah Oil and Gas B.V Company:**

Mellitah Oil and Gas B.V Company (MOGC) was previously called Agip Company (Otman, 2007), the upstream operating subsidiary of the Italian company Eni, and is one of the leading oil producers in Libya. It holds interests in 12 tracts that include seven producing oilfields and seven undeveloped fields. Its first major success was the discovery of the offshore Bouri field (located 140km north of Tripoli in block NC-41B), a 37,700km<sup>2</sup> tract in the Libyan sector of the Gulf of Gabes, which lies under 170 meters of water and covers an area of about 32km by 5km<sup>68</sup>.

This company has five oilfields, namely: Bouri, Bu Attifel, Wafa, Bahr Essalam and Elephant. The most important field is Bouri; it was discovered in 1976 by Eni and contains 5 bbl of 26° API Oil-In-Place, of which 670 mm bbl are considered to be recoverable, as well as over 2,500 billion cubic feet of natural gas. This field is operated by MOGC, a 50 per cent

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<sup>67</sup> See the future development of AOO <http://www.akakusoil.com>.

<sup>68</sup> Mellitah Oil and Gas B.V Company, see the company profile <http://www.mellitahog.ly>.

joint venture between NOC. The company started working on this field in 1983 on a US \$2 billion development program and brought the field into production in August 1988. The output of this field was running at 20,000 b/d by the end of that year and was up to 60,000 b/d a year later<sup>69</sup>.

The second phase of the field's development entailed the drilling of 55 more wells from three additional wellhead platforms. This boosted the production to 150,000 b/d in the early 1990s, but because the field's recovery rate is limited by a high gas/oil ratio, output fell back to 100,000 b/d between then and the end of 1998. Moreover, Bouri remains the leading offshore oilfield in production in Libya and is the largest known structure in the Mediterranean.

MOGC ranks as the biggest oil company in Libya, producing 600,000 equivalent oil barrels per a day. It has several products such as Crude Oil, Natural Gas, Condensed Gas Propane, Butane and Nafta, in addition to a daily production of 450 tons of Sulphur.

The company manages several onshore fields spread across the country. It also manages offshore fields, which consist of three platforms and a floating tank. Moreover, it manages a network of onshore pipelines of various sizes that extend for thousands of kilometres. The company is exporting part of the processed natural gas from Mellitah Industrial Complex through an offshore pipeline of 32 inches/516 km connecting Milletah Industrial Complex to the Southern Coast of Italy, and managed by Green Stream. This offshore export Line is considered to be the first link between Libya and Europe. Five years later the authorities approved this project which is costing over \$6 billion, and known as Western Libyan Gas Project<sup>70</sup>.

The company is also participating in supplying a lot of the natural gas for local consumption, which feeds some generating power stations and other manufacturing sectors such as the cement industry and the steel sector.

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<sup>69</sup> Mellitah Oil and Gas B.V Company, see the company achievements <http://www.mellitahog.ly>.

<sup>70</sup> Mellitah Oil and Gas B.V Company, see the company profile and the company achievements <http://www.mellitahog.ly>.

## **4.6 DATA ANALYSIS**

The data analysis method depends on whether the data collected is quantitative or qualitative. Data needs to be analysed to achieve the research results (Collis & Hussey 2003; Ghauri & Gronhaug 2005). The literature acknowledged that the research approach referred to the systematic, focused and orderly collection of data for the purpose of obtaining information to answer research problems or questions. In this study, therefore, the methods of data analysis involved both quantitative and qualitative approaches. Analysing the quantitative data involved collecting and analysing numerical data and applying statistical tests, which concentrate on measuring phenomena using computerised quantitative software such as SPSS package and Excel. This software was used in the first stage of the study in order to present the study's findings regarding the hypothesis drawn, which studies the relationship between environmental quality and economic development. It was also used to compare the responses and opinions of the general managers (decision-makers) and managers of several related departments to the objective of this research, as well as experts and consultants working in the area under investigation.

However, the qualitative approach is more subjective in nature and focuses on interpreting and examining perceptions and behaviours in order to gain deeper understanding of social and human activities. Qualitative data analysis and interpretation took place in phase two as mentioned before. A descriptive analysis of the data collected from the interviews has already been undertaken in order to investigate the proposed proposition and to answer each of RQ2, RQ3, and RQ4. Data gathered from interviews is recorded, categorised, summarised and documented (Leedy & Ormrod 2005).

Qualitative data analysis in this study involved the following steps: 1) data reduction; 2) data display; and 3) extraction of conclusions. During the interviews, it was not expected that respondents would use the same terms when they express their opinion. This means that



interviewees may express the same view using different words. Therefore, data reduction in the interviews has been used to avoid the large amount of the same opinions that were expressed in different terms and sometimes in different ways.

The qualitative data was analysed by content analysis in which key themes and categories were compiled from interviewees' replies in order to interpret general points. Content analysis was employed to analyse the interviews because it is one of the most important research techniques in analysing qualitative data (Krippendorff 2004). Cavana and others (2001, p. 7) defined the content analysis as 'the process of indentifying, coding and categorising the primary patterns in data'. This type of analysis allows the themes to emerge from the raw data, and this describes the main focus of the qualitative analyst.

Content analysis also can refer to the statistical analysis of key words, sentences and/or phrases that occur. In order to conduct a content analysis, coding of open-ended responses is essential. Therefore, coding enables the researcher to organise the large amount of texts. Content analysis can be conducted either by using a manual decision support system or by using a computer program. The current research has used a computer program because it allows the researcher to achieve the same outcomes without the need to physically undertake the activities that relate to a manual decision support system. Also, it saves time and allows the researcher to concentrate on the art of analysis.

#### **4.6.1 QUANTITATIVE DATA ANALYSIS**

Quantitative analysis methods for the secondary data are largely widespread, probably because their standardisation makes the collection and analysis of data more efficient (especially when using dedicated software tools) and because the subsequent possibility to conduct statistical analyses on large samples allows conclusions to be drawn with a well-defined level of certainty and confidence.

The researcher has used Excel spreadsheets for this research project to present and analyse the data gathered from the secondary source, which has been mentioned before in section 5.1 of this chapter. In this way the use of tables and diagrams was effective to present this data in the most appropriate way, such as presenting the data in numerical form, for instance, percentages. The next step which has been employed in analysing the qualitative data is the use of SPSS package in order to conduct the regression analysis of the EKC model.

The following three sections will demonstrate and give detailed information about the analysis of the EKC framework, the EKC conceptual framework and its proposed hypothesis, and finally conducting the regression analysis of the EKC.

#### **4.6.1.1 THE ANALYSIS OF THE EKC FRAMEWORK**

This research verifies the relationship between environmental quality and economic growth, which is based upon the so-called EKC. In this regard, many authors consider that the analysis of EKC is one of the most controversial theories of the interactions between “economic growth (income per capita GDP) and environmental degradation (air pollution)” (AkboostancI et al. 2009; Annicchiarico et al. 2009; de Bruyn & Heintz 1999; Dinda 2004; Grossman & Krueger 1995; Panayotou 1993; Selden & Song 1994; Shafik 1994).

Many researches in the early 1990s indicated that there is a similar relationship to what Kuznets has found between (income per capita GDP ‘economic growth’ and environmental degradation ‘air pollution’) (Grossman & Krueger 1995; Panayotou 1993; Selden & Song 1994; Shafik 1994; Shafik & Bandyopadhyay 1992). The common point of all EKC studies is that environmental quality deteriorates at the early stages of economic development/growth but eventually, as income level increases, this degradation in the environment will decrease at later stages (Dinda 2004). This is because the implementation of clean production approaches and effective environmental policies will take their place in societies.

There are several elements that can lead to economic growth. Modern growth theory (endogenous growth theory) accepts that human development, technological progress and natural resource are considered as the forces behind economic growth. In this context, (Van den Bergh 2002) has argued that recent economic studies deal with optimality of the growth, (how economic growth and environmental conservation are compatible in the long term), sustainable development, consequences of environmental policy for growth. Thus, as previously mentioned and identified by several authors, the results of the EKC approach show that economic growth could be made consistent with improving the environment by implementing efficient environmental policies. Therefore, the EKC approach may assist the Libyan policy makers to take action towards the problem of climate change.

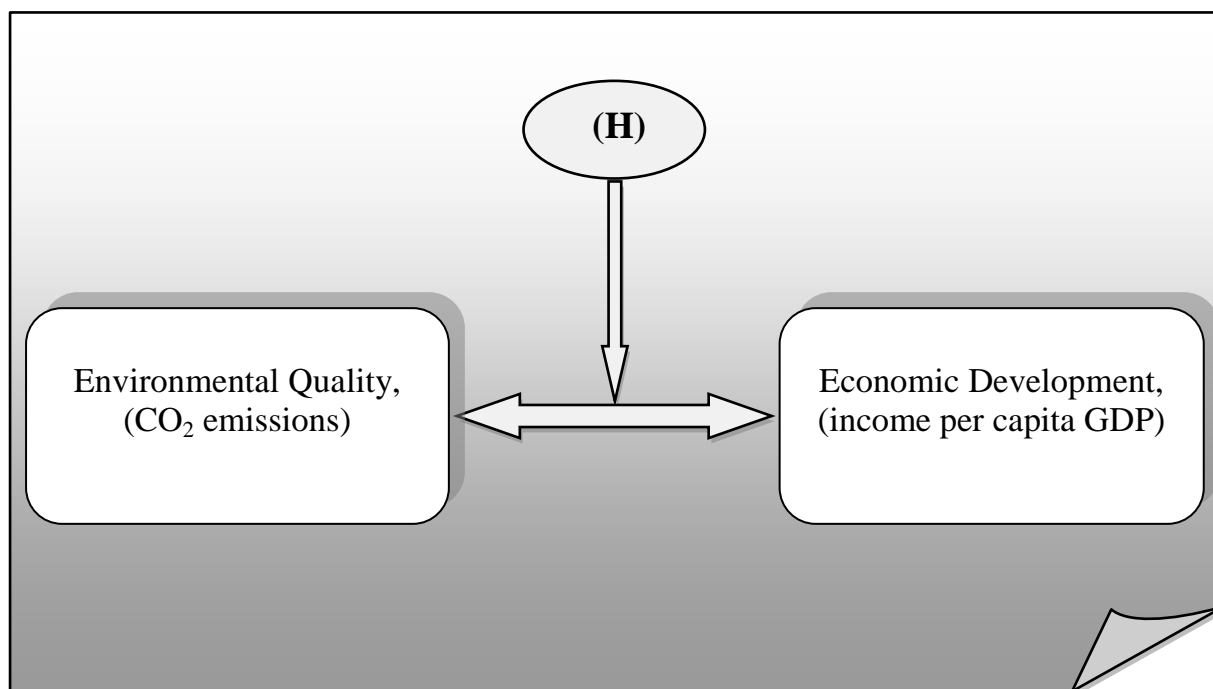
#### **4.6.1.2 CONCEPTUAL FRAMEWORK OF THE EKC AND ITS HYPOTHESIS**

##### ***The Conceptual Framework of the EKC***

The existence of strong policies and appropriate institutional structures are fundamental to the development of nations (Sharp 2002). This puts Libya in a critical position regarding the degradation of the environment resulting from its strong intention to move towards economic prosperity, especially over the last decade.

As can be seen from Figure 4.2, this study assumes that there is a link which is illustrated by two directions—the environmental quality (represented by CO<sub>2</sub> emissions) and the economic development (represented by income per capita GDP). The idea is that economic development affects environmental quality. As income per capita GDP increases the environmental degradation thus will decrease. Hence, confirming the EKC hypothesis.

**Figure 4.2:** The conceptual framework of the EKC.



***Hypothesis***

Following Dinda (2004) and other EKC specialists, this study hypothesises that: *There is a positive relationship between environmental quality (measured by CO<sub>2</sub> emissions) and economic development (measured by income per capita GDP) in the case of Libya.*

**4.6.1.3 CONDUCTING THE REGRESSION ANALYSIS OF THE EKC**

This study employed secondary data for a span of 35 years, between 1975 and 2009. This data included 35 observations, which were collected from world development indicators (WDI), the World Bank (2008) and some other Libyan institutions such as the Central Bank of Libya (CBL 2009) and the General Information Authority (GIA 2008) in Libya.

A regression analysis was conducted to test the related hypothesis. The hypothesis studies the relationship between environmental quality and economic development, which is based upon the EKC hypothesis. In this general format the hypothesis can be formulated as follows:

$$E = f(Y, Y^2, Y^3, Z) \dots \dots \dots (1)$$

Where  $E$  is the dependent variable which denotes one of the environmental indicators, that is CO<sub>2</sub> emissions,  $Y$  is the income (per capita GDP) and  $Z$  could be other explanatory variables, such as population density, that are supposed to influence environmental degradation. Conventional EKC studies employ functional forms where results can be evaluated with respect to presence or absence of a turning point and the significance of the parameters computed. The empirical evidence for the existence of an EKC has been found in various studies. These studies share some common characteristics with respect to data and methods employed. Most of the data used in these studies is cross-sectional panel data and time-series analysis. The following reduced form models are used to test the various possibilities between environmental pressures (pollution levels) and income per capita GDP. In this study the researcher investigates the existence of EKC through two different models. The use of the time-series model as it is formulated following de Bruyn and others (1998), Dinda (2004) and Akbostanci and others (2009) is given below:

$$E_t = \alpha + \beta_1 Y_t + \beta_2 Y_t^2 + \beta_3 Y_t^3 + \varepsilon_t \dots\dots\dots (2)$$

Here, for the environmental indicators ( $E$ ), we use CO<sub>2</sub> emissions per metric tonne in Libya. The income variable ( $Y$ ) is the income per capita GDP in constant US\$2000. The subscript  $t$  is time,  $\alpha$  is constant,  $\beta$  is the co-efficient of the explanatory variable and  $\varepsilon$  is the error term.

The second model that is used in this study indicates the population density measured ( $Z$ ) as an explanatory variable that is supposed to influence environmental degradation. This model is formulated as follows:

$$E_t = \beta_0 + \beta_1 Z + \varepsilon_t \dots\dots\dots (3)$$

### **4.6.2 QUALITATIVE DATA ANALYSIS**

There is no agreement among researchers as to the methods of analysing qualitative data (Creswell 1998). In addition, Silverman (2006) indicates that there is no standard approach among the qualitative research. Brewer (2000, p. 188) defines qualitative data analysis as ‘the

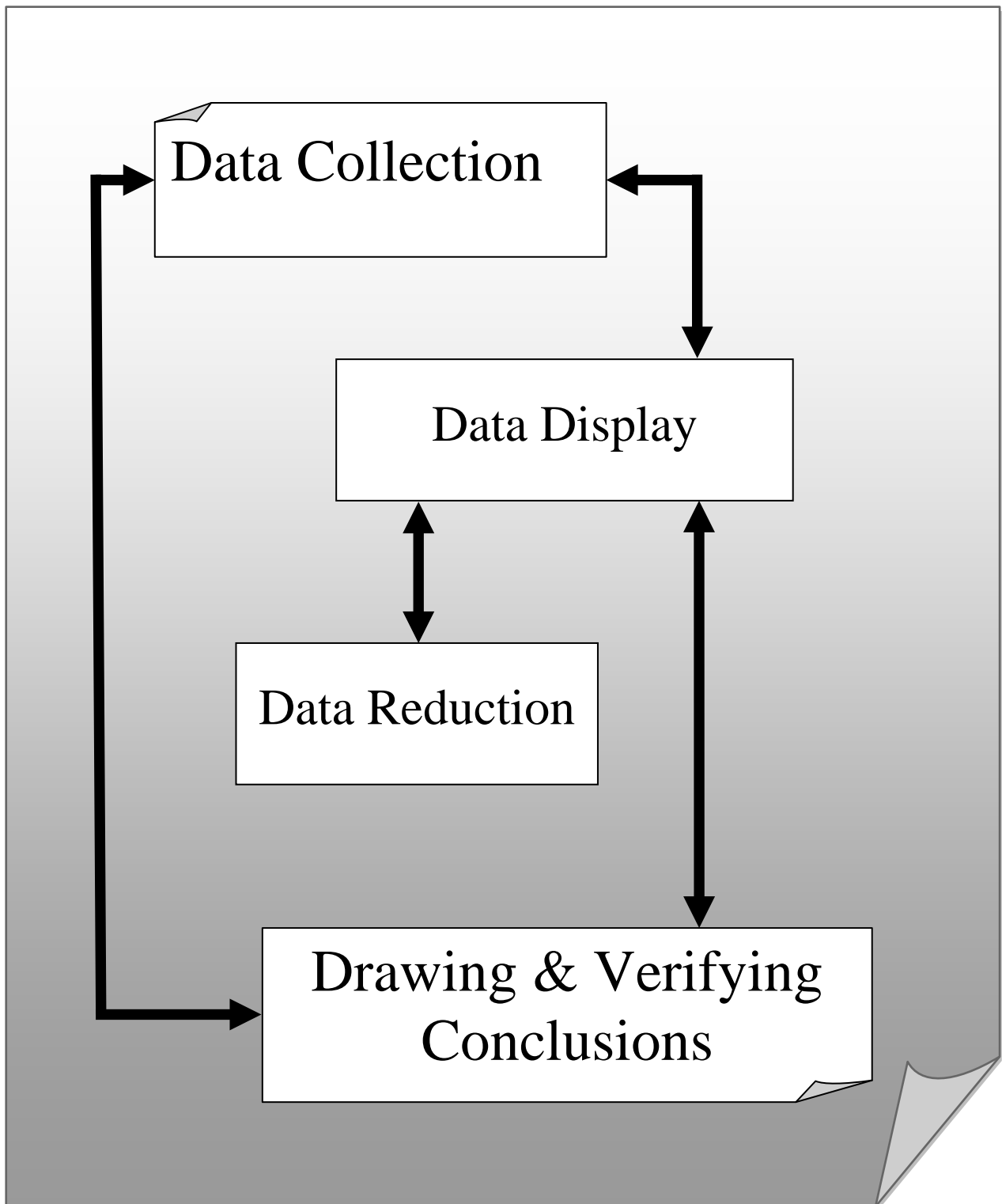
process of bringing order to the data, organising what is there into patterns, categories and descriptive units, and looking for relationships between them'. In addition, the process of data analysis in qualitative approach is eclectic. In light of this, Creswell (1994, p. 153) has asserted that:

'There is no 'right way'. Metaphors and analogies are as appropriate as open-ended questions. Data analysis requires that the researcher be comfortable with developing categories and making comparisons and contrasts. It also requires that the researcher be open to possibilities and see contrary or alternative explanations for the findings'.

In this study, the process of analysing the collected qualitative data has followed the components of data analysis in Miles and Huberman (1994), where data analysis involves three sub-processes: data reduction; data display; and drawing and verifying conclusions. Figure 4.3 demonstrates the components of data analysis.

In the below figure, data reduction refers to the process of selecting, focusing, simplifying, abstracting and transforming the raw data. Displaying the interview data in tables and other forms is a helpful tool to simplify, categorise, comprehend and interpret the data. Therefore, after the collection process, the data was sorted and reduced into different categories. Categorising the data assisted the researcher to acquire an understanding of how environmental reduction policies and their contribution to sustainable development were undertaken and understood by participants. This process was coupled with reducing the data gathered into categories to help the researcher arrange the data, in order to easily identify patterns which may emerge. Then, drawing and verifying conclusions were the final process.

**Figure 4.3:** Components of data analysis.



Source: Adapted from Miles and Huberman, 1994.

Marshall and Rossman (1999) organise the analytic procedures into six phases. These are as follows:

- 1) Organising the data
- 2) Generating categories, themes and patterns
- 3) Coding the data
- 4) Testing the emergent understandings
- 5) Searching for alternative explanations
- 6) Writing the report.

As mentioned previously, data in this study was collected by conducting interviews with 37 respondents in the Arabic (Libyan dialect) language and a few in the English language.

Therefore, organising and presenting data in this study includes the following steps:

- Step one: Transcription
- Step two: Translation
- Step three: Data reduction and pattern coding.

According to Marshall and Rossman (1989, p. 112), 'Qualitative data analysis is a search for a general statements about relationships among categories of data'. Cavana and others (2001) mentioned that there are a variety of suitable analytical approaches to qualitative research and many of them can be aided with computer software. On the other hand, it would be wrong for a qualitative researcher to allow the available software to drive the general research strategy (Silverman 2006). At the core of the process of qualitative data analysis is the decision to analyse data manually or with the aid of a computer software package, for example, Excel spreadsheets and/or NVivo program.

In this study, all interview data was imported, to be organised into Excel sheets and the NVivo software after it had been translated from Arabic language into English language and transcribed. The researcher then used the content analysis technique to analyse the qualitative data collected through semi-structured interviews. Content analysis has been found to be very useful and more appropriate in this case. This technique is widely used in social sciences



studies due its ability to reflect the actual reality of phenomenon. It was regularly performed in the 1940s; it became a more credible and frequently used research method from the mid-1950s (Cavana et al. 2001; Silverman 2006).

Some authors consider content analysis to be a research technique for the objective, systematic, and qualitative description of manifest content of communications (Leedy & Ormrod 2005; Naoum 2007). Others consider content analysis as a systematic, replicable technique for compressing many words into fewer content categories based on explicit rules of coding (Krippendorff 2001; Silverman 2006).

In this research, interview data went through the following steps:

- 1) Reviewing the manuscripts and clarifying the unclear words and meanings.
- 2) Classifying each manuscript based on themes discussed.
- 3) Using tables, frequencies and percentages to analyse the frequently used words and statements.
- 4) The final step was extracting the meanings from the analysed data. Details of these steps are explained further in the following sections.

#### **4.6.2.1 CONDUCTING THE INTERVIEWS**

The interviews were undertaken in parallel with the process of collecting the secondary data that has been mentioned before. After preparing the interview checklist, the researcher applied for Ethical Clearance approval from the Office of Research and Higher Degrees at the University of Southern Queensland (see Appendix H). The majority of interviews were conducted at workplace offices in both oil and cement companies and some were undertaken in oil fields and/or cement plants, and were held during the summer season of 2010 in Libya in the major cities of Tripoli, Benghazi, Al-khoums and Zawia, where the majority of Libyan people live. In all interview sessions the respondents tended to reply patiently and graciously to all questions that were asked. This is owing to the importance and the vitality of the

research study and possibly because the researcher had established a good relationship with some of the interviewees through his work background.

Owing to personal, political and cultural circumstances, the researcher did not record the majority of the interviews. This may be considered as one of the limitations of this study. Therefore, to overcome these barriers, the responses were written down on a prepared interview schedule, some by the interviewees and some by the researcher. In what follows, a brief outline will be provided about the interviews, and appendixes (A, B and C) give more detailed information about them and the questions asked.

In brief, it was planned to conduct forty interviews with the sampling units that have been described in previous sections, particularly in the section (5.2.3). These units include general managers (decision-makers) and managers of some particular departments such as environmental department, production department, energy department, finance and sales. In addition, experts and consultants working in the field were included. However, only 37 formal interviews were undertaken due to administrative reasons.

Ten of the interviewees were senior decision-makers (general managers) with a high level of responsibility regarding national, regional and local planning and policies, in direct and indirect connection to the environmental and sustainability issues and their associated operations at both central and local levels. In addition, seven interviews were conducted with experienced consultants and experts who had, for more than twenty years, been engaged in working and consulting activities, as well as research in various issues and aspects regarding the environmental policies and other related and relevant topics concerning the research study.

Furthermore, the rest of the interviews were conducted with the managers of several functional departments in both Libyan oil and cement companies; Table 4.5 lists these departments. In addition, Table 4.6 and Figure 4.4 respectively indicate the sample units of

the respondents and the percentage of their response rate. Questions concerned: issues for implementing an emissions trading policy and its contribution towards sustainable development; the use of emissions reduction policies, such as an emissions trading policy, and opportunity to stimulate innovation to address emissions problems in Libya (particularly in the oil and cement industries); and the environmental and economic implications of adapting an emissions trading program in the case of Libya. After these interviews, some of the project managers of several cement companies took the researcher on a walking guided tour around the plants. However, for security reasons it was difficult to do the walking guided tour in oil plants.

**Table 4.5:** Managers of departments that were interviewed

<b>Department<sup>71</sup></b>	<b>Manager's Title</b>
Environment <sup>72</sup>	Loss Prevention and Environmental Protection Manager/ Safety and Environment Manager/ Director of Environment, Health and Safety/ Health, Safety and Environmental Quality Manager
Production	Director of Production/ Production Co-ordinator
Energy	Operations Manager/ Director of Operations
Sales	Director of Marketing/ Marketing Co-ordinator/ Director of Commercial
Finance	Finance Manager/ Director of Finance

Source: Compiled from the conducted interviews.

<sup>71</sup> All these departments are located in both Libyan oil and cement companies.

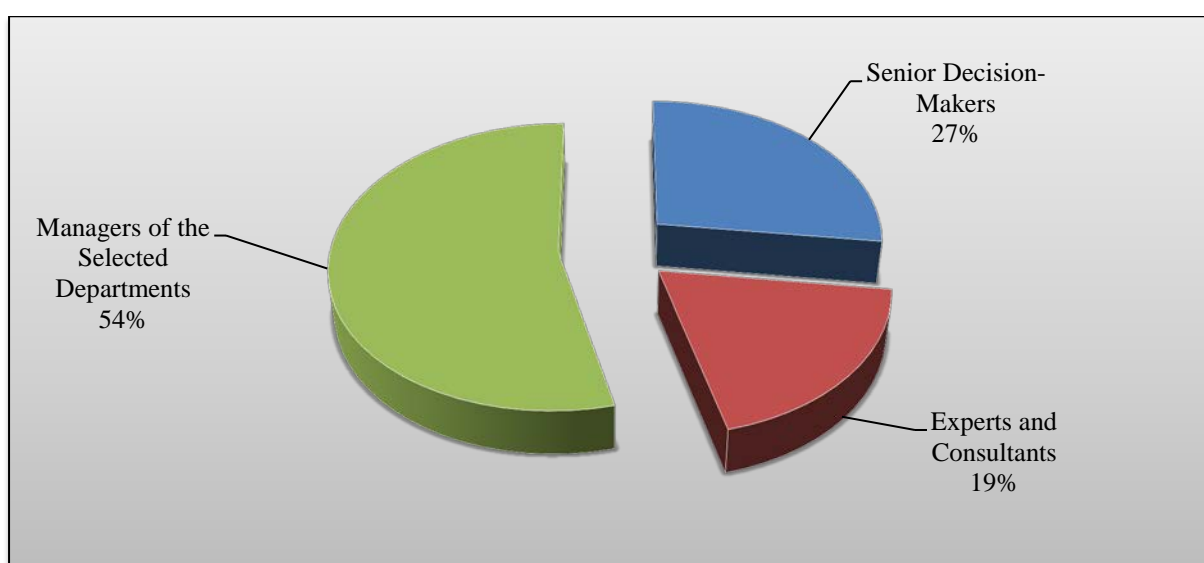
<sup>72</sup> This department has different names in all companies and the researcher has identified these names as provided above, in addition, the researcher has found other different names for the rest of the departments.

**Table 4.6:** the sample units of the respondents and the percentage of their response rate

Units of the interviewees	Number of the interviewees	The response rate (%)
Senior decision-makers	10	27 %
Directors of departments	20	45 %
Experts and consultants	7	19 %
Total	37	100 %

Source: Compiled from the conducted interviews.

**Figure 4.4:** The percentage of the response rate of the sample units of the interviewees.



Source: compiled from the conducted interviews.

#### **4.6.2.2 THE ANALYSIS OF THE SEMI-STRUCTURED INTERVIEWS**

The analysis of the semi-structured interviews' qualitative data was organised around content analysis. Lee and Fielding (2004, p. 530) state that content analysis was one of the earliest approaches to the analysis of texts. Lists of words are important tools in this tradition. One of the most familiar kinds of word list, the index, shows not only which words appear in a text but also their position. Thus, the ideas, opinions and views of the interviewees are extracted from the text. After organising the interviews by aided computer program, each interview was transcribed and analysed manually. The process of analysing the semi-structured interviews is summarised in Figure 4.5 and described in more detail in appendixes (E and F).

The first step includes preparing a clear text transcription from the replies of the interviewees.

According to Dey (1993, p. 83):

‘The aim of reading through our data is to prepare the ground for analysis. We can compare the actions of reading the data with a bit of gardening. By digging over the ground, we loosen the soil and make it possible for the seeds of our analysis’.

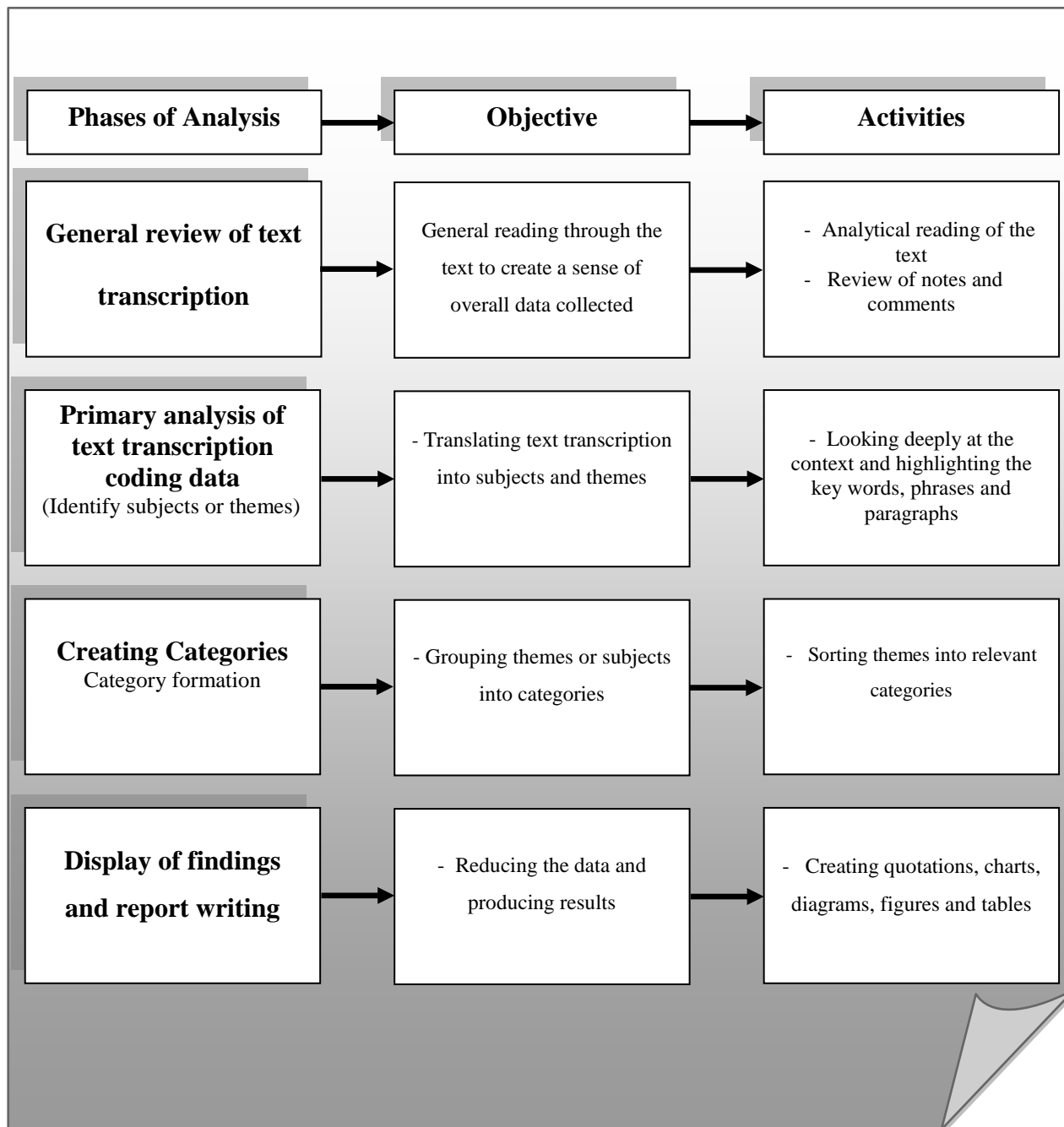
The second phase is the analysis of the text transcription by which the key words, phrases and paragraphs relevant to the enquiry are marked and highlighted in different colours. Moreover, paragraphs to be cited from transcription are underlined and marked in a specific colour. The main objective of this phase is to summarise the transcriptions, to identify the relevant themes, to translate and classify interviewee opinions, views and perceptions into subjects.

The third phase consists of creating coding categories, in to which subjects are grouped. The central objective of this phase is to group subjects under a particular title or a heading. The final step of the process is to display and present the findings of the analysis using many techniques, such as quotation, citation, charts, diagrams, tables and figures (for more detail see appendixes E and F).

The below procedures were employed to handle all of the interview data and information. The findings of the interviews were categorised under four broad issues or themes. These are: the emissions trading policy (definition, scope, emissions reduction policies, organisation, government, regulation, obstacles and future vision); the implementation of emissions trading policy (promoting GHG emissions reduction policies, the long and short-term challenges, government reduction targets, obstacles, environmental and economic implications); sustainable development (emissions reduction policy and its contribution towards sustainable development, the investment in new technologies, clean production, the incentives to innovate and build sustainable infrastructure, and obstacles constraining the industry’s operations); and the GHG emissions (strategies to reduce GHG emissions—particularly CO<sub>2</sub> emissions, scenarios involving reduction in GHG emissions, GHG emissions regulation and

trading regime, commercial risks and opportunities). These categories are tabulated and discussed in more detail in appendixes (E and F).

**Figure 4.5:** The process of analysing the semi-structured interviews



Source: Adapted from Creswell (1998).

## 4.7 SUMMARY

This chapter has described in depth the research methodology and methods available in the literature to conduct such a study, as well as the research methodology and methods adopted

in this study. After previous discussions in detail concerning the key issues arising from the literature, this chapter discusses the methodological issues relating to collection of research data in order to provide answers to the research questions raised in chapter one. In addition, the chapter has set out and described the research purpose, design and approach, and the analytical technique adopted. It has detailed the multi-approach of quantitative and qualitative research and describes the presentation of the data analysed. The chosen sample was defined and the interview technique has been described.

The discussion in this chapter falls into six main sections. Both the first and second sections give a brief introduction and overview of the chapter. The third section, which is named as research design, concentrated on the literature regarding designing the research study and concluded that this research is completely an exploratory study that has both quantitative and qualitative research design. The discussion then moved to describe the research methods and measures in the fourth section, where the researcher explained in detail the utilised methods in this research, including quantitative and qualitative methods. In this section the researcher also emphasised the adopted research methodology regarding collecting and analysing data. Then the section described the employed measures in this research, which consisted of two main phases—where phase one was described as the way of answering the RQ1 by utilising the EKC model, and phase two was used in order to answer each of RQ2, RQ3 and RQ4 by conducting the semi-structured interviews.

The process of collecting the data in the fifth section has included both primary and secondary data sources. The later on one hand was the key method of collecting the quantitative data which was obtained from archival records of federal and state government in addition to the Annual Reports from the Central Bank of Libya, the World Bank (CD-ROMs and hard copies), the National Oil Corporation in Libya, the General Information Authority in Libya, and annual reports (long-term movement in time series data) from both

Ministries of Libyan oil and industry in relation to CO<sub>2</sub> emissions per capita GDP. On the other hand, interviews (semi-structured interviews) were the main method in this research study for the purpose of collecting the qualitative data.

The final section in this chapter focused on the procedures of analysing the data gathered from both methods. In the quantitative data analysis part, the researcher determined the way of analysing the secondary data by conducting the regression analysis of the EKC framework and testing its proposed hypothesis. Then, the researcher has described in detail the process of analysing the qualitative data which was obtained from the interviews. In this regard, the researcher has simply tabulated the most important steps of analysing the semi-structured interviews, demonstrated in Figure 4.5.

Progressing from the discussions of methodological issues in this chapter, the following chapter will provide a discussion on the characteristics of the findings obtained from the analysis of the EKC framework, as well as the research results derived from the data analysis procedures through the qualitative data analysis phase.



## **CHAPTER FIVE: RESEARCH FINDINGS AND DISCUSSION**

### **5.1 INTRODUCTION**

This chapter presents, describes and discusses in detail the findings of the study conducted in Libya, particularly in both the Libyan oil and cement industries. The study investigates whether the organisational or corporate context surrounding the potential adoption of emissions trading in order to reduce GHG emissions in Libya, particularly CO<sub>2</sub> emissions, then contributes towards sustainable development. Interviewees covered all selected Libyan oil and cement companies, including general managers, senior decision-makers, directors of several departments and a number of experts and consultants.

It was aimed to conduct 40 interviews in the selected Libyan oil and cement companies, however, for administrative reasons, 37 interviews were conducted. The response rate of the semi-structured interviews was respectively 27 percent, 54 percent, and 19 percent for the sample units of senior decision-makers, managers of the selected departments and lastly experts and consultants who are working for those companies<sup>73</sup>.

The structure of this chapter is guided by the research questions and the objective. It is important to first assess the relationship between the environmental quality and the economic development within the context of the Libyan environment. Then, the following research questions in this study have been qualitatively assessed by employing the semi-structured interviews in the context of the study in order to achieve the objective of this research study. Hence, this chapter is concerned with providing practical insights by applying both the quantitative and the qualitative approaches to help in understanding the phenomenon of the current study.

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<sup>73</sup> For more information regarding the response rate (see chapter four).

## **5.2 OVERVIEW OF THE CHAPTER**

This chapter is concerned with providing practical insights by applying quantitative and qualitative research methodology to help in understanding the main objective of this research study. This chapter falls into six main sections. The first and second sections provide both the introduction and the overview of the chapter. The third section presents in detail the findings of the EKC model and its discussion. The fourth section provides in detail the findings of the conducted interviews and presents the results of: the emissions trading policy, the implementations of emissions trading policy, the emissions trading system and the innovation opportunities, an analysis of the function of adapting emissions reduction policies in both Libyan oil and cement industries, and the environmental and economic implications. More detailed information is provided in the fifth section, concerning and presenting the findings of the respondents regarding Yes/No questions that have been included in the conducted interviews. The last section provides a summary of the chapter.

## **5.3 THE FINDINGS OF THE EKC MODEL AND ITS DISCUSSION**

This section describes and discusses the findings of applying the EKC model in the case of Libya. The EKC analysis in Libya indicates that the Libyan economic system is located on unfavourable part (position of the inverted-U shape). This will be shown in this section.

Regarding to the equation (2) presented in the previous chapter, the regression results as well as the correlation outcomes of this model are given in Tables 5.1, 5.2, 5.3 and 5.4 respectively. The outcomes in table 5.1 show that both R Square and Adjusted R Square of the model (2) are to some extent high. In addition, the results of the equation (2) shown in table 5.2 (ANOVA table) indicate that there was a significant effect of the income per capita GDP on the environmental pressure. This means that the relationship between CO<sub>2</sub> emissions and the income per capita GDP is positive which asserts the first stage of the hypothesis

drawn. In addition to this, it indicates that as long as GDP per capita increases the CO<sub>2</sub> emissions thus will increase, this emphasises the theoretical view of the EKC. The following two tables show the descriptive results of the Summary statistics and the ANOVA table of the equation (2). Moreover, the correlation between the related variables has shown the significant relationship the economic development (income per capita GDP) and the environmental pressure (CO<sub>2</sub> emissions), see Table 5.4.

**Table 5.1:** Summary Statistics of the equation (2)

R	R Square	Adjusted R Square	Std. Error of the Estimate
.943	.890	.879	.708

The independent variable is Income per capita GDP.

**Table 5.2:** ANOVA table of the equation (2)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	17.937	3	41.834	83.382	.000
Residual	32.377	31	.502		
Total	50.314	34			

The independent variable is income per capita GDP.

**Notes:** The table shows the ANOVA statistics for the regression model of the equation (2). The F statistic and the associated significance value show that the regression model explains a significant amount of the variation in the environmental quality.

The coefficients have drawn in Table 5.3 telling that how the independent variable is associated with the dependent variable. Accordingly, it is shown that CO<sub>2</sub> emission increases by 0.001 unit (metric tonnes) of GDP per capita. This means that CO<sub>2</sub> emission is positively associated with GDP per capita.

The increase in air pollution (CO<sub>2</sub> emissions) reflects the view that pollution costs are not high in the related country. That is because of the increase in oil production and non-clean productions such as cement, iron and steel productions. Moreover, the abundance of primary sources used in cement, iron and steel manufacturing, in addition to the main source of crude oil, are fundamental reasons for increasing the environmental pressure in the case of Libya.

**Table 5.3:** Coefficients table of the equation (2)

	Un-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Income per capita GDP	.001	.001	1.860	2.540	.016
Income per capita GDP ** 2	-4.392E-8	.000	-.865	-.513	.611
Income per capita GDP ** 3	-5.990E-13	.000	-.171	.	.
(Constant)	1.843	1.189		1.551	.131

**Notes:** (1) This table reports the value of the coefficients for the variables and their significance. The value of the coefficients explains that the independent variable is to some extent associated with the dependent variable.

(2) The first order autocorrelation value of the residuals for the equation (2) was 0.72 (see Appendix G).

**Table 5.4:** Summary statistics of the correlations of the equation (2)

		CO <sub>2</sub> emissions per metric tonnes	Income per capita GDP
CO <sub>2</sub> emissions per metric tonnes	Pearson	1	.883**
	Correlation		
	Sig. (2-tailed)		.000
	N	35	35
Income per capita GDP	Pearson	.883**	1
	Correlation		
	Sig. (2-tailed)	.000	
	N	35	35

\*\* . Correlation is significant at the 0.01 level (2-tailed).

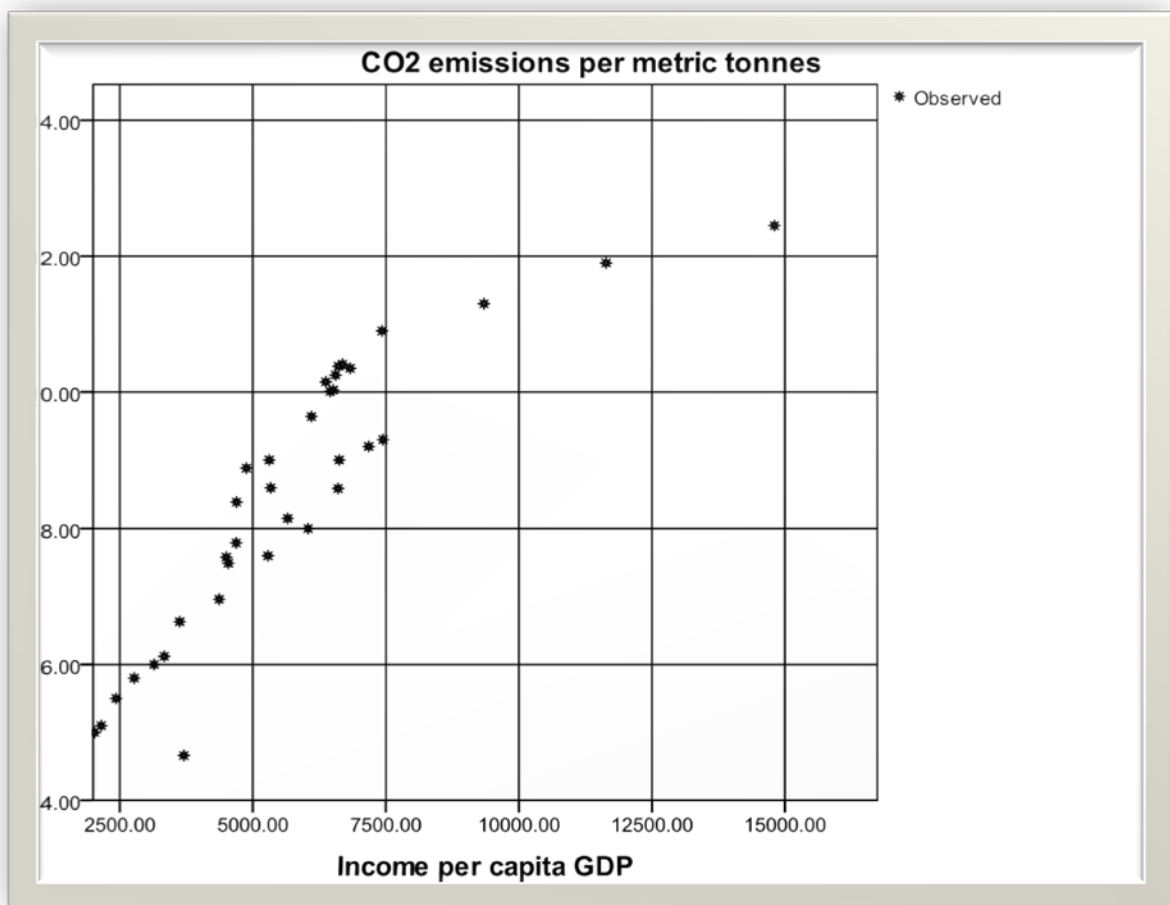
The results drawn from Figure 5.1 illustrate that there is a slight non-linear, functional relationship between air pollution (CO<sub>2</sub> emissions) and income growth (income per capita GDP) in Libya. The theoretical view of the EKC in many developed countries reflects that there is a turning point which indicates a decrease in environmental degradation. In the case of developing countries such as Libya, the analysis illustrates that, despite the increase in economic development, there is no such turning point, even though Figure 5.1 indicated that there is a slight decrease in the emissions (see the observed plots). However, in reality the environmental degradation is continually increasing with the increase of the economic growth in Libya. To assert this point, Figure 5.2 clearly shows the increase in air pollution (CO<sub>2</sub> emissions) caused by the rise in income per capita GDP in the Libyan state. This is due to the lack of environmental regulations as well as the absence of technological innovations.

The results reveal that the turning point occurs when the income per capita GDP reaches more than US\$12000 starting from the year 2008 until the year 2009 where the income reaches approximately US\$14000 (see Figure 5.2). In this regard, the analysis shows that the range of income per capita GDP from US\$3000-US\$6000 falls into the increased part of the inverted-U shape of the estimated pollution–income relationship, ‘the scale effect’. This

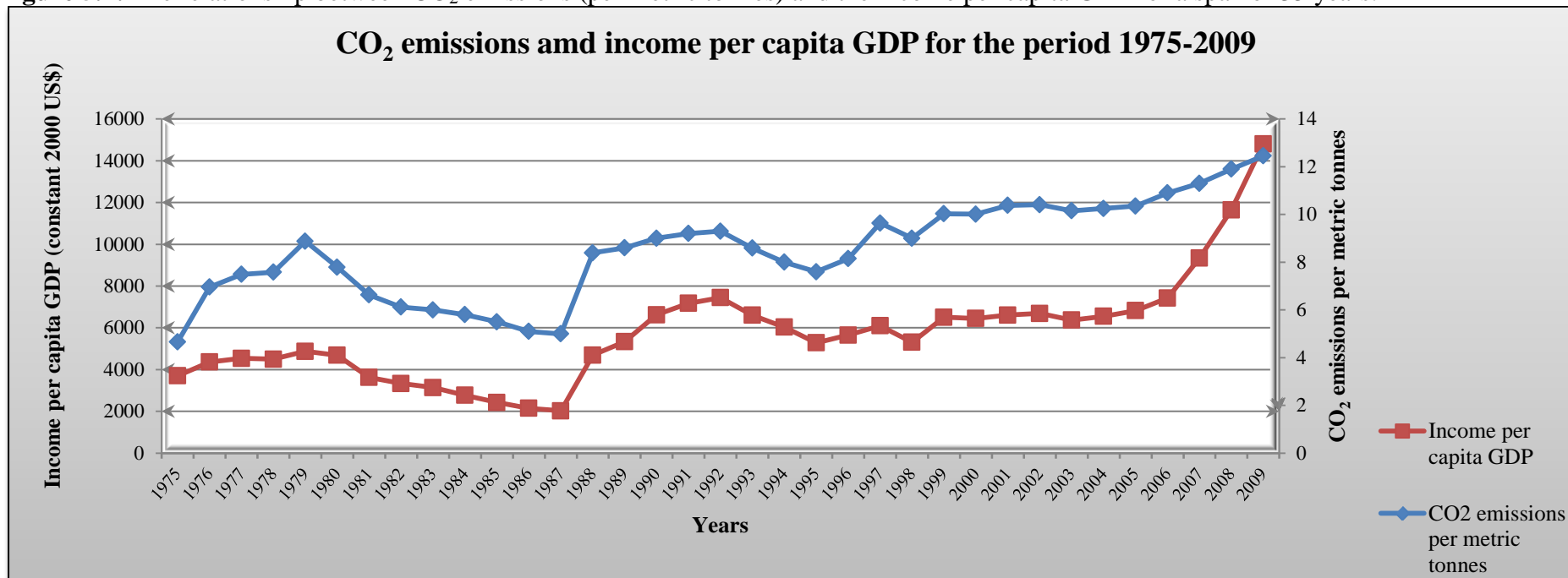
means that the scale effect dominates the period of 1975–2003 that aggravates the risk of environmental pressure. The period of 2008–2009 seems to be the beginning of the ‘composition effect’. Although it has witnessed a slight improvement in the environmental quality, there is a need to move towards the ‘technique effect’, so that the change will move to the use of cleaner technologies and adopting appropriate emissions reduction policies. This is solely to justify that Libya has a substantial amount of CO<sub>2</sub> emissions, therefore, there is a need to regulate those polluters in order to protect the environment.

That means the last two years of 2008–2009, the Libyan economy considers, in part, the composition effect could lower the harmful effects of the growth on the environment, through a change in the production structure.

**Figure 5.1:** The relationship between CO<sub>2</sub> emissions and income per capita GDP (the observed plots).



**Figure 5.2:** The relationship between CO<sub>2</sub> emissions (per metric tonnes) and the income per capita GDP for a span of 35 years.



**Data source:**

The World Bank, World Development Indicators, CD-ROM provided by the USQ Library.

The United Nations Statistical Division, 2008.

The World Bank, World Development Indicators, CD-ROM 2008, this includes data for the period 1975-2004 and also data from some other Libyan governmental reports which are as follows:

- 1- Reports from the Central Bank of Libya, Research and statistics Department, Economic Bulletin for the period 2003-2009.
- 2- Reports from the General Information Authority in Libya, statistics books 2007 and 2008.

As can be seen from the following Tables—5.5, 5.6 and 5.7—the results of the equation (3) illustrate that the independent variable ‘the population density’ is also strongly associated with the dependent variable ‘CO<sub>2</sub> emissions’. The relationship between these variables is highly significant. It means that the air pollution is positively connected with the population density, so that as long as the population is growing, the CO<sub>2</sub> emissions are increasing as well. This also can be seen in Figure 5.3. The following tables show the descriptive results of the equation (3), this including the Summary statistics, ANOVA table and the Coefficients table.

**Table 5.5:** Summary statistics of the equation (3)

R	R Square	Adjusted R Square	Std. Error of the Estimate
.741	.549	.535	.829

The independent variable is The total population density.

**Table 5.6:** ANOVA table of the equation (3)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	27.626	1	27.626	40.182	.000
Residual	22.688	33	.688		
Total	50.314	34			

The independent variable is The total population density.

Notes: The table shows the ANOVA statistics for the regression model of the equation (3). The F statistic and the associated significance value show that the relationship between the variables is highly significant.



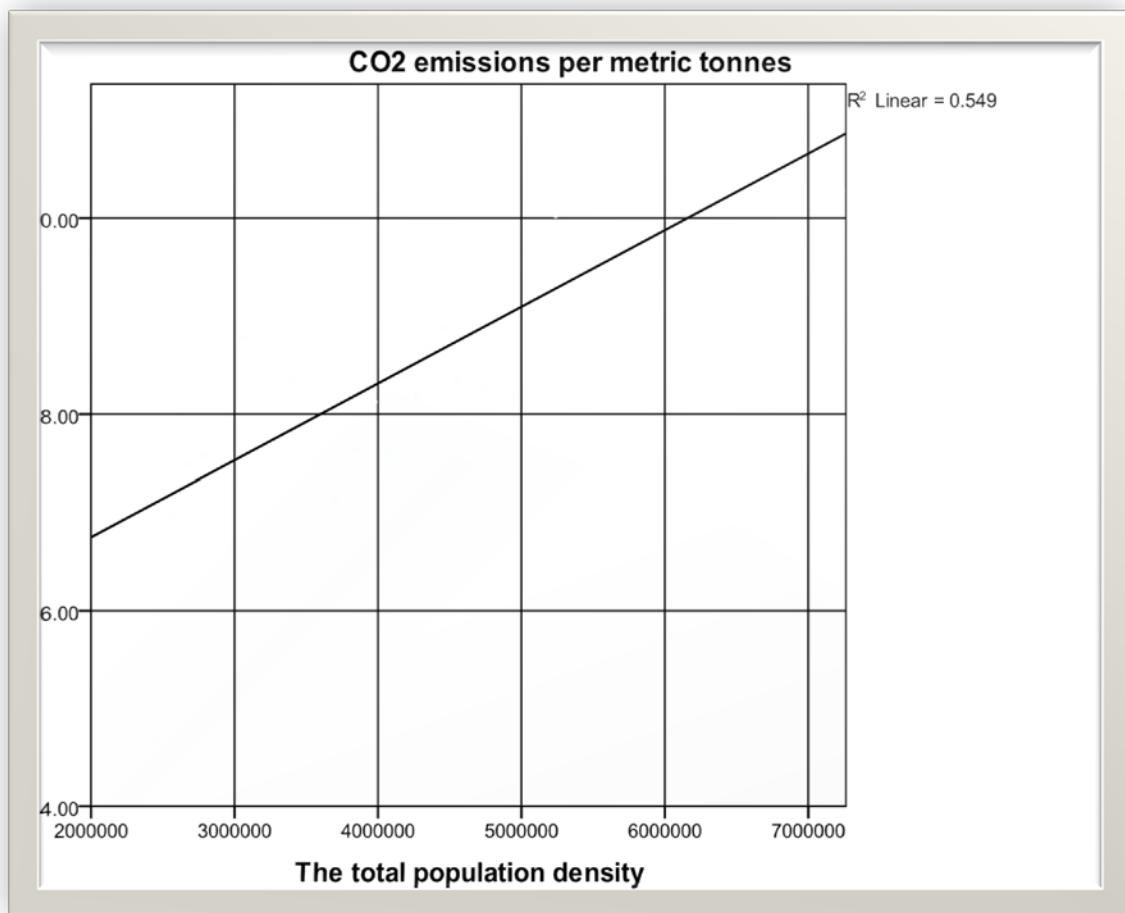
**Table 5.7:** Coefficients table of the equation (3)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
The total population density	7.820E-7	.000	.741	6.339	.000
(Constant)	5.186	.572		9.072	.000

**Notes:** (1) This table reports the value of the coefficients for the variables and their significance. It explains the significant relationship between population density and environmental pressure.

(2) The first order autocorrelation value of the residuals for the equation (3) was 0.91 (see Appendix G).

**Figure 5.3:** The relationship between CO<sub>2</sub> emissions and population density.



According to the current situation, environmental quality will improve for the next five to fifteen years in Libya if such emissions reduction policies are implemented. Poor countries with weak regulatory institutions can reduce pollution significantly by following a few basic principles. The first is focus. In many areas, relatively few sources are responsible for most of the pollution. Therefore, emissions can be significantly reduced by targeting regulatory monitoring and enforcement on those dominant sources. Another principle is that countries whose economic policies induce a rapid expansion of income and employment may experience severe environmental degradation unless appropriate environmental regulations are enacted and enforced. Furthermore, these countries should enact and enforce environmental regulations in order to reduce environmental damage. In this case, economic analysis can be employed to justify environmental regulatory policies that may result in a flatter and lower environmental Kuznets curve.

To sum up, the consequences of studying the nexus between environmental quality represented in CO<sub>2</sub> emissions and the economic development represented in income per capita GDP indicate that, there is a significant relationship between CO<sub>2</sub> emissions and economic growth 'income per capita GDP' in Libya. The key meaning of this relation shows that as long as economic development increases CO<sub>2</sub> emissions thus will increase. The results drawn are to some extent indicate a nonlinear relationship (see the observed plots in Figure 5.1) and, as can be seen from Figure 5.2 that, both CO<sub>2</sub> emissions and GDP per capita curves are close to each other. In addition, Figure 5.2 shows that the fluctuated decline of CO<sub>2</sub> emissions from the late of the 1970s until the late of the 1980s is due to the financial crisis in the related period with the extremely low energy prices that affecting the productivity during that period. Moreover, due to the lack of implementing such environmental regulations and the use of technological innovations, the analysis does not clearly reflect the existence of the turning point (inverted-U shape) in Libya. Therefore, the implementation of environmental

regulations in Libya may improve the environmental quality in the long-run and in this regard developed nations can play a fundamental role by transferring their technologies in order to protect the environment.

It is very important to understand that this part of the analysis sets the context of the conducted interviews in the next section.

## **5.4 THE FINDINGS OF THE CONDUCTED INTERVIEWS**

This section focuses primarily on the results, which are based on the analysis of the data obtained from 37 semi-structured interviews conducted with the Libyan oil and cement industry representatives responsible primarily for the selected oil and cement companies in both sectors. In addition, the conducted interviews included senior decision-makers (general managers), managers of a number of functional departments, as well as a number of experts and consultants working for those selected companies<sup>74</sup>. This qualitative phase has been developed as an attempt to provide exploratory information that could clarify and add rich value to the secondary data which was analysed in the previous section.

Given the large number of personal interviews conducted in this research, to facilitate the process of extracting the meanings provided by the interviewees and to guarantee providing the reader with a full understanding about all research-related issues, it has been found that employing the widely-used content analysis technique for qualitative data is more appropriate. This generates the following important findings in this study.

### **5.4.1 EMISSIONS TRADING POLICY**

Throughout the demonstration of the literature review chapter, it was obvious that the emissions trading policy is one of the most efficient reduction policies, or one of the key mechanisms that has been introduced since the establishment of the Kyoto Protocol in 1997.

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<sup>74</sup> For more information regarding these companies, see chapter four.

Key differences in response were noted between the participants in relation to proper definition of the emissions trading policy.

One of the participants has responded that the emissions trading policies considered as equipment for the purpose of reducing the environmental damage. The respondent stated that 'Emissions trading policy is a tool to reduce GHG emissions'. Some of other participants knew nothing about emissions trading policy; one of the informants stated that 'I do not have full information, but I know roughly what it means'. Another participant stated that:

'To be honest, we have small idea about this, because this is something new to us and the subject was put on the table some time ago, about two years, and we were thinking about it'.

In relation to the lack of information about the emissions trading policy, some other participants in high management positions did not have enough information about it; one of them concluded that 'I do not know too much information about this policy, and I am not aware of how this policy actually reduces the emissions'. Hence, the lack of providing adequate information about understanding the emissions trading policy from the participants has indicated that there has been a lack in specific policies in relation to the protection of environment from degradation, particularly the environmental damage that is occurring by the emissions of gases released into the atmosphere during the productive operation of the industrial sector.

However, some of the other participants have received slightly more appropriate information about the emissions trading policy, where it has been defined by some of them as being 'one of the most important mechanisms that has been introduced under the Kyoto Protocol in 1997, and the overall advantage of this policy is to reduce GHG emissions, CO<sub>2</sub> emissions in particular'. In this regard, one of the interviewees has stated that:

'Emissions trading is a policy that has introduced by the Kyoto Convention since 1997, and this policy has organised to reduce emissions particularly CO<sub>2</sub> emission which is the key factor that can strongly affect the ozone layer, where

this policy will have a positive impact on the environment if it is properly designed and effectively implemented by the government’.

In terms of the government’s and the organisations’ policies on emissions trading policy, the outcomes of the conducted interviews have demonstrated that<sup>75</sup>, although Libya has in recent years signed and ratified the Kyoto Convention in 2006, unfortunately both the government and the organisations have not acquired any advantages of it. In this regard, one of the senior decision-makers has concluded that:

‘Libya has signed and ratified the Kyoto agreement in 2006, but neither the Libyan Environmental Authority which is the main body who is responsible on the environmental issues in the country nor the organisations did take the Kyoto mechanisms under consideration’.

This means that there must be some barriers which are facing this policy or any other environmental policies to be put into practice.

Owing to the obstacles that are faced by both the government, represented in the environmental body, and the related industrial organisations, it was noted during the interviews that no action has been taken by the government and the organisations towards the emissions trading policy. The core of these impediments is represented in the following points:

- 1) The lack of qualified scientific expertise working in the environmental body.
- 2) The lack of awareness and understanding of what is going on in the world in relation to the latest environmental issues to keep pace with the technical development, which would reduce the environmental impact.
- 3) Lack of direct contact with the international environmental organisations in order to communicate and to be conscious of the latest developments in the environmental reduction policies and their international criteria.

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<sup>75</sup> For further information see section five of this chapter.

- 4) The absence of the legislative policies which would guarantee and ensure the preservation of the environment from degradation, especially the legislative environmental policies that are related to the industrial sectors such as oil, cement, iron and steel sectors.

According to the conducted interviews, in both the Libyan oil and cement industries, the future vision of the potential adoption of emissions trading policy in the Libyan state is totally positive if the country has effective and proper environmental legislations. In this regard, the participants have inferred and emphasised that there should be some priorities that the government must comply with. These priorities are stated as follows:

- 1) Enhancing the institutional capacity of EGA
- 2) Enhancing the national coordination of environmental issues
- 3) Enhancing the international cooperation regarding the emissions reduction policies that would reduce the environmental degradation.
- 4) Require the companies to follow the environmental legislation and to ensure that all required companies are complying with those regulations.

In brief, according to the conducted interviews in the relevant oil and cement companies, not have enough and adequate information about the policy of emissions trading reflects the view that the environmental regulations in the Libyan state is neglected. This in turn has led to not gaining any benefits of the Kyoto Convention, since Libya has signed and ratified this Convention in 2006. In addition, a number of difficulties are facing the government represented in the Libyan environmental body (EGA) and the related industrial organisations. This was in fact consistent with Al-Shihri's study who studied the strategic environmental assessment in Saudi Arabia in 2001. Moreover, the interviews obviously indicated that no action has been done by the government and/or the related industrial companies towards the

emissions trading policy. This indeed has attributed to weakness the status of the environmental regulation in Libya, which the next section will explain and discuss it in detail.

## **5.4.2 THE IMPLEMENTATION OF EMISSIONS TRADING POLICY**

### **5.4.2.1 THE STATE OF THE LIBYAN ENVIRONMENTAL REGULATIONS**

During the presentation of the chapter two, it became clear that although the environmental regulations have been organised for a long time, more than twenty years in fact since the establishment of the environmental law No. (7) in 1982, the development of environmental regulation is not in required professional stage. Through tracking the reality of the environmental professional regulations in the Libyan environment, it can be inferred that there is a lack of experienced Libyan environmental law, particularly in the environmental regulations (policies). All efforts to develop environmental laws and policies are diverse efforts and cannot reach the required level of development. This leaves the environmental regulations unable to advance and upgrade the environmental performance to be in par with other developed countries.

In this regard, the interviewees have been asked to give an evaluation of the state of the environmental regulations in Libya and their companies in particular. One of the interviewees of the senior decision-makers responded with the following comment:

‘Honestly, the state and the development of the environmental regulations in Libya and the industrial companies in particular are deplorable compared with other countries. Although, the environmental body (Environmental General Authority) was established long time ago, there are no noticeable achievements and no serious attempt was made to efficiently regulate and develop the environmental regulations in Libya’.

Some participants believed that the importance of the environmental regulations was because of the absence of experience and the unwillingness of qualified people to act effectively when proposing any environmental regulations. This was addressed by one of the consultants working in one of the selected oil companies in the following statement, ‘The unwillingness

of qualified people gives opportunity to less qualified people to control and formulate the environmental regulations'. Another interviewee concluded that:

'The environmental regulations have experienced internal conflicts among some laws and articles. That is why the environmental regulations are still at a lower level than required. The absence of qualified people to effectively act and accept the responsibility of managing the environmental regulations has opened up the door for inappropriate members to handle the affairs of implementing the environmental regulations. This is one of the main reasons for the inefficient environmental regulations in Libya'.

The environmental issues in Libya have had a long period of isolation and lack of development. This is because of the major change in the political, economic and social factors that Libya witnessed a long time ago<sup>76</sup>. Only a few years ago, Libya opened up to the outside world and some efforts have been started to improve the status of the environmental regulations. However, development of environmental regulations is still low and needs more research, efforts and concentration. This view was expressed in the following response:

'The environmental regulations have suffered from a lack of attention and regulation, but I think the environmental regulations will now be improved, I believe that the coming period will be better and will witness a major development In-Sha' Allah (by the will of Allah)'.

It is clear that the Libyan environment suffers from the lack of environmental regulations and their applications. This was consistent with some environmental studies conducted in the area of developing countries, particularly Middle East nations<sup>77</sup>. As discussed previously in chapter two, there are several factors that prevented the development of environmental regulations in Libya. These factors included:

- 1) The socialist system.
- 2) The political system.
- 3) The economic situation.
- 4) The status of the international sanctions and isolation imposed on the country.

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<sup>76</sup> For more information about the political, economical and social changes, see chapter two.

<sup>77</sup> For further information, see Al-Shihri 2001 and Hassan 2001.



- 5) The lack of a strong environmental body to control the environmental issues concerning the country and the industrial sector.
- 6) The dominance of the public sector as opposed to private.

To sum up, it can be noted through the interviews, that the participants believe that the development of environmental regulations in Libya is unstable and needs to be improved. In addition, there is a lack of legislation and standards governing the environmental regulations. Therefore, the environmental regulations in Libya need quick, intensive, international actions alongside national actions, which will assist in keeping pace with developed countries. Furthermore, a number of challenges are facing the Libyan government and its environmental body (EGA) solely in keeping pace with the international environmental criteria for the purpose of protecting the environment from degradation. These challenges will be interpreted and discussed in detail in the following section.

#### **5.4.2.2 THE CHALLENGES OF ADOPTING AN EMISSIONS TRADING POLICY**

Various participants noted the particular challenges associated with the adoption of an emissions trading policy in Libya. The perceptions of those respondents are summarised as follows:

- 1) Lack of activating the policy within companies—this is because of the absence of the important role which should be taken into account by the government and its environmental body (EGA) in the Libyan state.
- 2) Participants agreed that the overall challenge is the poor management in enforcing this policy in order to control/minimise the impact on the environment by ensuring that all work carried out in the business process is established to environmental standards and procedures.
- 3) Lack of financial capabilities and the necessary technical to put this policy into practice.

- 4) Lack of sufficient information and data, particularly in the Libyan environmental body, regarding the implementation of this policy or any other emissions reduction policy.
- 5) The absence of appropriate environmental legislations. In this regard, a variety of the interviewees have stated that there is no environmental legislations existed which allow the industrial companies to sell or even export CO<sub>2</sub> emissions or any other GHG emissions neither locally nor internationally.
- 6) A range of participants in the interviews have emphasised that the absence of local emissions markets is a significant challenge, leading to the absence of any benefit from the sale of emissions certificates and therefore reducing the chance of selling those certificates in either local markets or international markets.
- 7) Some other informants have inferred that the lack of technological and educational staff is also an important challenge facing the policy of emissions trading. This attributed to the lack of the technical capacity and human expertise in order to carry out and manage large projects regarding reducing emissions.
- 8) A strong challenge is the absence of the government's role in establishing regulations and determining the required targets in order to achieve the emissions reduction policy.
- 9) Participants who are working as environmental experts in the selected companies have contend that a major challenge facing the adoption of emissions trading policy in the industrial sector is that, with the current capabilities, it is difficult to achieve the emissions reduction that results from the production process, while simultaneously maintaining the level of the production.
- 10) A number of gaps exist in relation to the Libyan environmental Law No. (15), of the year 2003, for the environmental protection and its executive regulations. This law

has been updated based on the Law No. (7), which was issued in the year 1982. However, the majority of respondents agreed that this law does have a number of limitations and it is still facing difficulties in establishing appropriate environmental criteria and environmental policies that seek to reduce GHG emissions, particularly CO<sub>2</sub> emissions. This in turn has negatively affected the adoption of the emissions trading policy in the case of Libya.

For these above reasons, it is clear from what has been mentioned above that the adoption of an emissions trading policy has many significant challenges that the country should take into consideration when it is ready to implement this policy for the purpose of protecting the environment. To conclude, all respondents agreed that the listed challenges above are the major obstacles to adopting the emissions trading policy. However, it is the honest intention of the government to overcome those barriers in order to solve the problem of air pollution and to cope with the negative consequences of climate change. The next section interprets, explains and discusses the interviews results regarding the adaptation to climate change in the case of Libya, particularly Libyan oil and cement industries.

#### **5.4.2.3 THE ADAPTATION TO CLIMATE CHANGE**

An analysis of the interviews reveals that Libya lacks technical means and did not take any steps towards the adaptation to climate change, particularly with problems concerning gas emissions, which many respondents in the high management level and some other environmental experts working in the selected companies have emphasised. In addition, one of the major difficulties in adapting to climate change is the lack of a sufficient database system to collect all of the data regarding environmental waste that damages the environment. This waste includes the emissions of gases, medical wastes, metal wastes and civil wastes.

In this regard, many participants believed that the lack of a sufficient database system leads to the delay in submitting the National Communication Reports regarding environmental

protection<sup>78</sup> to be signed by the United Nations (UN). This has in turn contributed to slowing the process of adaptation to climate change in Libya, particularly for the industrial companies. In light of this, one of the main members in the National Committee of Climate Change and Ozone Layer Protection, who is working in one of the selected companies, said that:

‘So far, there is no comprehensive database regarding the environmental concerns in the entire state, and this could be one of the main difficulties that are facing Libya in order to adapt to climate change’.

The participant also stated that:

‘The Libyan state should provide the National Communication Reports to the UN. So far, for some administrative reasons, we could not finalise and submit the first National Communication Report. In contrast, some of the Middle East countries have submitted their first and second reports to the UN, in addition, some of them have reached to finalise the third National Communication Report which is concerning the adaptation to climate change’.

To assert this point, this was consistent with a study which has been done by Raouf (2007) in the Arab Gulf Countries.

Adaptation to climate change is the adjustment of a system to moderate the impacts of climate change, to take advantages of new opportunities, or to cope with the consequences. Throughout the presentation of the conducted interviews, it emphasised that the adaptation will have a significant effect on developing and addressing the environmental concerns in Libya. In light of this, interviewees were indirectly asked how the adaptation to climate change will affect the environmental situation as a result of the changing climate. Most of participants agreed that the adaptation to climate change will assist in addressing the environmental problems, particularly the problem of gas emissions as a consequence of the production process.

The efforts put towards adapting to climate change differ from one company to another; the interviewees disclosed that some of the companies are working individually to cope with the

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<sup>78</sup> For further information, (see section 5.1) in the related literature review chapter.

problem of air pollution. They are monitoring the gas emissions and the ambient air quality control. There are some implemented projects in a number of oil and cement companies which seek to minimise the problem of gas emissions, in particular CO<sub>2</sub> emissions. For instance, in some oil companies and their fields, there are a number of schemes being carried-out which seek to achieve the policy of Zero Flaring. Those projects are currently holders of the certifications from the International Organization for Standardization (ISO 14001) for the environment management system. This is based on many participants' views (senior decision-makers), where one of them stated that:

'In our company, we implement some projects in order to minimise the problem of air pollution and reduce emissions particularly CO<sub>2</sub> emissions. Recently, we are employing the policy of Zero Flaring in a number of oil fields, and as a result, some of our oil fields have currently certified by (ISO 14001) for the environmental management system, to ensure compliance with environmental laws and regulations'.

Little work has been done in a number of cement plants to carry out projects in order to reduce CO<sub>2</sub> emissions and adapt to climate change; only two cement companies have implemented new project in some of their plants Presently, a small number of those plants have been certified by the (ISO 14001). This is supported by the following argument of some interviewees, where one of them stated that:

'we can say that we did some activities regarding the reduction of air pollution in order to comply with even 10 per cent of the international environmental standards, also we recently are started to change the method of generating the power in a number of our cement plants, where we have replaced the use of the heavy oil by the natural gas in order to reduce CO<sub>2</sub> emissions and some other GHG emissions'.

To conclude, it is worth mentioning that adaptation to climate change has increasingly become a focus of policy debates. In this regard, changes in environmental legislation are being made to cope with the requirements of the adaptation policy and to close the gaps in the current environmental laws. However, it is clear that in the case of Libya, adaptation to various impacts of climate change have so far been very low and sometimes non-existent.

This in turn may affect sustainability in the case of Libya, if such emissions reduction policy has not taken a place in the related country. The following section will interpret and discuss in detail the contribution of emissions trading policy towards sustainable development.

#### **5.4.2.4 THE CONTRIBUTION OF EMISSIONS TRADING POLICY TOWARDS SUSTAINABLE DEVELOPMENT**

During the presentation of the literature review chapter, it became clear that reducing GHG emissions is one of the key concerns in many international organisations for the purpose of achieving sustainable development. In addition, limiting climate change and increasing the use of clean energy is one of the biggest challenges to sustainable development. In light of this, interviewees were indirectly asked to demonstrate their views, opinions and perceptions regarding the application of an emissions trading policy and its contribution towards sustainable development.

The objectives set up in the initial sustainable development strategy remain valid, within the framework of the three pillared approach to sustainable development (economic, social and environment). The focus was on the environmental aspect in attaining sustainable development. In this regard, the overall perceptions of the participants throughout the presentation of the conducted interviews indicate that an emissions trading policy may have a significant effect on sustainable development in the case of Libya.

All participants have emphasised that the country is in the development stage. Both the oil and cement sectors dominate a significant role in GHG emissions because the oil industry is considered the key resource in the country with its substantial revenue. In addition, the current massive infrastructure expansion in the country is placing greater demand on the cement industry to meet the requirements of the development. Hence, these facts demonstrate that the Libyan government should pay major attention towards environmental conservation, as it is considered to be one of the key aspects in fulfilling sustainable development.

Owing to the country's economic growth and its strategic geographical location, the majority of the interviewees were strongly supportive of the idea of implementing emissions trading policy throughout the country. This view was expressed in the following response:

'From my point of view as an environmental consultant, the government must ensure the implementation of the emissions trading policy because we are not a weak economically state, and therefore we can transfer technology, increase the use of clean energy and increase the clean production by the investment in new technologies. Consequently, maintaining the level of the gas emissions and seeking to sell or export our emissions permits either in the national or international markets'.

Interviews with several departments in the selected companies reveal that the challenge of climate change, which is the core of attaining sustainable development, should be tackled in a way that is consistent with competitiveness, development and clean energy security. This can be done through the development of adjustment strategies at the regional, national and international level. This was consistent with Al-Shihri's study on the sustainable development and strategic environmental assessment in the context of the Saudi Arabian planning process in 2001. In addition, all relevant emitting firms need to participate and should share the burden of GHG emissions reduction. In this regard, an emissions trading policy should be robust, maintain the competitiveness of the national firms and support investment throughout the country. To achieve this, the majority of the respondents have emphasised fulfilling the following points:

- 1) Greater use of EIA, before conducting any kind of emissions reduction projects.
- 2) Determine the value of emissions and stability of the market.
- 3) More extensive and rigours use of high quality cost benefit analysis so as to facilitate informed decision-making, notably in the environmental context.
- 4) Regular and ongoing policy evaluation.
- 5) More extensive use of market-based instruments, which contribute to linking environmental protection and economic growth.

Some participants have emphasised that, the environmental program in Libya is currently overseen by the EGA, which aims to promote national policies to protect the environment and uses an integrated approach to link economic, social and environmental policies. Therefore, companies are increasingly concerned with achieving and demonstrating sound environmental performance by controlling the impact of their activities, products or services on the environment. The actual implementation of strategies and methods requires minimising environmental impacts of the industries' operations. However, it is apparently difficult to effectively implement an environmental standard without strong legislative backing from the government.

It can be inferred throughout the conducted interviews that the application of an emissions trading policy may have a significant effect if the policy is properly designed and effectively implemented by strong environmental law. An interviewee agreed that:

‘Involving Libya in emissions trading through the negotiation of emission budgets would provide the state with substantial capital inflows through emissions trading, therefore stimulating their economic growth. It would also allow the World to take advantage of the fact that the country is building its infrastructure, which would determine long term paths of GHG emissions’.

Throughout this particular theme, the analysis of those interviews discloses that the potential benefits of such a system for the country would be:

- 1) To provide the country with substantial capital inflows, and stimulate its economic growth.
- 2) To allow the country to achieve its Kyoto commitments at the lowest possible cost.
- 3) To achieve global participation while reducing the risk of air pollution.

In brief, the results reveal that the related oil and cement industries are currently the dominant sources for the GHG emissions in the Libyan state. Therefore, Libya should concentrate on implementing and developing programs for the purpose of limiting GHG emissions and protecting the environment as it is considered to be one of the main aspects in fulfilling



sustainable development. In this regard, the outcomes of the conducted interviews demonstrated that emissions trading policy may have significant effect on sustainable development in the case of Libya. This may occur if the policy is successfully designed and implemented by strong environmental law. The outcomes also disclose that Libya has witnessed great development in its economy last decade. This is due to the cancellation of the UN sanctions on Libya since 2003. For these reasons, Libya has sufficient revenues which allow the state and the related governments to take place in transferring technologies, increase the use of clean energy and increase the clean production. This should be done in a way that is consistent with increasing the investment in new technologies. Definitely this also can be done if the country takes a place in adapting emissions trading policy. In the light of this, the next section will interpret, explain and discuss in detail the use of emissions trading policy and its innovation opportunities.

### **5.4.3 EMISSIONS TRADING SYSTEM AND INNOVATION OPPORTUNITIES**

Through the analysis of the overall interviews regarding emissions trading and innovation opportunities, the perceptions of those participants revealed the fact that the Libyan government has so far not enforced the industrial companies to comply with any emissions reduction targets. The majority of the interviewees frequently stated that an emissions trading system promotes technical innovation. This view was expressed in the following response, 'Emissions trading system will drive positive opportunities to the industrial sector and their related companies and this will contribute to reduce air pollution and remain competitive'. Similarly, an interviewee also stated that, 'Emissions trading system encourages the investment in new technologies in order to have clean production and maintain the level of the reduction limits'. Further statements were made, 'Emissions trading system does a great job in stimulating innovation to address environmental concerns'. In other words:

‘If the government has imposed emissions reduction targets, emissions trading system would tend to encourage the innovation and lowering the cost of compliance to government’s reduction targets through the investment in new technologies’.

Some participants believed that emissions trading programs authorise polluters to meet pollution reduction obligations by purchasing extra reductions from polluters who are reducing their emissions below applicable limit. In addition, respondents claim that this trading of compliance obligations fosters innovation. In this regard, government can require all polluters to purchase allowances from a limited supply at an auction. Whether or not polluters can trade allowances, this requirement that all polluters purchase allowances for each tonne of pollution can create incentives to innovate and reduce pollution.

In this regard, during the presentation of the conducted interviews, it can be concluded that not only does an emissions trading system foster innovation, but it also creates economic incentives. This has been stated by one of environmental experts working in one of the selected firms. The respondent stated that, ‘Emissions trading system can create economic incentives and therefore stimulating innovations’. In other words: ‘By selling and buying emissions credits, this would create an economic incentive, therefore, encouraging companies in the investment of new technologies’.

Many respondents have agreed that innovation can perform one of two basic functions. It can lower the cost of the product or increase its quality. In the light of this, one of the respondents has expressed the following statement:

‘New technical gas turbines which are operating by natural gas, for example, cost much more than traditional turbines that are operating by the heavy oil, but offer a much higher quality product with less environmental impact’.

As a result, innovation can reduce the cost of pollution control or make it possible to perform basic economic functions with less pollution than the existing approaches. In other words, environmental innovations can either offer qualitatively better environmental results or reduce the cost of achieving a particular result.

The majority of participants believed that, pollution from oil fields and cement plants bears a major portion of the responsibility for widespread destruction of ecosystems, and global climate change (which may produce rising sea levels, a spread of infectious diseases, ecosystem harms, and, in places, drought and starvation). Therefore, one of the environmental consultants has recommended that:

‘We need to change current technologies drastically if we hope to address these problems comprehensively in economically dynamic world. Because this dynamic tends to make environmental problems grow over time. Also, because this dynamic almost always undermines some of the progress environmental regulation would otherwise bring about, and, at times, leads to absolute declines in environmental quality’.

Politically, interviewees agreed that technological innovation, as a result of an emissions trading system, will also perform an important political function—making progress possible where otherwise it could not occur. This has been inferred by the following statement from one of the senior decision-makers:

‘The climate change regime, for instance, assumes that the richer countries will develop and share the technologies that will make it possible for relatively poor countries to enjoy a good quality of life and contribute to efforts to address climate change. Therefore, absent this kind of developed country leadership, advanced nations may have great difficulty persuading tomorrow’s greatest GHG emitters sectors, such as oil and cement, to reduce emissions in Libya to tolerable levels, if the government stands without doing anything about it’.

In relation to this, many respondents have emphasised that the government should reframe its environmental policy in order to combat the problem of air pollution. An interviewee has responded that:

‘We need to reframe the environmental policy debate around the question of addressing the economic dynamics of the environmental law. This involves, among other things, asking how we can design environmental law that stimulates environmental innovation effectively as we currently stimulate material innovation (some of which is environmentally destructive)’.

In light of this, environmental policy analysts in the related firms generally agree upon the desirability of stimulating technological innovation to improve the environment.

As it has been stated above, it can be inferred that the major challenge regarding the investment in new technologies is the capacity of the government to support and push the industrial firms to be a clean production. To overcome this obstacle, a number of respondents have recommended the following suggestions:

- 1) Setting up projects that adopt environmental conservations.
- 2) Supporting oil firms as well as cement companies regarding environmental conservation programs.
- 3) Transfer technologies that can contribute to reduce the environmental damage.
- 4) Disposal of the industrial waste produced by the related firms through the most modern means in the field of preserving the environment.

It is clear that the view of the participants, regarding an emission trading system and its innovation opportunities, is completely positive. The findings indicated that the majority of the participants believe that an emissions trading system does foster technical innovations. Furthermore, not only emissions trading system promotes the innovations, but also creates economic incentives. There is great potential to reduce emissions in contrast to an increased investment in modern technologies and hence, increased production. Therefore, the Libyan government and its related environmental body (EGA) should drastically adopt environmental policies that can effectively operate within its related industries in order to address environmental concerns. Also, industrial companies should adapt with emissions reduction policies in order to tackle the problem of air pollution, notably CO<sub>2</sub> emissions and other GHG emissions. In this regard, the following section explains, discusses and analyses the function of adapting emissions reduction policies in both Libyan oil and cement industries.

#### **5.4.4 ANALYSIS OF THE FUNCTION OF ADAPTING EMISSIONS REDUCTION POLICIES IN BOTH LIBYAN OIL AND CEMENT INDUSTRIES**

Through analysing the function of adapting emissions reduction policies in both the Libyan oil and cement industries, the results reveal that it has a significant effect on the related industrial companies. In order for those companies to effectively engage with any emissions reduction policy, the companies must fulfil certain minimum conditions. These include compliance with regional, national and international environmental criteria, the establishment of a specific department to administer the activities of the related adapted emissions reduction policy, and the implementation of economic and fiscal policies which will drive investment in the emissions reduction projects. This view has been expressed by one official who stated that:

‘This consideration with the needs or requirements of these policies was one of the fundamental determinants....in our company we are ready to adapt to the suitable emissions reduction policy, but this process needs to be planned and also needs to meet some requirements’.

The compliance of the Libyan government to international environmental criteria is the backbone of the endeavours and efforts to adapt to emissions reduction policies throughout the state and the relevant industrial firms. Consequently, one participant has emphasised that:

‘If the government has enforced us with strong environmental legislations to reduce our carbon emissions or any sort of GHG emissions, then we welcome this initiative and do our best to reduce carbon emissions’.

In other words:

‘If any emissions reduction policy has introduced by the government, this will positively impact our company, then we will be more cooperative solely in case there is flexibility with the institutions that are able to conduct researches and experiments in order to reduce the emissions’.

To confirm the fundamental role of the Libyan government in driving the industrial companies to adapt to emissions reduction policies, an interviewee in one of the related firms has disclosed the following expression:

‘Our company will not achieve the carbon reduction unless the environmental body in Libya enforces us to comply with the relevant regional, national and international environmental criteria, so that we can work with, and then we may say that we are able to comply and accomplish the carbon reduction targets’.

Unfortunately, the Libyan government has so far done nothing regarding the adaptation to emissions reduction policies because there is no consensus between the related ministries and the industrial firms.

The interviews also revealed that a number of the selected firms work individually and have their own projects which seek to reduce the emissions. Very limited work has been done by a variety of oil companies. The Zero Flaring Policy (see section 4.2.3 of this chapter) is a policy which recently has been utilised in some modern oil fields to minimise gas burning and contribute to reducing GHG emissions. In contrast, a number of cement companies have started the policy of replacing the utilised heavy oil with natural gas in their operation process, as well as installing the latest modern filters in their plants. The limitations in conducting such projects are owing to the Libyan government having not yet improved its institutional capacity, which includes broad technical competence in conducting emissions reduction projects and the related areas, in addition to the absence of the transparency and stability of governance.

To sum up, it was very important for those industrial companies to achieve some basic conditions for the purpose implementing emissions reduction policies. These terms comprise the companies’ commitments with the national, regional and international environmental criteria, the establishment of a specific department to administer the activities of the related adapted emissions reduction policy, and the implementation of economic and fiscal policies

which will drive investment in the emissions reduction projects. In addition, it has been mentioned before that the Libyan government has so far not lodged an initial National Communication Report on the steps it is taking to implement the UNFCCC. In this regard, it can be inferred from the respondents that the initial national communications are meant to be the major source of information on the steps taken to mitigate climate change. However, so far the oil and cement firms rarely include detailed assessments of past and/or ongoing emissions reduction projects or activities; they focus instead on projects, activities or programs and measures that are envisaged for the future. This can basically be attributed to the weakness of the government role in enforcing the environmental criteria on the industrial companies. The weakness of government role is not only the major obstacle; other environmental and economic implications are also contributor factors. The next section interprets, explains and discusses these implications.

## **5.4.5 THE ENVIRONMENTAL AND ECONOMIC IMPLICATIONS**

### **5.4.5.1 THE ENVIRONMENTAL IMPLICATIONS**

Despite the abundance of environmental laws at national level, as indicated in chapter two, it is clear that there is a lack of specific policies in relation to the protection of the environment, particularly the problem of air pollution. According to the review of the environmental body and committees responsible for environmental protection, the bodies with the greatest responsibility in this area are the EGA and the Ministry of Industry. However, these bodies operate at a national level and, as it has been demonstrated, there is no requirement from them for any study—such as an EIA or Strategic Environmental Assessment—to be carried out before the local project is approved. At the local level of the environmental body there has been no clear strategy to translate the plans, policies and programs of these bodies into effective action in regard to the related industrial companies.

This has been expressed by a number of managers working at the environment, production and finance departments. One official stated that:

‘Environmental policies, plans and regulations which exist are not enough and there is a need for local plans, programs and policies to manage and protect the environment. This should include implementation mechanisms, which require the cooperation and integration of other responsible governments. The aim should be to provide the balance between the economic development and the protection of the environment, to achieve sustainable development in the state’.

Another official stated that ‘the environmental policies need operational systems and to be integrated with comprehensive environmental planning strategies’. Yet another official stated that:

‘The existing environmental policies throughout the country do not reduce or stop the loss of the natural resources. This requires an implementation system, linked to the existing development processes’.

Policies relating to the general environment and the protection of the natural resources unfortunately have not yet been applied. There are, for example, studies identifying sensitive areas where natural resources and the environment should receive special attention. This has been attributed to the lack of studies, whether of a quantitative or qualitative type, on the Libyan natural and ecological resources, which could help planning for current and future activities in sustainable way. The lack of studies was consistent with a study has been done in 2001 by Al-Shihri on the case of Saudi Arabian which identified that the lack of researches and studies are one of the major environmental implications which basically affects the implementations of environmental policies in the developing nations.

It can be inferred from the conducted interviews that the major environmental implications that are constraining the adaptation to the emissions trading program in the case of Libya are attributed to the following points:

- 1) Lack of Environmental legislations, where a number of the respondents in the environmental department (managers of the environmental departments) in the



selected firms have confirmed that there is a lack of legal and professional standards, guidelines and requirements which have been established by the Libyan environmental body (EGA) and the related ministries. This in turn reflects the poor of implementing emissions reduction policies in the industrial companies. Thus, there is a need for guidelines and standards to close this gap and to show how those companies should be involved in protecting the environment.

- 2) The failure of policy-makers to form adequate regulations to reduce environmental damage—this has been attributed to insufficient staff who specialise in environmental planning studies. In this regard, some of the consultants have indeed asserted the lack of sufficient staff in the environmental bodies and the related ministries, which made it difficult to find the personnel qualified to carry out such environmental studies.
- 3) Poor environmental management, where the majority of the interviewees have in fact asserted the lack of administrative stability in a variety of the relevant firms and the Libyan environmental body. This may result in the incapacity to complete replacement and development programs and follow up the requirements of the adopted environmental criteria.

In addition, one of the environmental experts who is currently working in one of the selected firms, and who was the head of the National Activity Section in the EGA has emphasised that the main reasons behind the inability of the Authority to implement its part in environmental protection are as follows: firstly, administrative instability within the Authority<sup>79</sup> in its short life (since 1998), rendering it extremely difficult to draw up a fixed work strategy; and secondly, lack of specialist technical staff in this field—the Authority depends on specialist and scientific assistance from outside the Authority, on a part-time basis, to perform its tasks; and finally, scarce and limited financial means.

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<sup>79</sup> This is in addition to the instability in dependency, where it was established in 1998 as responsible to the GP Committee. However, in 2001, EGA became directly responsible to the GP Congress.

However, to eliminate these limitations, participants were recommended that concern should be focused on the following points:

- 1) Appraising and reviewing the rules and regulations pertaining to the environment, to its management, and to the safeguarding of natural resources. If necessary these rules and regulations were to be updated and to be published in a comprehensive way and adhered to in all development enterprises.
- 2) Producing a set of criteria to assess, in particular, the impact of projects. This would lay down what measures should apply in the procedures to be followed before, during, and after the undertaken of the evaluation studies in relation to projects.
- 3) Setting up hazardous and toxic materials coordinating work between government agencies and industry in order to improve the handling, storage, and disposal of such materials.
- 4) Improving environmental control by industry and ensuring that industrialists put environmental measures into application.
- 5) Adherence to all regional, national and international commitments by Libyan government in setting up environmental rules and regulations and in creating and carrying through environmental policies.
- 6) Specifying and defining all means of cooperation between government bodies and the EGA in relation to environmental conservation, and the strengthening of EGA's powers in this area.

#### **5.4.5.2 THE ECONOMIC IMPLICATIONS**

The argument in chapter two indicated that the economic system in Libya was based on the socialist orientation of Qathafi's Green Book. It is unique in many aspects, accompanied by peculiar characteristics of its political regime. It is neither bourgeois political economy nor

classical political economy. In this regard, the basic characteristics of both systems are not applicable to the Libyan economic system<sup>80</sup>. Therefore, the analysis of the conducted interviews demonstrated that the Libyan economic system was not sufficient to carry out such emissions reduction policies, because the economic structure in Libya was very complicated and lacks many vital means that can contribute to adapt such kinds of emissions reduction policies.

Economic constraints have been attributed to many aspects. One of the limitations is that the domination of the public sector has led to the delay in Libyan economic reforms, which in turn has contributed to the absence of the private sector and competitive market institutions.

This view was expressed in the following statement:

‘The Libyan market was controlled by the government, where the structure of the market was absolute monopoly which is difficult for the competition to be existed between the industrial firms. This in turn made it difficult for these firms to invest in new technologies to reduce emissions and save credits of emissions in order to be sold at either the national or international markets’.

Another limitation can be attributed to three key elements, these are:

- 1) The absence of material incentives and profit.
- 2) The lack of openness to foreign investment, technology transfer and development within the country.
- 3) The absence of the stock market.

In light of this, in answering the related questions, one of the senior-decision makers stated that ‘The main objective of such enterprises is to offer services and goods to a public rather than to make a profit’. In other words, the respondent stated that ‘profit maximisation has a lower priority for Libyan companies’. Thus, maximising their market value is not considered the companies’ main objective, especially in the case of the absence of the stock market (absence of the competition).

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<sup>80</sup> Private ownership is a characteristic of western societies, whereas eastern societies are characterised by the complete opposite.

A number of respondents believed that the emissions trading programme is potentially a vehicle for attracting new foreign investment and technology transfer, for building institutions involved in climate change mitigation and adaptation, and for different types of public and private actors and entities to increase their awareness of technical and economic aspects of mitigation strategies. But foreign direct investment is more likely to flow to countries with stable governance conditions, strong legal and contractual environments, macro-economic stability, a skilled workforce and institutional capacity. Unfortunately, these elements are rarely or sometimes non-existent in the case of Libya. This was inconsistent with a study has been done in 2005 by Sonneborn on the case of developed nations.

In addition, the results of the interviews indicated that emissions reduction projects development is constrained by the lack of institutional capacity and a stable investment environment. For instance, at present it is difficult to establish any national allocation institution because of the inconsistency between the related ministries and their institutions in the Libyan government. This view was expressed in the following statement, ‘Because of the conflicts between the related environmental institutions, this creates weak institutional capacity to the adoption of new technologies’. In other words, the interviews revealed that the major challenge regarding the investment in new technologies is that the capacity of the government to support, encourage and push the industrial sector to be clean production.

Libya is endowed with natural resources that make renewable energy feasible. There is potential for investment in large-scale projects that would provide a range of economic benefits, including employment and education opportunities. There is also potential for project development in the areas of waste management and transport infrastructure. However, the nature of the country’s political system and economic structures, its inconsistent policy history, uncertain governance and its reliance on the hydrocarbon sector imply that successful engagement in emissions reduction policies will be, to some extent, difficult.

## **5.5 THE FINDINGS OF THE RESPONDENTS REGARDING YES/NO QUESTIONS**

### **5.5.1 EMISSIONS REDUCTION TARGETS INTO THE COMPANY STRATEGY**

Table 5.7 shows the perceptions of the respondents in considering emissions reduction targets in the company strategy. Respondents were asked whether their company has considered any emissions reduction targets in its strategy. In the light of this question, the results indicate that 62.2 per cent of the respondents answered 'No', whereas 27 per cent of the respondents answered 'Yes'.

Table 5.7 demonstrates that over 62 per cent of the respondents have reported that their companies have not considered any emissions reduction targets as a part of responding to climate change. The majority of the companies have not so far considered any strategic measurement regarding the reduction targets, because these strategies as well as emissions reduction targets have not yet issued from the related governments (Libyan environmental body and other related ministries). This has been attributed to the absence of any emissions reduction targets, or even any emissions reduction policies, which must be enforced by the government or the Libyan environmental body. To assert this point, the majority of the interviewees have stated that 'we did not consider any emissions reduction targets because of the absence of any climate policy action from the governmental side'. Another expression has been stated by one of the environmental consultants:

'Our company did not take any strategic measures regarding any emissions reduction targets, because it has not yet been considered by the EGA...we are still seeking to comply with the international environmental criteria, and in this stage we are trying to do our best in order to reduce at least a small percentage of our emissions'.

In contrast, small percentages of the respondents have indicated that their companies have some initiatives regarding the reduction of the emissions. Although, their reduction has not reached the required level, but this target proportion indicates the individual work and the valuable efforts of those firms in order to reduce the environmental damage which is caused by their operating processes.

**Table 5.7:** Respondents view about considering emissions reduction targets in the company strategy

Q.N	TOT. RES.	NO. RES.	USL. RES.	ANS. YES.	ANS. NO.
1	37	4	33	10	23
PERCENTAGE %	100	10.8	89.2	27.0	62.2

**Key to the above table<sup>81</sup>:**

Q.N = Question Number; TOT. RES. = Total Response; NO. RES. = No Response; USL. RES. = Usable Response (Total Response – No Response); ANS. YES. = Answer Yes; ANS. NO. = Answer No.

To sum up, considering emissions reduction targets into the companies' strategy were non-existent in the case of Libyan oil and cement industries. This has been attributed to the absence of any climate policy action which must be enforced by the government (the Libyan environmental body or and other related ministries). However, little proportion of certain firms has some initiatives with respect to the reduction of the emissions, and this reflects their own efforts regardless the emissions reduction levels which have not reached the required level to reduce emissions to tolerable levels. To achieve acceptable emissions reduction level, the related industrial companies need considerable efforts to comply with national, regional and international environmental criteria. One of these efforts is the development and the investment in renewable energy generating technologies. In the light of this, the next section

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<sup>81</sup> The same key is applied for the rest of tables regarding Yes/No questions.

will explore and discuss the role of the related oil and cement firms in the development and the investment in renewable energy generating technologies.

### **5.5.2 THE DEVELOPMENT AND THE INVESTMENT IN RENEWABLE ENERGY GENERATING TECHNOLOGIES**

In relation to the outlook on reducing carbon emissions/energy consumption through the development and the investment in renewable energy generating technologies, participants in were asked about whether their companies have developed or invested in any renewable energy generating technologies as a part of their action towards reducing carbon emissions/energy consumption. Table 5.8 illustrates that 70.3 per cent of the interviewees’ answered ‘No’, in comparison, 21.6 per cent of the participants answered ‘Yes’.

**Table 5.8:** Perceptions of the respondents about the development and the investment in any renewable energy generating technologies

Q.N	TOT. RES.	NO. RES.	USL. RES.	ANS. YES.	ANS. NO.
2	37	3	34	8	26
PERCENTAGE %	100	8.1	91.8	21.6	70.3

The above table shows that a large majority of the respondents (more than 70 per cent) have asserted that their firms did not take any actions towards reducing carbon emissions/energy consumption and they have not yet developed and invested in any renewable energy generating technologies. The reasons behind this are attributed to the weakness of the government’s role to drive the industrial companies towards the compliance with the national and international environmental criteria to reduce carbon emissions. To overcome this deficiency, all participants agreed with conditions; good governance, including transparency, credibility and responsibility and the setting up of modern, scientific and effectiveness policy.

In addition, the complete reliance on the governmental subsidies has weakened the relevant companies' capabilities to develop and invest in new technologies, because of the domination of public enterprises. In relation to this, an environmental consultant has expressed his view by saying that 'we did not develop and invest in any renewable energy generating technologies, and this an important task that the government must take it into account'. Also, to assert these points, see sections (4.4) and (4.5) respectively.

However, over 21 per cent of the participants have shown that their firms have activated a number of policies in order to reduce carbon emissions/energy consumption. For instance, in some oil companies, they started using a policy of the gas project utilisation in order to generate the power for the purpose of producing oil. In this regard, an interviewee has stated the following statement:

'As a step towards reducing emissions, we started using the policy of gas project utilisation to run the turbines, where these turbines were operated by the crude oil which has a large quantity of emissions'.

Moreover, the replacement of heavy oil with natural gas in a number of cement plants was a valuable action towards reducing carbon emissions. However, there is more work to be done in order to keep pace with the development and the investment in modern technologies that can contribute to reducing the negative environmental impact.

In brief, the analysis of this section revealed that a large proportion of those related oil and cement firms have up to date not developed and invested in any renewable energy generating technologies. The weakness of the government's role to encourage the industrial firms in taken a place to respond to climate change by reducing their emissions was the most important cause behind. Good governance, including transparency, credibility and responsibility and the setting up of modern, scientific and effectiveness policy can effectively treat this difficulty. This in turn helps those industrial companies to set up their plans on the basis of sound with respect to eliminating environmental problems. In contrast, the results



disclosed that little proportion of the relevant oil and cement companies have activated some policies in order to reduce carbon emissions/energy consumption. However, there is more work to be done in order to progress the development and to keep pace with the investments in modern technologies that can contribute to reducing the environmental damage. Thus, Libya has a pressing need to set up emissions reduction policies in order to protect the environment. This needs to analyse the attitudes of those relevant firms with regard to commercial risks and/or opportunities of the adaptation to climate change. The following section interprets and discusses in detail.

### **5.5.3 COMMERCIAL RISKS AND/OR OPPORTUNITIES OF THE POLICY RESPONSES AND/OR ADAPTATION TO CLIMATE CHANGE**

Table 5.9 demonstrates the outcomes of investigating the views behind the policy responses to climate change and/or the adaptation to climate change. In this regard, interviewees were asked whether the policy responses to climate change and/or the adaptation to climate change represent commercial risks and/or opportunities for their companies. Through the presentation of the related interviews, the statements have introduced that the policy responses to climate change will have positive opportunities and will not have commercial risks were overwhelmingly supported by the respondents. As can be seen from Table 5.9, the results indicate that 81.1 per cent of the respondents answered 'No', while less than 3 per cent of the respondents answered 'Yes', and 16.2 per cent provided no views.

**Table 5.9:** Participants’ views regarding the commercial risks and/or the opportunities that would have been presented by the policy response and/or adaptation to climate change

Q.N	TOT. RES.	NO. RES.	USL. RES.	ANS. YES.	ANS. NO.
3	37	6	31	1	30
PERCENTAGE %	100	16.2	83.7	2.7	81.1

The above table shows that the vast majority of the respondents agreed that the policy responses and the adaptation to climate change by their firms will not bring any sort of commercial risks. Instead they will have a number of constructive chances to nationalise those environmental policies and their executive mechanisms in the relevant companies. This view has been expressed by a senior decision-maker who has stated that:

‘If our company have intended to invest in some emissions reduction policies as a part of responding to climate change, there will not be any business-related risks, alternatively there will be positive opportunities and therefore it will preserve the environment by achieving the national and international environmental criteria. Also, it will accomplish and nationalised those policies and their executive mechanisms’.

The nationalisation of such policies will generate positive opportunities in terms of employment and gaining some profits as a result of applying those policies in the related companies.

In comparison, a small percentage of those participants have reported that in the short-term there will be commercial risks for the old factories, particularly cement plants, in making the necessary preventive maintenance work on time. This has been attributed to the lack of financial capabilities and the necessary technical means to put these policies into practice. However, in the long-run, adaptation to climate change will accelerate structural shifts towards a stronger and more sustainable economic future. Innovation policies need to be

adapted to current conditions, both in terms of how such policies are crafted to work and also as elements of stimulus packages that may often be the foundation for these initiatives.

The conclusion drawn of this question is that in the long-term the relevant industrial companies seem to have positive opportunities in regards to the adaptation to climate change by implementing proper emissions reduction policies. This requires concerted efforts by both the government and its related environmental body in keeping pace with the modern environmental policies and enact the necessary environmental Laws that oblige those polluters to comply with the environmental criteria. However, in the short-term adaptation to climate change with those policy responses to climate change will bring commercial risks for those old factories and their related companies and the impact of applying these policies will be negative. To eliminate the negative impact, this requires the related companies to prepare strategies for emerging GHG emissions regulations and trading regimes. The next section explains and discusses in detail the participants' views, ideas, perceptions and opinions regarding this issue.

#### **5.5.4 STRATEGIES REGARDING PREPARATION FOR EMERGING GHG EMISSIONS REGULATIONS AND TRADING REGIMES**

The data presented in Table 5.10 shows the perceptions of the participants and their views about the strategies regarding preparation for emerging GHG emissions regulation and trading regimes in their firms. In this regard, interviewees were asked if they have any strategy in relation to emerging GHG emissions regulation and trading regimes. The findings indicate that a high proportion of the respondents (91.8 per cent) answered 'No', whereas 0 per cent of the interviewees answered 'Yes', and 8.1 per cent of the respondents provided no views.

The analysis gives a strong impression that there are indications of overall weaknesses in the current status regarding any attempts to operate the GHG emissions regulation and the

engagement in any emissions trading regimes, in particular the EU emissions trading scheme. This has been strongly attributed to a number of obstacles that have been mentioned in previous sections. The key obstacle which affects those firms is that the government did not yet take any serious actions towards such kind of those strategic policies. This view has been expressed by the following statement:

‘Unfortunately, we do not have any such kind of emissions regulations and trading regimes, because the government and the Libyan environmental body did not take any action towards these strategic policies’.

Another statement has been expressed by one official that:

‘The consequence of this matter belongs to the government attitude of emerging any emissions reduction regimes. To date, the government and its related environmental body did not have any emissions reduction strategy in place, because of the absence of serious application of the Libyan environmental law on those related industrial companies. In addition, the absence of the institutional capacity to control the procedures of applying those policies is a contributed factor’.

**Table 5.10:** The perceptions of the respondents about strategy preparation for emerging GHG emissions regulation and trading regimes

Q.N	TOT. RES.	NO. RES.	USL. RES.	ANS. YES.	ANS. NO.
4	37	3	34	0	34
PERCENTAGE %	100	8.1	91.8	0	91.8

In other words, there is a gap between respondents’ attitudes and their actions with regard to the environmental activities of the companies. This was justified by the respondents themselves by saying that a scarcity of legal and professional standards and guidelines, along with their lack of expertise, qualification and training in the field of protecting the environment, are the main determinants that have prevented them from the engaging in any

policy responses to climate change and implementing any GHG emissions regulations and trading regimes.

However, the results of the interviews reveal that a number of the related firms have, to some extent, plans to control the problem of air pollution as a part of responding to climate change, which reflects the individual work of those companies. In this regard, participants have shed light on some initiatives but they have not discussed them in detail. In addition, many of the interviewees have indicated that their firms do have some initiatives and plans regarding the reduction policies of GHG emissions, however, the companies are still waiting for the government and its related environmental body to regulate these policies to be utilised in the next few years.

To sum up, the analysis of this matter indicates that the related industrial firms have not enough capacity to create any GHG emissions regulations and trading regimes. This was attributed to many obstacles have been discussed in previous sections. The key difficulty which is faced the entire industry is that the absence of the government action towards the engagement of such kind of those strategic policies into the entire industrial sector. However, a small work has been done by a number of the related firms which reflects their own efforts towards the problem of the air pollution. For more information with regards to the intention of those related companies in reducing their GHG emissions, the participants were asked to provide information regarding measuring the emissions in the related firms. The next section explains and discusses in detail the ability of those companies in measuring the emissions.

#### **5.5.5 MEASURING THE EMISSIONS IN THE RELATED COMPANIES**

The data in Table 5.11 demonstrates the companies' ability in measuring the emissions associated with both the use and disposal of their products. To clarify this view, respondents were required to provide their perceptions of whether they do measure the emissions

associated with both the use and disposal of products. In answering this question, the results in table 5.11 indicate that 70.3 per cent of the respondents answered ‘Yes’, in contrast, 16.2 per cent of the respondents answered ‘No’, while almost the same proportion (13.5 per cent) of the respondents provided no answer.

Based on what has been observed, the table below indicates that the overwhelming majority (70.3 per cent) of the respondents tended towards agreeing that their companies do measure the emissions associated with both the use and disposal of products. In addition, the measurement procedures of the emissions vary from one company to another. However, the overall responses indicate that the vast majority of the related firms and their plants are measuring the emissions associated with the production processes. This view has been expressed by one official who has asserted that:

‘We do measure all emissions that are associated with our production operations in all relevant plants, so we do have laboratories to analyse all raw materials utilised in the production. Moreover, we have some scientific functions that can record and account all emissions during the production process’.

**Table 5.11:** Respondents view about measuring the emissions associated with both the use and disposal of the products

Q.N	TOT. RES.	NO. RES.	USL. RES.	ANS. YES.	ANS. NO.
5	37	5	32	26	6
PERCENTAGE %	100	13.5	86.5	70.3	16.2

In addition, participants were required to provide information about whether they also measure the emissions generated by the supply chain. In the light of this, data presented in Table 5.12 shows the perceptions of the respondents and their views about the above question. Therefore, the conducted poll shows that 70.3 per cent of the respondents agreed

that their companies do measure the emissions generated by the supply chain, whereas a small proportion (10.8 per cent) of the respondents answered ‘No’, with 18.9 per cent providing no insights. In many cases, the informants have emphasised that they do measure the emissions. However, some cement companies (and their related plants, in particular) have, to some extent, not recorded and measured the emissions generated by the power operation. This view has been expressed by one of respondents in the production department where he has asserted that:

‘We do have some functions that can help to record and measure the amount of emissions which generated by the supply chain except those emissions that were generated by the power operation ....This is the task of the related exported oil firms’.

**Table 5.12:** Respondents view about measuring the emissions generated by the supply chain

Q.N	TOT. RES.	NO. RES.	USL. RES.	ANS. YES.	ANS. NO.
6	37	7	30	26	4
PERCENTAGE %	100	18.9	81.1	70.3	10.8

The conclusion drawn of this matter is that, measuring the emissions in those related companies and their relevant plants and fields are existed. However, in some particular old cement plants and a number of oil fields, the procedures of such kind of measuring these emissions are non-existent, and this was owing to the deplorable situation of these cement plants and oil fields<sup>82</sup>. This has been observed by the researcher during the visits to those cement plants and oil fields. There is more work to be done with regards to modernise those cement plants and the oil fields in order to keeping pace with the latest development in the area of protecting the environment. Hence, the government should work very hard with its

<sup>82</sup> To assert this point, appendix (G) explains the situation of such these plants.

environmental body to cope with the problem of air pollution. This can be done by adopting workable environmental guidelines and sufficient standards for those industrial companies in order to protect the environment. Also, emissions reduction programs and scenarios are the most important projects that industrial companies should comply with for the purpose of reducing emissions, and this can be done by the government support. In the light of this, the next sections will explore, explain and discuss in detail the availability of these programs and scenarios in the related industrial firms.

### **5.5.6 EMISSIONS REDUCTION PROGRAMS**

In relation to the outlook on having emissions reduction programs in place, the data presented in Table 5.13 indicates the perceptions, views and opinions of those participants who were asked whether their related firms have any emissions reduction programs in place. Based on information in the table 5.13, it can be clearly seen that the large proportion (83.7 per cent) of the respondents answered 'No', a very small percentage (10.8 per cent) of the respondents answered 'Yes', while 5.4 per cent of the respondents provided no answer.

The outcomes indicate that the majority of the related firms did not have emissions reduction programs in place; this was overwhelmingly supported by the respondent's views. In the light of this, the vast majority of the informants have expressed that so far, their related companies have not undertaken any kind of emissions reduction programs. This is not because of the related firms' ability; instead the government is the key responsible for this. This view has been expressed by one official who has asserted that:

'At the moment, we do not have any kind of emissions reduction in place, but our companies are seeking to do so. However, this issue is still under the study from the governmental side, because up until now the Libyan environmental body has not undertaken any policy regarding the Kyoto convention or even any national policy that can help to encourage companies to reduce their emissions'.



In other words, an environmentalist who is working in one of the relevant firms has expressed his valuable view by saying that:

‘The ability of reducing emissions is already existed in our company. However, we cannot estimate the costs and savings associated with achieving those emissions reduction programs, because there is no any plan from the governmental side which can explain in detail those programs, so that our company can comply with’.

**Table 5.13:** Respondents view about having emissions reduction programs in place

Q.N	TOT. RES.	NO. RES.	USL. RES.	ANS. YES.	ANS. NO.
7	37	2	35	4	31
PERCENTAGE %	100	5.4	94.5	10.8	83.7

In contrast, a small number of the selected companies do have some emissions reduction programs which recently have been implemented in association with their production process, and they are still doing their best to reduce emissions in order to protect the environment. In addition, they have attributed the non-existence of such programs to the absence of imperative roles in government policies to reduce the emissions and conserve the environment. In the light of this, one of the consultants in a cement company has asserted that ‘our company did an obvious step towards the reduction of the emissions, including the change process of generating the power by using natural gas instead of heavy oil’. This has happened in a number of oil companies, where recently they have started using the gas project utilisation to run the turbines in order to generate the power for oil production purposes; this in addition to the policy of Zero Flaring<sup>83</sup>.

In brief, the lack and the absence of the vital governmental role in implementing effective and sufficient environmental policy has negatively affected those related companies in

<sup>83</sup> For further information see the previous sections of this chapter.

having any emissions reduction programs. In this regard, the analysis of the conducted interviews has demonstrated that the majority of the interviewees have advised that the government and its related environmental body (EGA) should take serious and active action towards implementing emissions programs in the Libyan state, so that the governmental institutions and the relevant polluters can adapt those environmental policies and act effectively to prevent the environment from degradation. In addition, the respondents in the high management level have confirmed that there are a number of studied plans which seek to reduce the emissions in the related industrial firms. However, these plans are still waiting to be activated and supported by the government and its related environmental body (EGA).

### **5.5.7 EMISSIONS REDUCTION SCENARIOS**

Table 5.14 represents perceptions, views and opinions when considering scenarios involving reduction in GHG emissions. Respondents were asked whether they have considered scenarios involving reduction in GHG emissions beyond existing national, regional and international targets. In answering this question, the results in the below table demonstrate that the large proportion (78.4 per cent) of the respondents answered 'No', a small percentage (8.1 per cent) of the respondents answered 'Yes', and a small proportion (13.5 per cent) of the respondents provided no answer.

The below table obviously shows that over 78 per cent of the respondents have reported that their companies have not considered any scenario involving the reduction in GHG emissions as a vital part of achieving the national, regional and international targets. This has been attributed to the absence of the governmental targets that would enforce the industrial companies to undertake any GHG emissions reduction scenarios in order to protect the environment. To assert this, an environmental consultant has expressed his view by saying that:

‘To date, we have not complied with any national, regional and international targets, and as a result, we did not consider any scenarios regarding the reduction of GHG emissions. The reason behind that is the lack of the governmental side to adopt workable policies and targets in order to reduce emissions....although the Libyan state has signed and ratified the Kyoto Protocol, but we still are not benefiting from this convention, this is because of the lack of governmental capacity in establishing an institution that considers all procedures regarding the application of any environmental policies’.

The government neglect left a considerable burden on the related companies, whilst a number of these companies are working individually and this in turn does not achieve the desirable benefit from adopting any emissions reduction program or scenario for the purpose of protecting the environment from degradation. Hence, this requires concerted efforts by both the government and its related environmental body as the legislative component, and the entire industrial companies as the executive part.

**Table 5.14:** Respondents views about considering scenarios involving reduction in GHG emissions beyond existing national, regional and international targets

Q.N	TOT. RES.	NO. RES.	USL. RES.	ANS. YES.	ANS. NO.
8	37	5	32	3	29
PERCENTAGE %	100	13.5	86.5	8.1	78.4

However, a small proportion of the related companies have had the full capacity to reduce emissions in order to meet the national and international criteria. This can be done by the governmental support. To do so, several respondents indicated that there should be some factors provided by the government, these factors are: 1) legislative support; 2) financial support; and 3) regulatory support. In this regard, one official has emphasised that:

‘Our companies are ready to apply any instruments to meet the national, regional and international targets in reducing the emissions. This can be done by the governmental support, because applying such kind of those instruments needs to be officially approved by the government and its related environmental body’.

From what has been mentioned, it can be inferred that the absence of enforcing any emissions reduction targets from the governmental side has led to not taken any steps towards the reduction in GHG emissions from the related firms. Applying emissions reduction scenarios needs a significant effort from both the government and the industrial firms. Although, the individual work and the valuable efforts of those limited firms reflect their honest intention to protect the environment, the cooperation between both sides is essential to cope with the problem of climate change.

## **5.6 SUMMARY**

This chapter demonstrates the outcomes of the analysed data obtained from the primary and secondary sources which has been discussed in detail in the previous chapter. The organisation of this chapter was guided by the research questions and the objective of this study. By utilising the quantitative approach in the first phase, it was essentially very important to understand the relationship between the environmental quality and the economic development within the context of Libya's environment. This was primarily based on studying the nexus between CO<sub>2</sub> emissions and per capita income GDP. In this regard, the findings indicated that there was a significant effect of the income per capita GDP on the environmental pressure, which asserts that as long as the economic development increases, the environmental pressure also will increase, hence, emphasises the theoretical view of the EKC. However, the analysis does not clearly reflect the existence of the turning point in Libya. Thus, there is a need to move towards the use of cleaner technologies and adopting appropriate emissions reduction policies. In addition, studying the relation between CO<sub>2</sub> emissions and income per capita GDP is solely to justify that Libya has a substantial amount of CO<sub>2</sub> emissions, therefore, there is a need to regulate those polluters in order to protect the environment.

The second phase of this study adopted the qualitative approach in analysing the data obtained from the interviews. This phase has been developed in an attempt to provide exploratory information that could clarify and add rich value to the analysed secondary data. The perceptions, views and opinions were examined in this chapter. The outcomes of the interviews revealed that the selected Libyan industrial companies are ill-equipped in handling environmental issues with respect to environmental conservation. The political ecology of Libya's potential engagement in carbon markets through the implementation of emissions reduction policies, such as an emissions trading system, is currently complex. It was obvious that adopting an emissions trading policy is constrained by the lack of institutional capacity and a stable investment environment. This is in addition to the absence of the vital governmental role to regulate those organisations by enacting and enforcing appropriate environmental legislations to be well activated in related fields.

The findings also demonstrated that, although Libya has in recent years signed and ratified the Kyoto Protocol in 2006, unfortunately both the government (with its related environmental body) and the industrial companies have not yet acquired any benefits of the Protocol. This has been attributed to a number of barriers that have been mentioned previously, which are preventing the implementation of any environmental policy being put into practice. The most important obstacle is the absence of legislative policies, which would guarantee and ensure the preservation of the environment from degradation, especially the legislative environmental policies that are related to the industrial sectors such as the oil, cement, iron and steel sectors. In this regard, efforts have taken place in order to develop those environmental regulations. However, in fact, all efforts of developing the environmental laws and the policies were diverse efforts and cannot reach the required level of development. This leaves the environmental regulations unable to advance and upgrade the environmental performance to be in par with other developed countries.

In order for those industrial companies to effectively engage with any emissions reduction policy, the companies must fulfil certain minimum conditions. These include the compliance with regional, national and international environmental criteria, the establishment of a specific department to administer the activities of the related adapted emissions reduction policy, and the implementation of the economic and fiscal policies which will drive investment into the emissions reduction projects. In addition, the Environment General Authority has recently been established as Libya's Designated National Authority, but unfortunately the country's UNFCCC obligations remain unfulfilled. Thus, Libya will need to improve its institutional capacity, which includes broad technical competence in emissions reduction projects and related areas, as well as transparency and stability of governance.

Despite what has been found in relation to the barriers preventing the potential implementation of the emissions trading policy in the case of Libya, it can be concluded that Libya still has a great opportunity to implement an emissions trading policy. A key focus is on the oil and cement industries, which have a dominant role in the country's economic growth because of various kinds of usage of fuels as energy input in the cement industry and, as previously mentioned in chapter two, the important role of the oil industry and its major contribution to Libyan revenues and the GDP. Therefore, adopting emissions reduction policies in both the oil and cement industries, and their potential for economic development, will make a major contribution to sustainable growth in Libya, while protecting the environment from degradation.

## **CHAPTER SIX: RESEARCH CONCLUSION, RECOMMENDATIONS AND FUTURE RESEARCH**

### **6.1 INTRODUCTION**

The purpose of this chapter is to summarise and synthesise the outcomes presented in this dissertation. This chapter provides an overview of the findings, and draws some overall conclusions. The focus of this study is on emissions trading and sustainable development in the case of Libya, in particular the oil and cement industries. In addition, this chapter also provides a concise discussion of the results presented in chapter five with respect to the research impetus and scope, and the research objective and questions presented in chapter one. The conclusions and interpretations are discussed according to the influence of the Libyan environmental situation on the adoption of emissions reduction policies and its contribution to sustainable development. Policy implications and recommendations are made to provide a guideline and give insight to the industrial companies and how to handle their related environmental problems.

### **6.2 OVERVIEW OF THE CHAPTER**

This chapter is organised as follows: Sections 6.1 and 6.2 provide both the introduction and the overview of the chapter. Section 6.3 (the research impetus and scope) presents justifications and clarifications of the study. Section 6.4 provides brief conclusions relating to the research questions. Then, the discussion moves to providing an overall conclusion in section 6.5. Section 6.6 presents the contributions of the study. Sections 6.7 and 6.8 respectively introduce the policy implications and the limitations of the research. Then, section 6.9 provides some recommendations. Section 6.10 suggests a number of potential

areas in which further research could usefully the work documented in this research. Then, the final section gives a summary of this chapter.

### **6.3 THE RESEARCH IMPETUS AND SCOPE**

Despite the fact that the problem of climate change, in particular air pollution (the emissions of GHG) is often considered to be a contemporary phenomenon, Libya as a developing country has not undertaken any steps towards the reduction of its GHG emissions, particularly CO<sub>2</sub> emissions. In its fourth assessment report, the IPCC (2007c) concluded that the increase in GHG emissions in the atmosphere had led to an increase in global air and ocean temperatures, and rising sea levels due to the widespread melting of snow and ice. The report also confirms that the global warming phenomenon is occurring due to the current atmospheric concentration of CO<sub>2</sub> emissions. In this regard, considerable discussion and warning against the risk of climate change have been made by many experts. The debate has asserted that the impact of a changing climate will affect economic, social and environmental sustainability. In light of this, global efforts have been made to discover potential policies to limit and mitigate GHG emissions and contribute towards sustainable development. Reviewing the prior studies related to emissions trading policy, and the sustainable development and theoretical justifications and clarifications represented in the earlier chapters of this study, made the following important points:

**First:** The key objective of this research was to investigate the organisational or corporate context surrounding the adoption of an emissions trading policy in order to reduce GHG emissions in Libya, particularly CO<sub>2</sub> emissions, and then contribute towards sustainable development. To provide contextual completeness, the EKC, which explains the nexus between environmental quality represented in CO<sub>2</sub> emissions and the economic development represented in income per capita GDP, is deployed. Initial results of the EKC framework



indicated that the Libyan economic system is located on an unfavourable part of the inverted-U shape; therefore, investigations<sup>84</sup> along the lines of the study were warranted. In this regard, the methodology of this study has undertaken the quantitative and qualitative approaches in collecting and analysing the data. With respect to the above objective, this study hypothesised that there is a relationship between environmental quality represented in CO<sub>2</sub> emissions and economic development represented in income per capita GDP. In addition, this study made the proposition that there is a need to implement emissions reduction policies, and this may positively affect companies in both the oil and cement sectors in Libya.

**Second:** The key motivation of this research comes from the strong global desire to reduce the risk of GHG emissions. More specifically, the debate on implementing emissions reduction policies that can help to reduce GHG emissions and their environmental and economic implications on both advanced industrialised countries and developing nations. In the Libyan context, there is no known research which investigates the organisational or corporate context of the potential implementation of an emissions trading policy to affect GHG emissions reduction. Therefore, the study attempts to bridge the gaps presented in chapter three.

**Third:** There were several reasons that can justify selection of Libya as a case study for this research. These motivations are as follows:

- 1) Libya has recently been emerging from an extended period of isolation from the international community and seeking to address the very real environmental and economic concerns which affect its population. The Libyan political and economic interests with developed nations have greatly progressed since 2003, particularly with the EU and the USA. This is because Libya has undertaken positive steps towards the

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<sup>84</sup> Semi-structured interviews were conducted with the selected companies in both the Libyan oil and cement industries. For further information see chapter four.

cancellation of its nuclear program and to eradicate its weapons of mass destruction, cancellation of Libya from the list of state sponsors of terrorism followed. Also, the strong intentions of many foreign companies from various industrialised nations to invest in the Libyan oil sector as well as the construction sector were derived from the Libyan intention to shift towards the development of its infrastructure and to ensure the evolution of economic growth. However, new challenges have apparently emerged. The dramatic political upheavals of early 2011 imply that Libya will be faced with substantial challenges in terms of economic reconstruction and reorganisation, while at the same time requiring positive engagements with global markets and the international community at some future date, in order to rebuild its infrastructure and social, economic and ecological systems.

- 2) Libya has been characterised by the United Nations Development Programme and the International Monetary Fund as one of the developing countries which is attempting a rapid movement towards economic prosperity (UNDP 2007). The literature indicates that Libya is the world's 11<sup>th</sup> largest oil producer which occupies the first position of oil reserves for the oil producer's countries in Africa (EGA 2008; OPEC, 2009; Pratten & Mashat 2009). The oil industry has crude oil reserves of approximately 46.4 billion barrels, which makes Libya holds the largest proven oil reserves in Africa. However, most analysts agree that the country is still unexplored. As a result of increasing oil production and its substantial revenues that accounts for approximately 95 per cent of export earnings and contributes more than 54 per cent to the Libyan GDP, the country has a significant rise in GHG emissions, particularly CO<sub>2</sub> emissions. In this regard, oil sector accounts for approximately 70 % of the country's total emissions (CBL 2007; EGA 2003; Elhage et al. 2008). In addition, Human Development Report (2007/2008) indicates that the annual change of CO<sub>2</sub> emissions

was 4.2 per cent during the period 1990-2004. Moreover, the report finds that Libya accounts for 0.2 per cent of global emissions; an average of 9.3 tonnes of CO<sub>2</sub> per person.

- 3) Among environmental agreements, Libya has signed and ratified several conventions, such as the Vienna Convention in 1990, the United Nations Framework Convention on Climate Change in 1999 and the Kyoto Protocol in 2006 as a Non-Annex I party (UNDP 2007; UNFCCC 2003; WDI 2003). Therefore, the country has the opportunity to implement emissions reduction policies, such as an emissions trading mechanism. Furthermore, in terms of global trading Libya is one of the main members in the OPEC. It has a fundamental role in producing and exporting both the raw oil and natural gas to many advanced industrialised nations, such as the USA, the UK, France, Italy, Germany and Spain.
- 4) The study concentrates on the case of the Libyan manufacturing industry. Both the oil and cement sectors dominate a role in GHG emissions in the country because the oil sector is considered the main resource in the country with substantial contribution to its revenue. The use of fossil fuels in the cement sector as energy input is also a contributing factor. In addition to this, the cement industry is on a large scale in Libya, producing as much as 50 per cent of the total particulate emissions (Stated by the World Bank 1995, cited in Otman & Karlberg 2007, p.372). Global cement production alone plays a role in contributing to approximately 3.8 per cent of the global GHG emissions (IGCC 2007). Furthermore, the cement industry is considered to be one of the major industrial emitters of GHG emissions, particularly CO<sub>2</sub> emissions (Mehta 2002). Both the oil and cement sectors represent a substantial amount of CO<sub>2</sub> emissions in Libya coupled by source<sup>85</sup>. In this context, in 1998 the

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<sup>85</sup> For further information, see Figure 1.1 in chapter one.

WRI (2003) divided CO<sub>2</sub> emissions by source into liquid fuels, gaseous fuels, gas flaring and cement manufacturing. These sources represent the percentages of 57, 29, 10 and 4 of CO<sub>2</sub> emissions respectively. Further justification for the selection of cement industry in Libya is that all cement companies and their plants are closely located in the biggest cities such as Tripoli, Al-Khums, Zliten, Musratah, Benghazi and Darnah where the majority of the Libyan population is living. To add more clarifications regarding the environmental situation of some Libyan cement plants, appendix (G) has some photos which explain and compare the environmental situation of some cement plants in Libya with other cement plants in developed nation such as the UK.

- 5) The literature also demonstrates that Libya's economy is growing at over 6 per cent per annum and its population growth rate is one of the fastest in the world, which accounts for about 2.9 per cent during the period 1975-2005 (CBL 2007; IMF, 2008; UNDP 2007). According to the National Development Plan (2007), working to a budget of US\$120 billion for 2008-2012, is calling for massive infrastructure expansion involving the construction of new housing units, new airports, roads, schools and hospitals. This is placing greater demands on the cement industry which is already under pressure to meet the government's target of doubling production to 15 million tonnes per annum by 2012 (CBL 2007). Therefore, this substantial production leads to release of huge amount of CO<sub>2</sub> emissions which in turn will affect the environment.

It is worth mentioning that oil production and its contribution to the Libyan GDP has considerably increased. In addition to this, there is a significant increase in cement production as one of the key factors towards the rapid economic development. This substantial production from both the oil and cement sectors has a significant amount of releasing CO<sub>2</sub> emissions. Therefore, there is a need to implement emissions reduction policies in Libya in

order to reduce GHG emissions, particularly CO<sub>2</sub> emissions and then contribute towards sustainable development. Furthermore, in relation to GHG emissions, CO<sub>2</sub> emissions in particular, little or limited literature has been produced in developing countries. Thus, the present research seeks to bridge the gaps in the literature and provides the policy-makers with insights in order to achieve their GHG emissions reduction and attain long-term environmental and economic objectives.

## **6.4 CONCLUSIONS RELATED TO THE RESEARCH QUESTIONS**

This study targets to examine the various aspects of the environmental quality (represented in CO<sub>2</sub> emissions) and economic development (represented in income per capita GDP) in Libya. The key objective of this research was based on investigating the organisational or corporate context surrounding the potential adoption of emissions trading in order to reduce GHG emissions in Libya, particularly CO<sub>2</sub> emissions and then contribute towards sustainable development. Four research questions were explored in order to achieve the above objectives.

### **6.4.1 THE FIRST RESEARCH QUESTION**

In chapter one, the first research question to be addressed was outlined as follows:

***“What is the relationship between the environmental quality and economic development in the case of Libya?”*** (This sets the scene for the main research question).

The first phase of this research adopted a quantitative approach (a regression analysis) to analyse the secondary data gathered. Consideration with the first question, the nexus between environmental quality represented in CO<sub>2</sub> emissions and economic development represented in income per capita GDP was measured for a span of 35 years, between (1975 and 2009) using the theoretical framework of the EKC analysis in order to test the hypothesis drawn in chapter one.

The outcomes of the EKC analysis demonstrated that Libya is critically located in an unfavourable part of the EKC model (position of the inverted-U shape). Based on the oil revenues, the Libyan economy has significantly changed. However, the means of the production in Libya did not take into account the negative impact on the environment. The increase in production (oil and cement) has resulted in increased pollution and environmental degradation. This means that a greater economic activity raises the demand for all inputs, increasing emissions. In the early stages of Libyan economic development, there was, to some extent, positive relationship between income per capita GDP and the environmental pressure (CO<sub>2</sub> emissions), which partly asserts the early stage of the EKC hypothesis<sup>86</sup>. However, in the case of Libya the analysis does not clearly reflect the later stage of the hypothesis.

The period of 2008–2009 seems to be the beginning of the ‘composition effect’ which may have a positive impact on the environment. Although it has witnessed a slight improvement in the environmental quality, there is a need to move towards the ‘technique effect’, so that the change will move to the use of cleaner technologies and adopting appropriate emissions reduction policies. This is solely to justify that Libya has a substantial amount of CO<sub>2</sub> emissions, therefore, there is a need to regulate those polluters in order to protect the environment.

The results drawn from Figure 5.1 illustrate that there is a slight non-linear, functional relationship between air pollution (CO<sub>2</sub> emissions) and income growth (income per capita GDP) in Libya. However, Figure 5.2 demonstrates the reality that the environmental degradation is continually increasing with the increase of the economic growth in Libya, and both CO<sub>2</sub> emissions and GDP per capita curves are close to each other. In addition, Figure 5.2 shows that the fluctuated decline of CO<sub>2</sub> emissions from the late 1970s until the late 1980s is

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<sup>86</sup> For further information regarding the EKC hypothesis see chapter three (Review of the Related Literature).

due to the financial crisis in the related period with the extremely low energy prices that affected productivity during that period. Moreover, due to the lack of implementing such environmental regulations and the use of technological innovations, the analysis does not clearly reflect the existence of the turning point in Libya. Therefore, the implementation of environmental regulations in Libya may improve the environmental quality in the long-run and in this regard developed nations can play a fundamental role by transferring their technologies in order to protect the environment.

#### **6.4.2 THE SECOND RESEARCH QUESTION**

The second research question to be addressed was as follows:

*“How and to what extent can the implementation of an emission trading policy help to promote the reduction of GHG emissions, particularly CO<sub>2</sub> emissions and contribute towards sustainable development in Libya, particularly in the oil and cement industries?”*

The second phase of this study has adopted a qualitative approach in analysing the data obtained from the conducted interviews. This approach has been applied to answer each of RQ2, RQ3 and RQ4. The perceptions, views and opinions of the participants were examined in this study. The outcomes of the conducted interviews disclosed that the selected Libyan industrial companies are ill-equipped to handle environmental issues with respect to the environmental conservation. The political ecology of Libya’s potential engagement in carbon markets through the implementation of emissions reduction policies, such as an emissions trading system, is currently complex. It was obvious the adopting emissions trading policy constrained by the lack of institutional capacity and a stable investment environment, this in addition to the absence of the vital governmental role in regulating those organisations by enacting and enforcing appropriate environmental legislations to be well activated in related fields.

With respect to implementing emissions reduction policies, such as an emissions trading policy, it can be concluded that although Libya signed and ratified the Kyoto Protocol in 2006, unfortunately both the government and the organisations have not acquired any advantages of this convention. This means that there must be some barriers facing this policy or any other environmental policies to be put into practice. Owing to the obstacles that are faced both, the government represented in the environmental body (EGA) and the related industrial organisations, it was obviously noted during the interviews that no action has been taken by the government and the organisations towards the emissions trading policy. The core of these impediments represented in the following points:

- 1) Low level of awareness and capacity amongst the public, private and industrial sectors about adopting emissions trading policy and its opportunities towards sustainable development.
- 2) The lack of qualified scientific expertise working in the environmental body.
- 3) Lack of full awareness and understanding of what is going on in the world in relation to the latest environmental issues to keep pace with the technical development, which would reduce the environmental impact.
- 4) A long time is required for permissions to emissions reduction projects.
- 5) Lack of financial and technical sources to implement emissions reduction policies, such as emissions trading policy.
- 6) Lack of enough baseline data.
- 7) Lack of the direct contact with the international environmental organisations in order to communicate and be conscious of the latest developments in the environmental reduction policies and their international criteria.
- 8) The absence of the legislative policies which would guarantee and ensure the preservation of the environment from the degradation, especially the legislative



environmental policies that are related to the industrial sectors such as oil, cement, iron and steel sectors.

Participants who are working as environmental experts in the selected companies have contended that a major challenge faces the adoption of an emissions trading policy in the industrial sector. This challenge is that, with the current capabilities, it is difficult to achieve the emissions reductions that result from the production process and simultaneously maintaining the level of the production.

Throughout the presentation of the literature review chapter, it became clear that reducing GHG emissions is one of the key concerns in many international organisations for the purpose of achieving sustainable development. In addition, limiting climate change and increasing the use of clean energy is one of the biggest challenges to sustainable development. In light of this, interviewees were indirectly asked to demonstrate their views, opinions and perceptions regarding the application of an emissions trading policy and its contribution towards sustainable development. The overall perceptions of the participants throughout the presentation of conducted interviews revealed that an emissions trading policy may have a significant effect on sustainable development in Libya.

All participants have emphasised that the country is in a development stage. Both the oil and cement sectors play a significant role in GHG emissions because the oil industry is considered the key resource in the country, giving a substantial revenue. In addition, the current massive infrastructure expansion in the country is placing greater demand on the cement industry to meet the requirements of the development. Hence, these facts demonstrate that the Libyan government should pay attention towards the environmental conservation as it is considered to be one of the key aspects in fulfilling the sustainable development.

Owing to the country's economic growth and its strategic geographical location, the majority of the interviewees strongly support the idea of implementing an emissions trading policy

throughout the country. In addition, the government must ensure the implementation of the emissions trading policy because it is not an economically weak state and, therefore, the country can transfer technology, increase the use of clean energy and increase clean production through investment in new technologies. Hence, maintaining the level of the gas emissions and seeking to sell or export our emissions permits either in the national or international markets.

Interviews with several departments in the selected companies reveal that, the challenge of climate change, which will aid the attainment of sustainable development, should be tackled in a way that is consistent with competitiveness, development and clean energy security. This can be done through the development of adjustment strategies at a regional, national and international level. In addition, all relevant emitting firms need to participate and should share the burden of GHG reduction. In this regard, an emissions trading policy should be robust, maintain the competitiveness of the national firms and support investment throughout the country. To achieve this, the majority of the respondents have emphasised the following points:

- 1) Greater use of EIA, before conducting any kind of emissions reduction projects.
- 2) Determine the value of emissions and stability of the market.
- 3) More extensive and rigorous usage of high quality cost benefit analysis so as to facilitate informed decision-making, notably in the environmental context.
- 4) Regular and ongoing policy evaluation.
- 5) More extensive use of market-based instruments, which contribute to linking environmental protection and economic growth.

The analyses of the conduct interviews with respect to the second research question have disclosed that the environmental program in Libya is currently overseen by the EGA which aims to promote national policies to protect the environment and uses an integrated approach

to link economic, social and environmental policies. Therefore, companies are increasingly concerned with achieving and demonstrating sound environmental performance by controlling the impact of their activities, products or services on the environment. The actual implementation of strategies and methods requires minimising environmental impacts of the industries' operations. However, it is apparently difficult to effectively implement an environmental standard without strong legislative backing from the government.

It can also be inferred from the conducted interviews that the application of an emissions trading policy may have a significant effect if the policy is properly designed and effectively implemented by strong environmental law. An interviewee agreed that:

'Involving Libya in emissions trading through the negotiation of emission budgets would provide the state with substantial capital inflows through emissions trading, therefore stimulating their economic growth. It would also allow the World to take advantage of the fact that the country is building its infrastructure, which would determine long term paths of GHG emissions'.

Throughout this particular theme, the analysis of those interviews discloses that the potential benefits of such a system for the country would be as follows:

- 1) To provide the country with substantial capital inflows, and stimulate its economic growth.
- 2) To allow the country to achieve its Kyoto commitments at the lowest possible cost.
- 3) To achieve global participation while reducing the risk of air pollution.

### **6.4.3 THE THIRD RESEARCH QUESTION**

The third research question to be addressed was outlined as follows:

*Does the use of an emissions trading policy have the opportunity to stimulate innovation to address emissions problems in Libya, particularly oil and cement industries?*

With respect to the above question and through the analysis of the interviews regarding emissions trading and innovation opportunities, the perceptions of participants demonstrates that despite the fact that the Libyan government has so far not enforced the industrial

companies to comply with any reduction targets. The majority of interviewees have frequently stated that an emissions trading system promotes technical innovation. This view was expressed in the following response, 'Emissions trading system will drive positive opportunities to the industrial sector and their related companies and this will contribute to reduce air pollution and remain competitive'. Similarly, an interviewee also stated that, 'Emissions trading system encourages the investment in new technologies in order to have clean production and maintain the level of the reduction limits'. Further statements were made, 'Emissions trading system does a great job in stimulating innovation to address environmental concerns'. In other words:

'If the government has imposed emissions reduction targets, emissions trading system would tend to encourage the innovation and lowering the cost of compliance to government's reduction targets through the investment in new technologies'.

Within the trade-off process, by selling or purchasing the extra reduction allowances, all polluters purchase allowances, because each tonne of pollution can create incentives to innovate and reduce pollution. In this regard, during the presentation of the conducted interviews, the outcomes indicate that not only does an emissions trading system fosters the innovations, but it also creates economic incentives. This has been stated by one of environmental experts working in one of the selected firms. The respondent stated that, 'Emissions trading system can create economic incentives and therefore stimulating innovations'. In other words: 'By selling and buying emissions credits, this would create an economic incentive, therefore, encouraging companies in the investment of new technologies'

Many respondents have agreed that innovation can perform one of two basic functions: it can lower the cost of the product or increase its quality. In light of this, one of the respondents has expressed the following statement:

‘New technical gas turbines which are operating by natural gas, for example, cost much more than traditional turbines that are operating by the heavy oil, but offer a much higher quality product with less environmental impact’.

As a result, innovation can reduce the cost of pollution control or make it possible to perform basic economic functions with less pollution than the existing approaches. In other words, environmental innovations can either offer qualitatively better environmental results or reduce the cost of achieving a particular result.

Interviewees have agreed that technological innovation as a result from emissions trading system will also perform an important political function—making progress possible where otherwise it could not occur. This has been inferred by the following expression which has been expressed by one of the senior decision-makers:

‘The climate change regime, for instance, assumes that the richer countries will develop and share the technologies that will make it possible for relatively poor countries to enjoy a good quality of life and contribute to efforts to address climate change. Therefore, absent this kind of developed country leadership, advanced nations may have great difficulty persuading tomorrow’s greatest GHG emitters sectors, such as oil and cement, to reduce emissions in Libya to tolerable levels, if the government stands without doing anything about it’.

In relation to this, many respondents have emphasised that the government should reframe its environmental policy in order to combat the problem of air pollution. An interviewee has responded that:

‘We need to reframe the environmental policy debate around the question of addressing the economic dynamics of the environmental law. This involves, among other things, asking how we can design environmental law that stimulates environmental innovation effectively as we currently stimulate material innovation (some of which is environmentally destructive)’.

In light of this, environmental policy analysts in the related firms generally agree upon the desirability of stimulating technological innovation to improve the environment.

The outcomes also reveal that the major challenge regarding investment in new technologies is that, the capacity of the government to support, encourage and push the industrial firms to be a clean production. However, it is clear that the overview of the participants is completely

positive towards an emissions trading system and its innovation opportunities. There is a great potential to reduce emissions in contrast to an increased investment in modern technologies and to increase the production. Therefore, the Libyan government and its related environmental body (EGA) should adopt environmental policies that can effectively operate with its related industries in order to address environmental concerns.

#### **6.4.4 THE FOURTH RESEARCH QUESTION**

The fourth research question to be addressed was outlined as follows:

*What are the environmental and economic implications of adapting an emissions trading programme in the case of Libya?*

This question can be divided into two parts:

##### ***First: The Environmental Implications***

Despite the abundance of environmental laws at national level, as indicated in chapter two, it is clear that there has been a lack in specific policies in relation to the protection of the environment, particularly the problem of air pollution. According to the review of the environmental body and committees responsible for environmental protection, the bodies with the greatest responsibility in this area are the EGA and the Ministry of Industry. These bodies operate at national level and, as it has seen, there is no requirement from them for any study such as an EIA or Strategic Environmental Assessment to be carried out before the local project is approved. At the local level of the environmental body there has been no clear strategy to translate the plans, policies and programs of these bodies into effective action in regard to the related industrial companies.

This has been expressed by a number of managers working at the environment, production and finance departments, where one official stated that:

‘Environmental policies, plans and regulations which exist are not enough and there is a need for local plans, programmes and policies to manage and protect

the environment. This should include implementation mechanisms, which require the cooperation and integration of other responsible government. The aim should be to provide the balance between the economic development and the protection of the environment, to achieve sustainable development in the state’.

Another official stated that, ‘the environmental policies need operational systems and to be integrated with comprehensive environmental planning strategies’. Yet another official stated that, ‘the existing environmental policies throughout the country do not reduce or stop the loss of the natural resources. This required an implementation system, linked to the existing development processes’.

In addition, policies relate to the general environment and the protection of the natural resources, unfortunately these have not yet been applied. There are, for example, studies identifying sensitive areas where natural resources and the environment should receive special attention. This has been attributed to the lack of studies, whether of a quantitative or qualitative type on the Libyan natural and ecological resources, which could help planning for current and future activities in a sustainable way.

With respect to the environmental implications theme, the outcomes of the conducted interviews demonstrated that the major environmental implications which constrain the adaptation to the emissions trading program in the case of Libya are attributed to the following points:

- 1) Lack of Environmental legislations, where a number of the respondents in the environmental department (managers of the environmental departments) in the selected firms have confirmed that there is a lack of legal and professional standards, guidelines and requirements which have been established by the Libyan environmental body (EGA) and the related ministries. This in turn reflects the poor of implementing emissions reduction policies in the industrial companies. Thus, there is

a need for guidelines and standards to close this gap and to show how those companies should be involved in protecting the environment.

- 2) The failure of policy-makers to form adequate regulations to reduce environmental damage—this has been attributed to insufficient staff who specialise in environmental planning studies. In this regard, some of the consultants have indeed asserted the lack of sufficient staff in the environmental bodies and the related ministries, which made it difficult to find the personnel qualified to carry out such environmental studies.
- 3) Poor environmental management, where the majority of the interviewees have in fact asserted the lack of administrative stability in a variety of the relevant firms and the Libyan environmental body. This may result in the incapacity to complete replacement and development programs and follow up the requirements of the adopted environmental criteria.

In addition, one of the environmental experts who is currently working in one of the selected firms, and who was the head of the National Activity Section in the EGA has emphasised that the main reasons behind the inability of the Authority to implement its part in environmental protection are as follows: firstly, administrative instability within the Authority<sup>87</sup> in its short life (since 1998), rendering it extremely difficult to draw up a fixed work strategy; and secondly, lack of specialist technical staff in this field—the Authority depends on specialist and scientific assistance from outside the Authority, on a part-time basis, to perform its tasks; and finally, scarce and limited financial means.

### ***Second: The Economic Implications***

The argument in chapter two indicated that the economic system in Libya was based on the socialist-orientation of Qathafi's Green Book. It is unique in many aspects accompanied by peculiar characteristics of its political regime. It is neither bourgeois political economy nor

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<sup>87</sup> This is in addition to the instability in dependency, where it was established in 1998 as responsible to the GP Committee. However, in 2001, EGA became directly responsible to the GP Congress.



classical political economy. In this regard, the basic characteristics of both systems are not applicable to the Libyan economy system<sup>88</sup>. Therefore, the analysis of the conducted interviews demonstrated that the Libyan economic system was not sufficient to carry out such emissions reduction policies, because the economic structure in Libya was very complicated and lacks many vital means that can contribute to adapt to emissions reduction policies.

Economic constraints have been attributed to many aspects. One of the limitations is that, the domination of the public sector has led to the delay in the Libyan economic reforms, which in turn has contributed to the absence of the private sector and competitive market institutions.

This view has been expressed in the following statement:

‘The Libyan market was controlled by the government, where the structure of the market was absolute monopoly which is difficult for the competition to be existed between the industrial firms. This in turn made it difficult for these firms to invest in new technologies to reduce emissions and save credits of emissions in order to be sold at either the national or international markets’.

Another limitation can be attributed to three key elements:

- 1- The absence of the encouragement of the material incentives and profit.
- 2- The lack of openness to the foreign investment and technology transfer and the development within the country.
- 3- The absence of a stock market.

During the presentation of the conducted interviews, one of the senior-decision makers in answering the related questions has stated that ‘The main objective of such enterprises is to offer services and goods to a public rather than to make a profit’. In other words, the respondent stated that ‘profit maximisation has a lower priority for Libyan companies’. So, maximising their market value is not considered as the companies’ main objective, especially in the case of the absence of a stock market (absence of the competition).

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<sup>88</sup> The private ownership is the characteristic of western societies, whereas, eastern societies are characterised by the complete opposite.

The results of the interviews indicated that a number of respondents are believed that the emissions trading program is potentially a vehicle for attracting new foreign investment and technology transfer, for building institutions involved in climate change mitigation and adaptation, and for different types of public and private actors and entities to increase their awareness of technical and economic aspects of mitigation strategies. However, foreign direct investment is more likely to flow to countries with stable governance conditions, strong legal and contractual environments, macro-economic stability, a skilled workforce and institutional capacity. Unfortunately, these elements are rarely or sometimes non-existent in the case of Libya.

In addition, the results of the interviews indicated that emissions reduction projects development is constrained by the lack of institutional capacity and a stable investment environment. For instance, at present it is difficult to establish any national allocation institution because of the inconsistency between the related ministries and their institutions in the Libyan government. This view was expressed in the following statement, ‘Because of the conflicts between the related environmental institutions, this creates weak institutional capacity to the adoption of new technologies’. In other words, the interviews revealed that the major challenge regarding the investment in new technologies is that the capacity of the government to support, encourage and push the industrial sector to be clean production.

## **6.5 THE OVERALL CONCLUSION**

The findings demonstrated that, although Libya has in recent years signed and ratified the Kyoto Protocol in 2006. However, both the government with its related environmental body (EGA) and the industrial companies have not seen any benefits of the Protocol. This has been attributed to a number of barriers<sup>89</sup> are facing the implementation of any environmental

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<sup>89</sup> For more information regarding those obstacles, see chapter five.

policy put into practice. The most important obstacle was the absence of the legislative policies which would guarantee and ensure the preservation of the environment from the degradation, especially the legislative environmental policies that are related to the industrial sectors such as oil, cement, iron and steel sectors. In this regard, efforts have been made to develop those environmental regulations. However, all efforts of developing the environmental laws and the policies were diverse and cannot reach the required level of development. This leaves the environmental regulations unable to advance and upgrade the environmental performance to be in par with other developed countries.

In light of this, the outcome of the conducted interviews indicates that not having emissions reduction programs in place in the selected companies was overwhelmingly supported by the respondents (over 83 per cent). In relation to this, the vast majority of the informants have expressed that so far, their related companies have not undertaken any kind of emissions reduction programs. This is not because of the companies' abilities; instead the governmental side holds the key responsibility. In addition, the results show that over 78 per cent of the respondents have reported that their companies have not as yet considered any scenarios involving the reduction in GHG emissions as a vital part of achieving the national, regional and international targets. This has been attributed to the absence of the governmental targets that would enforce the industrial companies to undertake any GHG emissions reduction scenarios in order to protect the environment.

As a result of the absence of emissions reduction targets, the results of the conducted interviews demonstrate that over 62 per cent of the respondents have reported that their companies have not considered any emissions reduction targets in response to climate change. The majority of the companies have not so far considered any strategic measurement regarding the reduction targets, because it is yet to be mandated from the related governments. This has been attributed to the absence of any emissions reduction targets or

even any emissions reduction policies which must be enforced by the government or the Libyan environmental body (EGA).

As a part in reducing carbon emissions and/or energy consumption, the selected companies have not developed and invested in any renewable energy generating technologies. The results demonstrated that the large majority of the respondents (more than 70 per cent) have asserted that their firms did not take any actions towards reducing carbon emissions/energy consumption, and they have not yet developed and invested in any renewable energy generating technologies. The reasons behind that are attributed to the weakness of the government's role to drive the industrial companies towards the compliance with the national and international environmental criteria to reduce carbon emissions. In addition, the complete reliance on the governmental subsidies has weakened the relevant companies' capabilities to develop and invest in new technologies, because of the domination of public enterprises. However, a small number of those selected companies have undertaken some steps towards reducing their GHG emissions which reflect their individual work.

Moreover, the outcomes indicated that over 91 per cent of the respondents have asserted that their companies did not have any strategy in relation to emerging GHG emissions regulation and trading regimes. The analysis gives a strong impression that there are indications of overall weaknesses in the current status regarding any attempts to operate the GHG emissions regulation and the engagement in any emissions trading regimes, in particular the EU emissions trading scheme. This has been attributed to a number of obstacles that have been mentioned in chapter five. The key factor which is associated with the relevant firms in order to engage into the GHG emissions regulation and trading regimes is a result of the government not yet taking any serious action towards such strategic policies.

In order for those industrial companies to effectively engage with any emissions reduction policy, the companies must fulfil certain minimum conditions. These include the compliance

with regional, national and international environmental criteria, the establishment of specific departments to administer the activities of the related adapted emissions reduction policy, and the implementation of the economic and fiscal policies which will drive investment in the emissions reduction projects. In addition, the EGA has recently been established as Libya's Designated National Authority, but unfortunately the country's UNFCCC obligations remain unfulfilled. Thus, Libya will need to improve its institutional capacity, which includes broad technical competence in emissions reduction projects and related areas, as well as transparency and stability of governance.

Despite the obstacles in respect to the potential implementation of the emissions trading policy in the case of Libya, the results indicated that Libya still has a great opportunity to implement the emissions trading policy in the country. A key focus is on the oil and cement industries which have a dominant role in the country's economic growth because of various kinds of usage of fuels as energy input in the cement industry and, as previously mentioned in chapter two, the important role of the oil industry and its major contribution to Libyan revenues and the GDP. Therefore, adopting emissions reduction policies in both the oil and cement industries and their potential for economic development will make a major contribution to the sustainable growth in Libya, while protecting the environment from degradation.

New forces, circumstances and issues are affecting the lives and futures of people in the Middle East and North Africa, and public policy in the region must consider these forces as leaders choose strategic paths toward the future. Applying emissions reduction policies represents an opportunity to encourage emission reduction and sustainable development activities not only in the hydrocarbon sector but in other priority areas including cement sector, waste management and renewable energy generation.

As a result of the current Middle East Revolutions, particularly in Libya, the Arab Spring will yield a political order that is not only more transparent and accountable but more responsive to popular demands for responsible stewardship of the environment. This is the very outcome that the international community should help its regional partners to achieve. In this regard, the dramatic political upheavals of early 2011 imply that Libya will be faced with substantial challenges in terms of economic reconstruction and reorganisation, while at the same time requiring positive engagements with global markets and the international community at some future date, in order to rebuild its infrastructure and social, economic and ecological systems. Libya is endowed with natural resources that make renewable energy projects feasible. There is potential for investment in large-scale projects that would provide a range of economic benefits including employment and education opportunities; this in addition to some environmental advantages. There is also potential for project development in the areas of industrial companies, waste management and transport infrastructure. However, the nature of the country's political system and economic structures, its inconsistent policy history, uncertain governance and its reliance on the hydrocarbon sector imply that successful engagement in emissions reduction policies might be difficult at the present time. Prospects for developing emissions reduction projects in the foreseeable future were extremely poor in the Qathafi regime. If the current civil conflict results in positive regime change, the international community should consider the emissions reduction projects as a potentially valuable component of Libya's reconstruction and development strategy. The goals of the UNFCCC, including emission reductions, institutional capacity building and technical development, can be facilitated through international support from developed nations, and the emissions trading policy could also be employed as one mechanism to support the people of Libya in the future.

## 6.6 CONTRIBUTION OF THE STUDY

In light of the study's remarks, the following points are the study's main contributions:

**First:** Methodologically and methodically, the study was reinforced by the importance of and the need to conduct in depth field research, as the environmental situation in Libya still needs much more study and research.

**Second:** To extend the limited amount of research on the environmental conservation in Libya by providing a more comprehensive of perceptions of the stakeholders in Libya.

**Third:** Although there are huge amount of research on the environmental quality, most of the previous studies were quantitative. This study is one of the few qualitative and quantitative researches about the environmental protection and sustainable development and it is the first in Libya.

**Fourth:** This study contributed to the limited studies on the environmental policies and sustainable development conducted on Arab countries in general and within the Libyan socialist and industrial contexts in particular.

**Fifth:** This study provides an understanding of the influences of political, social, industrial and economical contexts on the environmental protection in Libya.

**Sixth:** The observations of this study complemented previous studies in their attempt to understand and theorise the current Libyan environmental situation.

**Seventh:** The study contributed to knowledge by including the environmental protection in the debate around Libyan environmental practices.

**Eighth:** The study is the first that links the environmental conservation with sustainable development that is the most important goal for Libya's future.

## 6.7 POLICY IMPLICATIONS

The main observations of this study indicate the scarcity of legal and professional standards and guidelines, along with the lack of expertise, qualification and also training managers in the field of protecting the environment have led to low levels of environmental conservation in Libya. Therefore, the major policy implications for raising the level of protection of the environment by the Libyan government and its environmental body in addition to the related industrial companies can be summarised as follows:

**First:** Guidelines and standards should be issued by the EGA, the main Libyan environmental body concerning protecting the environment on the form and content of best practice to persuade the relevant companies to be more involved in adapting emissions reduction policies in their projects. This facilitates the comparability across companies over time for the purpose of economic development plans and maintaining the level of environment.

**Second:** Academics and experts in the environmental conservation field who work in the relevant environmental institutions can affect those industrial companies in handling the relevant environmental data. They can carry and enter into a dialogue with practitioners and officials concerned. Therefore, this facilitates the procedures of obtaining all the necessary data to be ready for the purpose of submitting the National Communication Report to the UNFCCC.

**Third:** There is a necessity to give the current managers the chance to take part in many training courses and activities regarding the administration, leading personal, social, economic and environmental issues, including emissions reduction policies, environmental management system and sustainable development. This will help them to make direct contact with any new theories and administrative opinions in those fields which help them to conduct their activities with skill and accuracy. In addition, workers who are working in the field should also be targeted by the training courses which relate to environmental issues.



## 6.8 LIMITATIONS OF RESEARCH

The study was conducted in Libya. The rationale for choosing Libya was because the country is one of the developing nations that has not undertaken any steps towards reducing the environmental damage, in particular the problem of air pollution. However, there are certain factors that researchers should take into consideration when methods and techniques for the study are being selected. Although every effort has been made to conduct comprehensive and detailed research analysis in this thesis remains subject to a number of limitations. These limitations should be considered when interpreting the study's observations. For more information, these limitations are summarised as follows:

**First:** The majority of all participants in this study were Libyan. Therefore, the outcomes of this study are limited solely to Libya because it only reflects the views of the participants living in Libya. These views, opinions and perceptions may be influenced by the culture, regulations and the system of the country. Thus, the findings of this study may not be capable of being extended or generalised to other countries.

**Second:** Due to time limitations, the researcher could not use direct observation to collect data, so the study uses in-depth interviews as the key method of data collection in the qualitative approach. Also, as the researcher lives and studies in Australia, which is a great distance from Libya, access, time, cost constraints and the amount of work involved prevented the researcher from expanding the research setting.

**Third:** Interviewing candidates requires permission and consent from individuals or their organisations. This issue drove the researcher to use some personal connections in government departments and organisations in order for these interviews to be conducted. Hence the potential for some bias was unavoidable.

**Fourth:** The research is a small-scale evaluation study, in which the research was undertaken for a period of three years, this period was insufficient to indicate the real effects of implementing the environmental policies whether at the present or in the future.

**Fifth:** The study was primarily concerned with the Libyan industrial companies (oil and cement companies) and their efforts towards the problem of the environmental degradation. Hence, the generalisations might therefore be limited merely to manufacturing companies (oil and cement companies). However, in seeking to understand the attitudes of managers toward the environmental conservation, the researcher contacted the senior decision-makers (General Managers) and the Directors of several functional departments such as environment, production, energy, finance and sales. In addition, experts and consultants working in the related companies were chosen. In this regard, access, time and cost constraints prevented the researcher from expanding the research to managers of other departments who could have a part in the issues of environmental policies. Thus, any findings for using these particular managerial perspectives might therefore be limited to this particular sample and no claims can be made for their generalisability.

## **6.9 RECOMMENDATIONS**

Based on the study's findings, some recommendations are made in relation to environmental conservation within the Libyan context. These recommendations are summarised as follows:

**First:** to the current situation, environmental quality in Libya will improve for the next five to fifteen years, if such emissions reduction policies are implemented. Poor countries with weak regulatory institutions can reduce pollution significantly by following a few basic principles. The first principle is focus. In many areas, relatively few sources are responsible for most of the pollution. Therefore, emissions can be significantly reduced by targeting regulatory monitoring and enforcement on those dominant sources. Another principle is that countries

whose economic policies induce a rapid expansion of income and employment may experience severe environmental degradation unless appropriate environmental regulations are enacted and enforced. Furthermore, Libya should enact and enforce environmental regulations in order to reduce environmental damage. In this case, economic analysis can be employed to justify environmental regulatory policies that result in a flatter and lower environmental Kuznets curve.

**Second:** In order to improve the environmental status and the environmental policy practices, the Libyan environmental body should develop and adopt emissions reduction policies and standards that are suitable for the country's environment. These standards will provide guidance and rules for all related parties which have any interest or concern in the environmental conservation.

Adopting emissions reduction policies can help the country in eliminating the risk of environmental degradation. In this regard, the government should take part in controlling all activities that may negatively affect the environment. In addition, the government (the environmental body in Libya) should contact the developed countries in order to gain more understanding regarding the latest environmental policies including the emissions reduction policies and the environmental standards which help in reducing the gas emissions, particularly CO<sub>2</sub> emissions. Moreover, in order to improve the work and maintain the environmental conservation, efforts should be spent to co-ordinate cooperation between the Libyan environmental body and the related companies to enhance the work and eliminate all obstacles that may face the adopted environmental standards and/or the selected emissions reduction policy.

**Third:** The future vision of the potential adoption of emissions trading policy in the Libyan state is totally positive if the country has effective and proper environmental legislations. In

this context, there should be some priorities that the government must comply with. These priorities are stated as follows:

- 1) Improving and enhancing the institutional capacity of EGA.
- 2) Enhancing the national coordination on the environmental issues.
- 3) Enhancing the international cooperation regarding the emissions reduction policies that would reduce the environmental degradation.
- 4) Require the companies to follow the environmental legislation and to ensure that all required companies are complying with those regulations.

**Fourth:** To overcome the obstacles that have raised in the findings chapter. Concern should be focused on the following:

- 1) Appraising and reviewing the rules and regulations pertaining to the environment, to its management and to the safeguarding of natural resources. If necessary, these rules and regulations were to be updated and published in a comprehensive way and adhered to in all development enterprises.
- 2) Producing a set of criteria to assess in particular the impact of projects. This would lay down what yardsticks should apply in the procedures to be followed before, during and after the undertaking of the evaluation studies in relation to projects.
- 3) Setting up hazardous and toxic materials, coordinating work between government agencies and industry in order to improve the handling, storage and disposal of such materials.
- 4) Improving environmental control by industry and ensuring that industrialists put environmental measures into application.
- 5) Adherence to all regional, national and international commitments by Libyan government in setting up environmental rules and regulations and in creating and carrying through environmental policies.

- 6) Specifying and defining all means of cooperation between government bodies and the EGA in relation to environmental conservation, and the strengthening of EGA's powers in this area.

## **6.10 SUGGESTIONS FOR FUTURE RESEARCH**

This is the first study to be carried out on investigating the potential implementation of emissions reduction policies such as an emissions trading policy in Libyan industrial companies. Thus, the outcomes of this study raise many research possibilities related to the environmental protection policies. Also, the limitation of the current research can be at least partly overcome by suggesting future research. These suggestions are outlined as follows:

**First:** A study to investigate the role played by the professional bodies, central authorities and educational institutions in developing the environmental protection policies in Libya, and how it can be done, may be considered valuable and needs the urgent attention of the future researchers.

**Second:** A longitudinal study based on a reasonably large sample including the small and medium industrial companies and the non-industrial companies in addition to the transportation and the power generation sectors is needed for future researchers. Moreover, expanding the sample units so that it is not only limited to the managers and the consultants' perspectives, but also other employees in Libya may be considered worthwhile and needs the urgent attention of future researchers.

**Third:** Similar studies could be undertaken on the other Arabic countries as well as the North African region, and future comparative studies between these countries could be made on the extent implementing emissions reduction policies. Such studies could give better understanding of those environmental policies and their practices in those countries and

provide more support to improve the environmental quality and protecting the environment from degradation.

## **6.11 SUMMARY**

This chapter has concluded with the findings in this study with respect to research questions. Overall, the thesis has made a contribution both at a theoretical and practical level in the area of protecting the environment and the emissions reduction policies. In addition, the study has attempted to bridge some gaps raised in the literature chapter. The work has achieved its objective, has made policy recommendations and has raised issues for future research in the area.

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## **APPENDIXES**

**Appendix (A):** Interviews Consent Form

**Appendix (B):** Interviews Questions in English Language

**Appendix (C):** Interviews Questions in Arabic Language

**Appendix (D):** Letter of Ethical Clearance

**Appendix (E):** Sample of Interviews Transcription

**Appendix (F):** Data and Sources collection, Data Analysis Strategy and  
Categorisation of the Findings

**Appendix (G):** The Autocorrelation Results of Both Equations 2 and 3

**Appendix (H):** Some Photos that Compare the Status of the Cement Plants  
between Libya and the United Kingdom

## APPENDIX (A): Interviews Consent Form



*Sami Shibani*  
*PhD Candidate*  
*School of Accounting, Economics & finance*  
*University of Southern Queensland*  
*West St. Toowoomba, Qld 4350 Australia*  
*E-mail: [shibani@usq.edu.au](mailto:shibani@usq.edu.au)*

Dear (Participants),

As a PhD candidate at University of Southern Queensland, Toowoomba. I am conducting interviews with interviewees who are in direct contact with policy making, policy implementing and environmental protection function. The outcomes of interviews will be used as input to develop more understanding of the potential implementation of an emission trading policy in a developing country such as Libya in order to reduce GHG emissions, particularly CO<sub>2</sub> emissions and its contribution towards sustainable development, for the Libyan manufacturing industry which is the core of my PhD dissertation titled: “Emissions Trading and Sustainable Development: A Case Study of Libyan Oil and Cement Industries”.

In this interview, you will be asked the questions attached with this letter. During the interview I will listen to and transcribe your responses. Reporting of the study will be in aggregate terms without any references to identity specific organizations or participants, unless you and your organization specifically give written permission. If written permission is not obtained, your name and organization’s name or any identifiers will not appear in any outputs of the study.

I would also like to advise that participation in this interview is completely voluntary and you may choose to withdraw at any time during or after the interview.

I, \_\_\_\_\_ have read the above statements and agree to participate in an interview under conditions stated.

I, \_\_\_\_\_ give/do not give permission for the interview to be digitally recorded on the undertaking that I or my organization will/will not be identified on the recording.

I, \_\_\_\_\_ and my organization do/do not give permission for the information disclosed in the interview to be identified with me and my organization and I have the authority to give this permission.

*This research is part of PhD study program managed by the University of Southern Queensland, Toowoomba 4350 Qld, Australia. Any question related to this study can be directed to either Dr, Peter Phillips on (07) 46315490; email: [phillips@usq.edu.au](mailto:phillips@usq.edu.au) or to USQ Ethics via email: [ethics@usq.edu.au](mailto:ethics@usq.edu.au).*

\_\_\_\_\_  
Signature of participant

\_\_\_\_\_  
Signature of interviewer

\_\_\_\_/\_\_\_\_/\_\_\_\_  
date

## APPENDIX (B): Interviews Questions in English Language

<b>General Characteristics of Company</b>
<ul style="list-style-type: none"><li>• To confirm that your company belongs to ..... sector (s)</li><li>• Your operation/ department/ sections are based in.....</li></ul>
<b>The Key Themes</b>
<p>Via semi-structured interviews, the researcher seeks to cover the three key themes identified in the present study, which are emissions trading policy, GHG emissions reduction (CO<sub>2</sub> emissions in particular) and sustainable development. A range of key questions were developed for the interviews, in order to explore the areas highlighted in the RQ2, RQ3 and RQ4 in this research.</p> <p><b>Note:</b> Semi-structured interviews, not all questions asked to all interviewees, adjustment by function.</p>
<b>Interviews Questions</b>
<ol style="list-style-type: none"><li>1- In brief, can you please describe the profile of your company?</li><li>2- How much do you know about emissions trading policy, and its effect on the manufacturing sector?</li><li>3- How will emissions trading actually reduce GHG emissions, particularly CO<sub>2</sub> emissions?</li><li>4- What do you believe are the major issues impacting the oil/cement industry and/ or your company with regard to the proposed emissions trading policy?</li><li>5- What is the impact of adapting emissions reduction policies on the Libyan oil/cement industry and/ or your company?</li><li>6- What are your views on targets set by the government for the Libyan oil/cement industry, if an emissions trading policy introduced by the government, and how do you think this may impact your company?</li><li>7- Has will your company achieve the carbon reduction targets set out in the government policy?</li><li>8- What do you feel are the biggest challenges faced by the Libyan oil/cement industry to adapt to changing climate and reduce CO<sub>2</sub> emissions?</li></ol>

- 9- What are the barriers to reducing emissions in the Libyan oil/cement industry and /or your company?
- 10- What strategic measures should the industry be taking, in order to adapt to climate change?
- 11- What are the long and short term challenges faced by your company?
- 12- How is your company affected by or adapting to changes as a result of climate change?
- 13- Are you aware of your company's footprint and emissions?
- 14- What are your views on the carbon reduction measures proposed by the government?
- 15- What is your awareness and understanding of an emissions trading scheme? Are you aware of the EU ETS and its outcomes?
- 16- What challenges do you feel an ETS would present for your company and its operations?
- 17- How would an emission trading system impact the oil/cement industry and its ability to meet increasingly stringent quality standards? Do you feel it would be the necessary legislative requirement to push the manufacturing industry to make the appropriate strategic decisions to cut their emissions, in order to remain competitive?
- 18- What recommendations would you make for oil/cement industry and/ or your company to reduce emissions, in line with an ETS?
- 19- (Introduce ETS allocation methods- grandfathering, benchmarking and auctioning.) What do you feel would be the best permit allocation method for the ETS, to support oil/cement industry and/ or your company' entry into the scheme?
- 20- How does the government (Ministry of the environment and industry) work with the oil/cement industry and its related companies and to support them to adapt to a changing climate?
- 21- What do you feel are the barriers to reducing emissions, particularly CO<sub>2</sub> emissions in the Libyan oil/cement industry?
- 22- What do you feel are the major challenges for the Libyan manufacturing industry, presented by environmental policies such as an emissions trading policy?
- 23- What recommendations would you make to support and drive the oil/cement industry to invest in new technologies and adapt to climate change, in order to reduce carbon emissions?
- 24- What are the most important/significant areas for development or investment in order to increase production and effectively reduce emissions in the Libyan oil/cement industry and/ or your company?
- 25- What are the major challenges and risks associated with investment in new, more production, long term technologies? For example, technologies to increase oil/cement production (clean production).
- 26- What are the incentives to increase oil/cement production efficiency and awareness, through emissions trading policy? Does your organization demonstrate and production efficiency methods?
- 27- What are the incentives to innovate, build sustainable infrastructure and to develop more carbon efficient technologies?
- 28- What incentives exist for companies and/ or your company to invest in energy efficiency, with a view to reducing their carbon emissions?
- 29- What is the quantity of annual CO<sub>2</sub> emissions produced by your operations?
- 30- Please explain how you could reduce your GHG emissions to meet national, regional and international targets for reductions. What are your estimated costs and savings associated with achieving these targets?

### Yes / No Questions

- 1- How is your company responding to changes in the climate? Have you considered an environmental or emissions reduction targets in your company strategy?
  - If yes, please provide further information.
  - If not, please specify why?
  
- 2- What is your company doing to reduce its carbon emissions/energy consumption? Has your company invested or developed in any renewable energy generating technologies?
  - If yes, please provide further information.
  - If not, please specify why?
  
- 3- Do you believe climate change; the policy responses to climate change and/or adaptation to climate change represent commercial risks and/or opportunities for your company?
  - If yes, specify the implications, detail the strategies adopted and actions taken to date.
  - If no, please indicate why?
  
- 4- Do you have a strategy regarding preparation for emerging GHG emissions regulation and trading regimes, in particular the European Union Emissions Trading Scheme?
  - If yes specify the implications, detail the strategies adopted and actions taken to date.
  - If no, are you planning on doing so, if so when?
  
- 5- Products and services: Do you measure the emissions associated with both the use and disposal of your products?
  - If yes, please provide further information.
  - If no, are you planning on doing so, if so when?
  
- 6- Supply chain: Do you measure the emissions generated by your supply chain?
  - If yes, please provide further information including details of the boundaries you apply.
  - If no, are you planning on doing so, if so when?
  
- 7- Do you have emission reduction programs in place?
  - If yes, please provide further information.
  - If no, are you planning on doing so, if so when?
  
- 8- Have you considered scenarios involving reduction in GHG emissions beyond existing national, regional and international targets?
  - If yes, please detail these scenarios, and your estimated costs or savings associated with each one.
  - If no, are you planning on doing so, if so when?

### **Thanks for Participation**

Thank you very much for participating in the interview. I also thank you for discussing your economic and environmental experiences in the study field with me. Your comments have proved to me not only extremely interesting, but also very useful to my research. I will forward a copy of results once analysis has been completed.

Once again, I thank you for being so generous with your time and wish and your institution every success in your future endeavours.

### **Participants' Profile**

- 1- Role/position title: \_\_\_\_\_.
- 2- Your education background: \_\_\_\_\_.
- 3- Your work experience in the company: \_\_\_\_\_years.
- 4- Your work experience in environmental and economic issues: \_\_\_\_\_years.
- 5- Work responsibility in environmental, social and economic issues (please briefly specify):  
\_\_\_\_\_.

If you want to receive a copy of summary results of this study, please provide your contact details

- 1- Electronic copy (  ) Email: \_\_\_\_\_
- 2- Hard-copy (  ) Address: \_\_\_\_\_  
\_\_\_\_\_

**((THANK YOU VERY MUCH FOR YOUR PARTICIPATION))**

## **APPENDIX (C): Interviews Questions in Arabic Language**

الخصائص العامة للشركة
<ul style="list-style-type: none"> <li>• للتأكد شركتكم تعود لقطاع .....</li> <li>• الإدارة / التشغيل / القسم يستند علي .....</li> </ul>
المواضيع الرئيسية
<p>من خلال المقابلات شبه المنظمة، يسعى الباحث لتغطية ثلاثة عناصر أساسية والمحددة في هذه الدراسة الحالية. تخفيض انبعاثات غازات الاحتباس الحراري ، وخاصة انبعاثات غاز ثاني أكسيد الكربون، والتنمية المستدامة . وقد وضعت مجموعة من الأسئلة لهذه المقابلات، من أجل إستكشاف المجالات المحددة في كل من أسئلة البحث، سؤال البحث الثاني، الثالث والرابع في هذه الدراسة .</p> <p><b>ملاحظة :</b> في هذه المقابلات شبه منتظمة، لن يتم طرح جميع الأسئلة على المشتركين في المقابلات، بل سيتم تكيف هذة الأسئلة حسب الوظيفة .</p>
أسئلة المقابلات
<ol style="list-style-type: none"> <li>1. بإختصار، هل بإمكانك وصف أو إعطاء نبذة مختصرة عن الشركة؟</li> <li>2. ماذا تعرف عن سياسة تجارة الانبعاثات وأثرها على قطاع الصناعات التحويلية؟</li> <li>3. كيف تستطيع تجارة الانبعاثات الحد من أو تخفيض انبعاثات غازات الإحتباس الحراري ولاسيما انبعاثات ثاني أكسيد الكربون؟</li> <li>4. ماذا تعتقد أو ماهي القضايا الرئيسية المؤثرة على قطاع النفط والإسمنت في ظل سياسة تجارة الانبعاثات المقترحة؟</li> <li>5. ماهو أثر التكيف مع سياسات الحد من الانبعاثات على كل من قطاعي النفط والإسمنت؟</li> <li>6. ماهي وجهات نظركم بشأن الأهداف التي حددتها الحكومة لكل من قطاعي النفط والإسمنت الليبي، وذلك في حالة طرح سياسة تجارة الانبعاثات من قبل الحكومة، وكيف تعتقد أن هذا سوف يؤثر على شركتكم؟</li> <li>7. هل تعتقد بأن شركتكم سوف تنجز أهداف تخفيض أو الحد من الكربون والمحددة من قبل سياسة الحكومة؟</li> <li>8. ماهو شعورك بالنسبة لأكبر التحديات التي يواجهها كل من قطاعي النفط والإسمنت الليبي على التكيف مع تغير المناخ والحد من انبعاثات ثاني أكسيد الكربون؟</li> <li>9. ماهي العوائق أو الصعوبات التي تحول دون خفض الانبعاثات في كل من قطاعي النفط والإسمنت؟</li> <li>10. ماهي المقاييس الإستراتيجية التي يجب أن تأخذ بالحسبان، من أجل التكيف مع تغير المناخ؟</li> </ol>



11. ماهى التحديات الطويلة والقصيرة الأجل التي تواجهها شركتكم، فى ظل سياسة تجارة الانبعاثات المقترحة/وكذلك التكيف مع تغير المناخ؟
12. كيف يمكن أن تتأثر الشركة فى ظل التكيف للتغيرات كنتيجة لتغير المناخ؟
13. هل أنتم مدركون أو على علم بأثر وانبعاثات شركتكم؟
14. ماهى وجهات نظركم بالنسبة لمقاييس الحد من الكربون المقترحة من قبل الحكومة؟
15. ماهو مدى إدراكك وماعرفتك أو مفهومك لمخطط تجارة الانبعاثات؟
16. فى رأيكم، ماهى التحديات التي تواجه شركتكم حيال تنفيذ وتشغيل مخطط تجارة الانبعاثات؟
17. كيف سيؤثر نظام تجارة الانبعاثات على كل من قطاعي النفط والإسمنت الليبي، وكذلك قدرتها على الوفاء بمعايير الجودة على نحو متزايد؟ هل تشعر بأنه من الضروري وجود متطلبات تشريعية لدفع القطاع/أو الصناعة نحو إتخاذ الإستراتيجية المناسبة للحد من الانبعاثات، وذلك لتظل قادرة المنافسة؟
18. ماهى التوصيات التي تقترحها لكل من قطاعي النفط والإسمنت الليبي للحد من انبعاثاتها، وذلك تمشياً مع مخطط تجارة الانبعاثات؟
19. التعريف بأساليب تخصيص مخطط تجارة الانبعاثات يتضمن كل من المزايدات، الأساليب القياسية والأساليب المكتسبة. برأيك ماهو أفضل أسلوب (أسلوب تخصيص) بالنسبة لمخطط تجارة الانبعاثات وذلك لدعم كل من قطاعي النفط والإسمنت للدخول فى المخطط؟
20. كيف يمكن للحكومة (وزارة النفط و الصناعة) العمل مع كل من قطاعي النفط والإسمنت الليبي لدعمهم للتكيف مع تغير المناخ؟
21. بإعتقادك، ماهى الحواجز أو المعوقات التي تحول دون الحد أو التخفيض من الانبعاثات، ولاسيما انبعاثات غاز ثنائي اكسيد الكربون لكلى قطاعي النفط والإسمنت الليبي؟
22. برأيك، ماهى التحديات الأساسية لكل من قطاعي النفط والإسمنت الليبي فى ظل السياسات البيئية الحالية مثل سياسة تجارة الانبعاثات؟
23. ماهى التوصيات التي ترغب فى طرحها لدعم ودفع قطاعي النفط والإسمنت للإستثمار فى التكنولوجيات الجديدة والتكيف مع تغير المناخ، وذلك للحد من انبعاثات الكربون؟
24. ماهى أهم المجالات للتنمية أو الإستثمار من أجل زيادة الإنتاج والحد أو خفض الانبعاثات على نحو فعال لكل من قطاعي النفط والإسمنت الليبي؟
25. ماهى أهم التحديات و المخاطر الرئيسية والمرتبطة بالإستثمار على المدى الطويل فى

<p>التكنولوجيا والإنتاج؟ على سبيل المثال الإستثمار فى التكنولوجيا لزيادة إنتاجية النفط والإسمنت.</p> <p>26. ماهى أهم الحوافز لزيادة الوعى والكفاءة الإنتاجية لكل من النفط والإسمنت ،من خلال تطبيق سياسة تجارة الانبعاثات؟ هل مؤسستكم أظهرت أو أثبتت أساليب كفاءة وفعالة فى الإنتاج؟</p> <p>27. ماهى الحوافز التى تحفز على الابتكار، وبناء البنية التحتية المستدامة وتطوير المزيد من تكنولوجيا الكربون الفعالة؟</p> <p>28. ما هي الحوافز المتاحة للشركات للاستثمار في كفاءة استخدام الطاقة ، وذلك بهدف الحد من انبعاثاتها من الكربون؟</p> <p>29. ماهى كمية انبعاثات ثانى اكسيد الكربون السنوية التى تنتجها عمليات التشغيل الخاصة بالشركة؟</p> <p>30. يرجى توضيح كيف يمكن الحد من انبعاثات غازات الإحتباس الحرارى وذلك لتلبية أهداف التخفيض المحلية والوطنية والدولية؟ ماهى المدخرات والتكاليف المقدرة والمرتبطة بإنجاز هذه الأهداف؟</p>
<p>أسئلة نعم / لا</p>
<p>1. كيف تستجيب شركتكم للتغيرات فى المناخ؟ هل أخذتم فى الإعتبار الإستراتيجيات البيئية أو أهداف الحد من الانبعاثات فى إستراتيجية الشركة الخاصة بك؟</p> <p>❖ إذا كانت الإجابة بنعم، يرجى تقديم المزيد من المعلومات .</p> <p>❖ إذا لم يكن كذلك، الرجاء التحديد لماذا؟</p> <p>2. ما الذى تفعله شركتكم للحد من انبعاثات الكربون وإستهلاك الطاقة؟ هل قامت شركتكم بالإستثمار أو التنمية فى أى مجال من تقنيات تجديد وتوليد الطاقة؟</p> <p>❖ إذا كانت الإجابة بنعم، الرجاء تقديم المزيد من المعلومات .</p> <p>❖ إذا لم يكن كذلك ، الرجاء التحديد لماذا؟</p> <p>3. هل تعتقد أن تغير المناخ، إستجابات السياسات العامة لتغير المناخ أو التكيف مع تغير المناخ تمثل مخاط أو فرص تجارة بالنسبة لشركتكم؟</p> <p>❖ إذا كانت الإجابة بنعم ، هل بإمكانكم تحديد الأشار وتفصيل الإستراتيجيات المعتمدة والإجراءات المتخذة حتى الآن؟</p> <p>❖ إذا لم يكن كذلك، من فضلك بين لماذا؟</p> <p>4. هل لديك إستراتيجية بشأن التحضير للأنظمة التجارية واللوائح الناشئة بالنسبة لإنبعاثات غازات الإحتباس الحرارى ،ولاسيما مخطط تجارة الانبعاثات بالنسبة للإتحاد الأوروبى؟</p>

- ❖ إذا كانت الإجابة بنعم، هل بإمكانكم تحديد الآثار وتفصيل الاستراتيجيات المتعمدة والإجراءات المتخذة حتى الآن؟
- ❖ إذا لم يكن كذلك، هل تخططون للقيام بذلك، وإذا كان كذلك متى؟
5. المنتجات والخدمات : هل يمكن قياس الانبعاثات المرتبطة باستخدام والتخلص من المنتجات الخاصة بشركتكم؟
- ❖ إذا كانت الإجابة بنعم، يرجى تقديم المزيد من المعلومات .
- ❖ إذا لم يكن كذلك، هل تخططون للقيام بذلك، وإذا كان ذلك متى؟
6. سلسلة التوريد: هل يمكنك قياس الانبعاثات الناتجة عن سلسلة التوريد الخاصة بشركتكم؟
- ❖ إذا كانت الإجابة بنعم، يرجى تقديم المزيد من المعلومات متضمناً تفاصيل الحدود المطبقة؟
- ❖ إذا لم يكن كذلك، هل تخططون للقيام بذلك، وإذا كان كذلك متى؟
7. هل يمكن برامج للحد والتخفيض من الانبعاثات في الوقت الحاضر؟
- ❖ إذا كانت الإجابة بنعم، يرجى تقديم المزيد من المعلومات .
- ❖ إذا لم يكن كذلك، هل إنتم تخططون للقيام بذلك، ماذا كان الأمر كذلك متى؟
8. هل أخذتم في إعتباركم السيناريوهات التي إحتوت على الحد من إنبعاثات غازات الإحتباس الحرارى إبعاد أهدافها الإقليمية والوطنية والدولية؟
- ❖ إذا كانت الإجابة بنعم، يرجى تقديم تفاصيل فيما تخص هذه السيناريوهات، وماهى المدخرات والتكاليف المقدره والمرتبطة بإيجار هذه الأهداف؟
- ❖ إذا لم يكن كذلك ، هل أنتم تخططون للقيام بذلك ، وإذا كان الأمر كذلك متى؟

#### شكر و تقدير للمشارك

أتوجه لكم بالشكر لمشاركتم في المقابلة. كما أشكر لكم مناقشة خبراتكم البيئية و الاقتصادية في هذه الدراسة معي. لقد ثبت لي أن تعليقاتكم ليست فقط مثيرة للإهتمام ولكنها أيضاً مفيدة للبحث. سوف يتم تحويل نسخة من النتائج اليكم و ذلك عندما يتم الانتهاء كلياً من التحليل.

مرة أخرى، أشكر لكم وقتكم المعطاء ، وأتمنى لكم و لمؤسستكم كل النجاح في مساعيكم المستقبلية.

#### بيانات المشارك

<p>1 ( الدور / الموقع: _____ .</p> <p>2) المؤهل العلمي: _____ .</p> <p>3) خبرتك في الشركة: _____ سنة / سنوات.</p> <p>4) خبرتك العلمية في مجالي البيئة و الاقتصاد: _____ سنة / سنوات.</p> <p>5) المسؤولية العملية في المجالات البيئية ، الاجتماعية و الاقتصادية (من فضلك حدد باختصار): _____</p>
<p>إذا كنت ترغب في إستلام ملخص نتائج هذه الدراسة، من فضلك زودنا ببيانات الإتصال.</p> <p>1) نسخة الكترونية ( ) الإيميل: _____ .</p> <p>2) نسخة ورقية ( ) العنوان: _____</p>
<p style="text-align: center;"><b>(( شكراً جزيلاً على إهتمامكم ))</b></p>

## APPENDIX (D): Letter of Ethical Clearance



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#### OFFICE OF RESEARCH AND HIGHER DEGREES

Ashley Steele

Ethics Officer

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EMAIL [steele@usq.edu.au](mailto:steele@usq.edu.au)

Tuesday, 23 March 2010

Sami Shibani  
1/30 Horrocks Crescent  
Toowoomba QLD 4350

Dear Sami,

Thankyou for submitting your project below for human ethics clearance. The Chair of the USQ Fast Track Human Research Ethics Committee (FTHREC) recently reviewed your responses to the FTHREC's conditions placed upon the ethical approval for the below project. Your proposal meets the requirements of the *National Statement on Ethical Conduct in Human Research* and full ethics approval has been granted.

Project Title	Emissions Trading and Sustainable Development: A Case Study of Libyan Manufacturing Industry
Approval no	H10REA038
Period of Approval	22/03/2010 – 22/03/2011
FTHREC Decision	Approved

The standard conditions of this approval are:

- conduct the project strictly in accordance with the proposal submitted and granted ethics approval, including any amendments made to the proposal required by the HREC;
- advise the HREC (email: [ethics@usq.edu.au](mailto:ethics@usq.edu.au)) immediately if any complaints or expressions of concern are raised, or any other issue in relation to the project which may warrant review of ethics approval of the project;
- make submission to the HREC for approval of any amendments, or modifications to the approved project before implementing such changes;
- in the event you require an extension of ethics approval for this project, please make written application in advance of the end-date of this approval;
- provide the HREC with a written "Annual Progress Report" for every year of approval. The first progress report is due 12 months after the start date of this approval (by **22/03/2011**);
- provide the HREC with a written "Final Report" when the project is complete;
- if the project is discontinued, advise the HREC in writing of the discontinuation.

For (c) to (f) proformas are available on the USQ ethics website: <http://www.usq.edu.au/research/ethicsbio/human>

Please note that failure to comply with the conditions of approval and the *National Statement on Ethical Conduct in Human Research* may result in withdrawal of approval for the project.

You may now commence your project. I wish you all the best for the conduct of the project

Yours sincerely

Ashley Steele  
Ethics Officer  
Office of Research and Higher Degrees

**APPENDIX (E): Sample of Interviews Transcription and Analysis**

**YES / NO QUESTIONS:**

<b>QUESTIONS</b>	<b>RESPONSE</b>
<p><b>Q1)</b> How is your company responding to changes in the climate? Have you considered any environmental or emissions targets in your company strategy?</p> <ul style="list-style-type: none"> <li>- If yes, please provide further information.</li> <li>- If not, please specify why?</li> </ul>	<p>Most questioned were answered “No”. They have believed that the reason behind and the crucial factor is the absence of any emissions reduction targets or even any emissions reduction policies which must be enforced by the government or the Libyan environmental body. Over 62 % of the respondents have described that, up to date, the relevant firms have not considered any strategic measurement regarding the reduction targets, because it is yet to be issued from the related governments. An expression has been stated by one of the environmental consultants:</p> <p style="padding-left: 40px;">‘our company did not take any strategic measures regarding any emissions reduction targets, because it has not yet been considered by the Environment General Authority.... He continued, we are still seeking to comply with the international environmental criteria, and in this stage we are trying to do our best in order to reduce at least a small percentage of our emissions’.</p> <p>However, small percentages of the respondents have demonstrated that their companies have some initiatives regarding the reduction of the emissions. Although, their reduction have not reached the required level, but this target proportion indicates the individual work and the valuable efforts of those firms in order to reduce the environmental damage which is caused by their operation processes.</p>
<p><b>Q2)</b> What is your company doing to reduce its carbon emissions/energy consumption? Has your company invested or developed in any renewable energy generating technologies?</p> <ul style="list-style-type: none"> <li>- If yes, please provide further information.</li> <li>- If not, please specify why?</li> </ul>	<p>The majority of the respondents were answered “No”. More than 70 % of the respondents were agreed that the insufficient role of the government to drive the industrial companies towards the compliance with the national and international environmental criteria to reduce carbon emissions is a contributor factor. Therefore, this affected the related firms in developing or investing in any renewable energy generating technologies as a part of their action towards reducing carbon emissions/energy consumption. In relation to this, an environmental consultant has expressed his view by saying that ‘We did not develop and invest in any renewable energy generating technologies, and this an important task that the government must take it into account’.</p> <p>To overcome this deficiency, all agreed with conditions; good governance, including transparency, credibility and responsibility and the setting up of modern, scientific and effectiveness policy. Therefore, Libya has a pressing need to set up emissions reduction policies in order to protect the environment. In addition, the complete reliance on the governmental subsidies has weakened the relevant companies’ capabilities to develop and invest in new technologies, because of the domination of public enterprises. Moreover, Libya should pursue a clear policy targeting the encouragement of development and investment in any promising emissions reduction policy.</p>

	<p>In contrast, over 21 % of the respondents have demonstrated that their companies have activated a number of policies in order to reduce carbon emissions/energy consumption. Participants in some oil companies have asserted the use of the so-called gas project utilisation policy. An interviewee has stated that:  ‘As a step towards reducing emissions, we started using the policy of gas project utilisation to run the turbines, where these turbines were operated by the crude oil which has a large quantity of emissions’.</p> <p>According to some of the target respondents in a number of cement companies, the replacement of the heavy oil by the natural gas in a number of cement plants was a valuable action towards reducing carbon emissions.</p>
<p><b>Q3)</b> Do you believe climate change; the policy responses to climate change and/or adaptation to climate change represent commercial risks and/or opportunities for your company?</p> <ul style="list-style-type: none"> <li>- If yes, specify the implications, detail the strategies adopted and actions taken to date.</li> <li>- If no, please indicate why?</li> </ul>	<p>The vast majority of the respondents were answered “No”. More than 81 % of the informants have agreed that the policy responses and the adaptation to climate change by their firms will not bring any sort of commercial risks; instead it will have a number of constructive chances to nationalise those environmental policies and their executive mechanisms in the relevant companies. This view has been expressed by a senior decision-maker who has stated that:  ‘If our company have intended to invest in some emissions reduction policies as a part of responding to climate change, there will not be any business-related risks, alternatively there will be positive opportunities and therefore it will preserve the environment by achieving the national and international environmental criteria. Also, it will accomplish and nationalise those policies and their executive mechanisms’.</p> <p>Participants agreed that, nationalising of such policies will generate positive opportunities in terms of appointing the employment and gaining some revenues as a result of applying those policies in the related companies.</p> <p>In comparison, less than 3 % of those respondents who are working in cement firms have described that in the short-term there will be a commercial risks on those old factories with respect to making the necessary preventive maintenance work on time. The related participants have attributed this matter to the lack of financial capabilities and the necessary technical means to put these policies into practice. However, in the long-run, adaptation to climate change will accelerate structural shifts towards a stronger and more sustainable economic future. Innovation policies need to be adapted to current conditions both in terms of how such policies are crafted to work, but also as elements of stimulus packages that may often be the foundation for these initiatives.</p>
<p><b>Q4)</b> Do you have strategy regarding preparation for emerging GHG emissions regulation and trading regimes, in particular the European Union Emissions Trading Scheme?</p> <ul style="list-style-type: none"> <li>- If yes specify the implications, detail the strategies adopted and actions taken to date.</li> </ul>	<p>Through the presentation of the participants’ statements in answering this question. Not having any strategies regarding preparation for emerging GHG emissions regulation and trading regimes in their firms, were overwhelmingly advocated by the respondents. More than 91 % of the respondents were answered “No”. The analysis demonstrated that the weaknesses in the current status regarding any attempts to operate the GHG emissions regulation and the engagement in any emissions trading regimes have attributed to a number of difficulties. The main difficulty that the respondents insisted on was related to the absence of government actions towards such kind of those strategic policies. This reply may be unreliable because there are other possible reasons that it was neglected such as a lack of commitment and professional skills in the area of</p>

<p>- If no, are you planning on doing so, if so when?</p>	<p>concern. In this regard, this view has been expressed by the following statement:          ‘Unfortunately, we do not have any such kind of emissions regulations and trading regimes, because the government and the Libyan environmental body did not take any action towards these strategic policies’.</p> <p>Another statement has been expressed by one official that:          ‘The consequence of this matter belongs to the government attitude of emerging any emissions reduction regimes. To date, the government and its related environmental body did not have any emissions reduction strategy in place, because of the absence of serious application of the Libyan environmental law on those related industrial companies. In addition, the absence of the institutional capacity to control the procedures of applying those policies is a contributed factor’.</p> <p>The analysis also indicates that, there is a gap between respondents’ attitudes and their actions with regard to environmental activities of the companies. This was justified by the respondents themselves in saying that, a scarcity of legal and professional standards and guidelines, along with their lack of expertise, qualification and training in the field of protecting the environment are the main determinants that have prevented them from the engagement in any policy responses to climate change, and emerging any GHG emissions regulations and trading regimes.</p> <p>However, the results of the interviews reveal that a number of the related firms have to some extent plans to control the problem of air pollution as a part of responding to climate change, which reflects the individual work of those companies. In this regard, participants have shed light on some initiatives but they have not discussed them in details. In addition, many of the interviewees have indicated that their firms do have some initiatives and plans regarding the reduction policies of GHG emissions, however, the companies are still waiting for the government and its related environmental body to regulate these policies to be utilised in the next few years.</p>
<p><b>Q5) Products and services: Do you measure the emissions associated with both the use and disposal of your products?</b>          - If yes, please provide further information.          - If no, are you planning on doing so, if so when?</p>	<p>Most of these questioned said “Yes”. In answering this question, the majority of the respondents (more than 70 %) have agreed that their related firms do measure the emissions associated with both the use and disposal of products. In addition, the measurement procedures of the emissions vary from company to another. However, the overall responses indicate that the vast majority of the related plants are measuring the emissions associated with the production processes. This perception has been expressed by one official who has asserted that:          ‘We do measure all emissions that are associated with our production operations in all relevant plants, so we do have laboratories to analyse all raw materials utilised in the production. Moreover, we have some scientific functions that can record and account all emissions during the production process’.</p> <p>In comparison, more than 16 % of the respondents were answered “No”, this was because of the number of the old plants which associated with their insufficient facilities as well as the deplorable mechanisms are up until now still operating. Particularly some cement plants and a small number of the oil fields.</p> <p>This view was also supported by the researcher’s observation in doing some field visits to the locations of these plants and some oil fields.</p>



<p><b>Q6)</b> Supply chain: Do you measure the emissions generated by your supply chain?</p> <ul style="list-style-type: none"> <li>- If yes, please provide further information including details of the boundaries you apply.</li> <li>- If no, are you planning on doing so, if so when?</li> </ul>	<p>Participants were required to provide information about if they also measure the emissions generated by the supply chain. Those questioned agreed that they do also measure the emissions generated by the supply chain. In this case, more than 70 % of the respondents were answered “Yes”, and informants have emphasised that they do measure the emissions. However, in some cement companies and their related plants in particular have to some extent not recorded and measured the emissions generated by the power operation. This view has been expressed by one of respondents in the production department where he has asserted that:</p> <p style="padding-left: 40px;">‘We do have some functions that can help to record and measure the amount of emissions which generated by the supply chain except those emissions that were generated by the power operation’.... He continued. ‘This is the task of the related exported oil firms’.</p> <p>To sum up, measuring the emissions in those related companies and their relevant plants and fields are existed. However, in some particular cement plants and a number of oil fields, the procedures of such kind of measuring these emissions are non-existent, and this was owing to the deplorable situation of these cement plants and oil fields.</p>
<p><b>Q7)</b> Do you have emission reduction programs in place?</p> <ul style="list-style-type: none"> <li>- If yes, please provide further information.</li> <li>- If no, are you planning on doing so, if so when?</li> </ul>	<p>In relation to the outlook on having emissions reduction programs in place for those relevant firms, a large proportion of the respondents (more than 83 %) were answered “No”. The outcomes of analysing those related questioned have indicated that, the participants are overwhelmingly agreeing that their relevant companies have not undertaken any kind of emissions reduction programs. This was not solely because of the related firms’ capabilities with respect of implementing such kind of programs, instead governmental side was the key responsible for. This view has been expressed by one official who has asserted that:</p> <p style="padding-left: 40px;">‘At the moment, we do not have any kind of emissions reduction in place, but our companies are seeking to do so. However, this issue is still under the study from the governmental side, because up until now the Libyan environmental body has not undertaken any policy regarding the Kyoto convention or even any national policy that can help to encourage companies to reduce their emissions’.</p> <p>In other words, an environmentalist who is working in one of the relevant firms has expressed his valuable view by saying that:</p> <p style="padding-left: 40px;">‘The ability of reducing emissions is already existed in our company. However, we cannot estimate the costs and savings associated with achieving those emissions reduction programs, because there is no any plan from the governmental side which can explain in details those programs, so that our company can comply with’.</p> <p>In addition, all respondents’ views were agreed that the suitable time of implementing such emissions reduction programs is when the government and its related environmental body enact suitable environmental policy that can be workable with those relevant firms in both short and long terms. However, the analysis indicates that a very few number of the selected firms do have some emissions reduction programs which recently have been issued to be associated with their production process, and they are still doing their best to reduce emissions in order to protect the environment. In addition, they have attributed the</p>

	<p>non-existent of such programs to the absence of the imperative roles of the government policies towards reducing the emissions and conserving the environment. In the light of this, one of the consultants in a cement company has asserted that the above statement by saying that:</p> <p style="padding-left: 40px;">‘Our company did an obvious step towards the reduction of the emissions including the change process of generating the power by using the natural gas instead of the heavy oil’.</p> <p>This has happened in a number of oil companies, where recently they have started using the gas project utilisation to run the turbines in order to generate the power for the oil production purposes, this in addition to the policy of Zero Flaring.</p> <p>In brief, the lack and the absence of the vital governmental role in implementing effective and sufficient environmental policy has negatively affected those related companies in having any emissions reduction programs. In this regard, the analysis of the conducted interviews has demonstrated that the majority of the interviewees have advised that the government and its related environmental body (EGA) should take serious and active action towards implementing emissions programs in the Libyan state, so that the governmental institutions and the relevant polluters can adapt those environmental policies and act effectively to prevent the environment from degradation.</p>
<p><b>Q8)</b> Have you considered scenarios involving reduction in GHG emissions beyond existing national, regional and international targets?</p> <ul style="list-style-type: none"> <li>- If yes, please detail these scenarios, and your estimated costs or savings associated with each one.</li> <li>- If no, are you planning on doing so, if so when?</li> </ul>	<p>Respondents were asked whether they have considered scenarios involving reduction in GHG emissions beyond existing national, regional and international targets. Most of those questioned were answered “No”. More than 78 % of the participants have reported that their companies have not up to date considered any scenarios involving the reduction in GHG emissions as a vital part of accomplishing the national, regional and international targets. This has been attributed to the absence of the governmental targets that would enforce the industrial companies to undertake any GHG emissions reduction scenarios in order to protect the environment. To assert this, an environmental consultant has expressed his view by saying that:</p> <p style="padding-left: 40px;">‘To date, we have not complied with any national, regional and international targets, and as a result, we did not consider any scenarios regarding the reduction of GHG emissions. The reason behind that is the lack of the governmental side to adopt workable policies and targets in order to reduce emissions....He continued his conversation by saying that, although the Libyan state has signed and ratified the Kyoto Protocol, but we still are not benefiting from this convention, this is because of the lack of governmental capacity in establishing an institution that considers all procedures regarding the application of any environmental policies’.</p> <p>In the time being, the relevant companies are still waiting for adopting emissions reduction policy if it has enacted and effectively monitored by the government and its related environmental body. In the light of this, the results indicated that a small percentage of the related companies have had the full capacity to reduce emissions in order to meet the national and international criteria. This can be done by the governmental support. To do so, several respondents indicate that there should be some factors provided by the government, these factors are: 1)</p>

	<p>legislative support; 2) financial support; and 3) regulatory support. In this regard, one official has emphasised that:</p> <p>‘Our companies are ready to apply any instruments to meet the national, regional and international targets in reducing the emissions. This can be done by the governmental support, because applying such kind of those instruments needs to be officially approved by the government and its related environmental body’.</p> <p>From what has been mentioned, it can be inferred that the absence of enforcing any emissions reduction targets from the governmental side has led to not taken any steps towards the reduction in GHG emissions from the related firms. Applying emissions reduction scenarios needs a significant effort from both the government and the industrial firms. Although, the individual work and the valuable efforts of those limited firms reflects their honest intention to protect the environment. The cooperation between both sides is essential to cope with the problem of climate change.</p>
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## **APPENDIX (F): Data and Sources Collection, Data Analysis Strategy and Categorisation of the Findings**

The main objective of this appendix is to introduce the analytical strategy employed for managing the quantitative and qualitative data gathered during all phases of the empirical research in this study. It also synthesises and categorises the findings of the study into key issues and aspects. In addition, it forms an analytical framework which guides the process of analysing and interpreting the findings of the theoretical and empirical studies in this research. Furthermore, researchers can use the analytical strategy and procedures adopted in this study in further research.

### ***1- Data and Sources Collection***

The socioeconomic and environment data presented for this study are drawn from several sources; primary and secondary data from archival records of federal and state government, oil industry records, the National Oil Corporation in Libya, the Organisation of the Petroleum Exporting Countries and Arab Oil Petroleum Exporter's Countries, the cement industry records, the Ministry of Industry, Central Bank of Libya, the Environment General Authority, the General Information Authority, books, journals, Documentation and Information Corporation, the World Bank, the World Resource Institute, information from statistical publications, various Research Institute, such International Organisations as the Organisation for Economic Cooperation and Development, the Intergovernmental Panel on Climate Change, the International Monetary Fund and both Organisations of the United Nation Environment and Development Programs. Also, Archives, the documentation, the published and unpublished writings of previous researches in the area on concern, however, when actual figures were not available, estimates were derived from the available raw data.

The primary source of data collection in this research was based on conducting the semi-structured interviews with open-ended questions. Quantitative data relied on an interviews survey (37 semi-structured interviews) with different parties involved in both selected oil and cement companies and other supportive research activities such as written documents, descriptions, and formal and informal interviews, meeting, and broad range of written materials, reports, and photographs. For more information regarding the conducted interviews see chapter four of this study. After data have been obtained through documentations and mouth interviews, they need to be analysed. Once the data are ready for analysis, the

researcher is ready to test both the hypothesis and proposition already developed for the study.

## **2- Data Analysis Strategy**

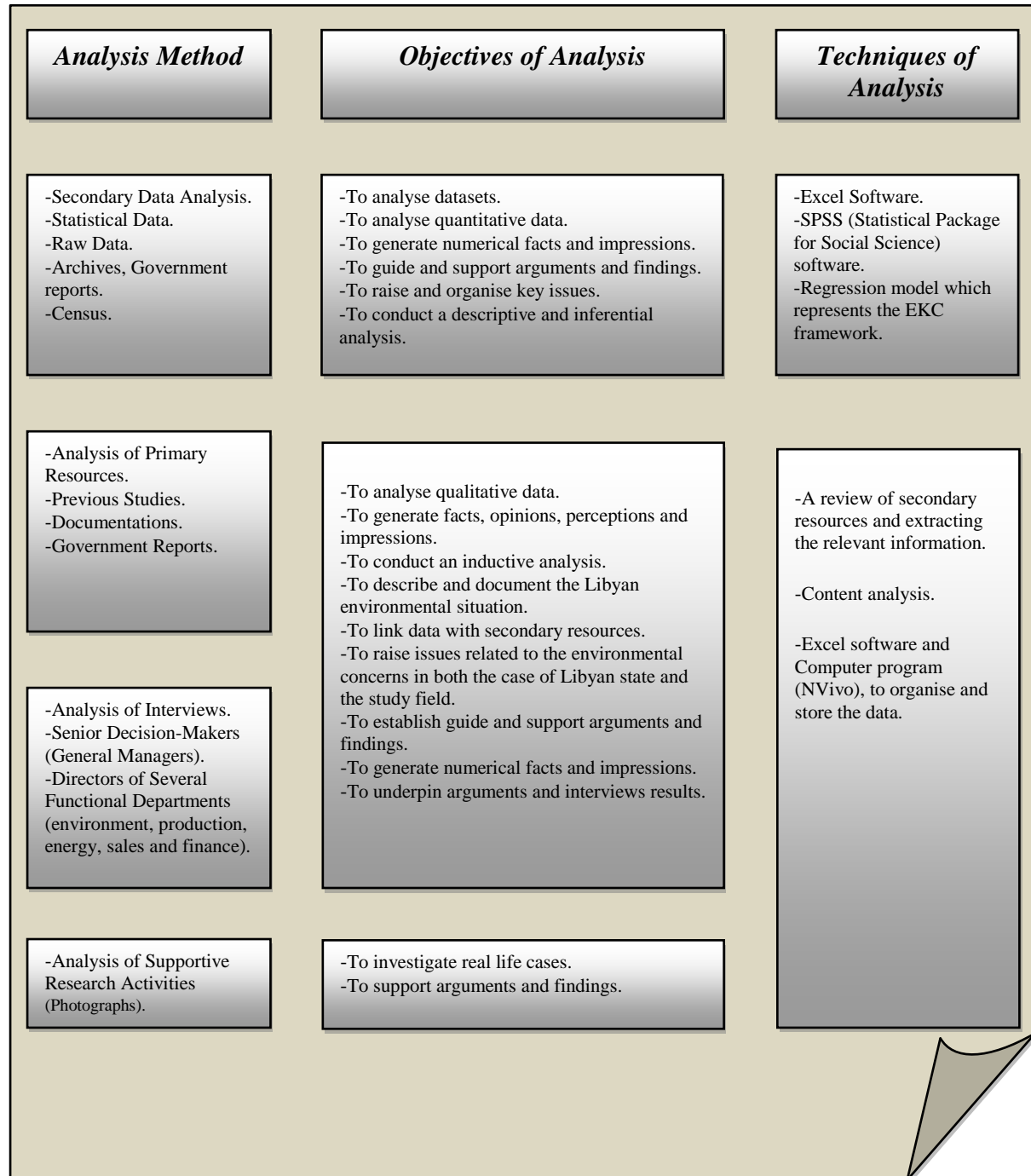
According to Marshall and Rossman (1999, p. 150), 'data analysis is the process of bringing order, structure, and interpretation to the mass of collected data. It is a messy, ambiguous, time consuming, creative and fascinating process'. The study is concerned with gathering facts, perceptions, opinions and views of key operatives and many other participants involved in the area of environmental conservation. Hence, the data analysis strategy used in this study is guided by the following considerations: the purpose of the study; key questions to be answered; the sampling frame of the study; primary and secondary resources and raw data gathered; the response rates achieved from the interviews survey; the quality and validity of data; the possibility to generalise the results emerging from this study; and the influence of social, political circumstances. Added to these considerations, the theoretical framework on which the study was based and the available data, time constraints and other limitations of the study determined the scope and depth of the analysis.

Based on the above considerations, the analysis was organised around exploratory methods, in which empirical data and theory was used in order to analyse and interpret the findings of the study. Consequently, the analytical framework in this study comprises two main phases. The first phase was based on quantitative data, and in the second phase qualitative data was analysed. Two sub-phases of analysis were carried out, including: secondary data analysis (quantitative data); and the analysis of the interviews (qualitative data). The following subsections will explain phase and its main objectives, and explain how this strategy enabled the data and information collected to be managed and analysed efficiently. For further information, Figure 1.6 describes the analytical methods and phases of this study.

The process of planning and the interview survey was discussed in broad detail in chapter four, and the general approach to analysing the conducted interviews was also explained. In this study, it is very important to emphasise that the objective of the statistical analysis is to explore and generate statistical and numerical indicators concerning the environmental quality and economic development in the case of Libya. These enable the general characteristics, key issues, and major obstacles of the environmental situation in Libya to be categorised, described and then statistically analysed and confirmed. In addition, it is very important that this part sets the context of the conducted interviews which concerning the achievement of the key objective in this study (see chapter one). Therefore, owing to the nature of the study (as the first exploratory study in Libya), its purposes and the type of

questions asked, there is no need to conduct rigorous statistical tests. In this sense, a large part of the statistical analysis in this study was organised around descriptive statistics, but the inductive analyses were employed to examine and explore the differences between opinions, perceptions and views of those decision-makers (general managers), directors of several functional departments, and experts and consultants using content analysis.

**Figure 6.1:** The Analytical Methods and Phases of the Study



**2.1 Secondary Data Analysis**

Throughout the course of theoretical and empirical study, great efforts were made by the present researcher during all phases of the research to collect all possible data relevant to this study in Libya. Owing to the absence and acute shortages of previous studies about the environmental quality and economic development in the case of Libya, the secondary data analysis was one of the most important phases of the analytical strategy in this research. In this study, analysing such type of data was based on conducting the EKC model in order to understand whether the Libyan economic system is located on an unfavourable part of the EKC, and therefore investigations along the lines of the proposed study are warranted.

This study employed secondary data for a span of 35 years, between 1975 and 2009. These data include 35 observations. In respect to these observations, the literature indicated that to conduct such type of study, the number of observations should be 30 or more. In this regard, the number of these observations was 35 which are more than enough to apply the EKC model in the case of Libya. Such type of data was collected from the World Development Indicators (the World Bank, CD-ROM 2008), some Libyan governmental recorded reports from the Central Bank of Libya, the Environment General Authority, the General Information Authority, oil industry records, the National Oil Corporation in Libya, the cement industry records and the Ministry of Industry. In addition, a number of international institutions were included such as the Organisation of the Petroleum Exporting Countries and Arab Oil Petroleum Exporter's Countries, the Organisation for Economic Cooperation and Development, the Intergovernmental Panel on Climate Change, the International Monetary Fund and both Organisations of the United Nation Environment and Development Programs. A regression analysis was conducted to test the related hypothesis. The hypothesis studies the relationship between environmental quality and economic development, which based upon the EKC hypothesis. In this general format the hypothesis can be formulated as follows:

$$E = f(Y, Y^2, Y^3, Z) \dots \dots \dots (1)$$

Where E is the dependent variable which denotes on one of environmental indicators that is CO<sub>2</sub> emissions, Y is the income (per capita GDP) and Z could be other explanatory variables such as population density that are supposed to influence environmental degradation. Conventional EKC studies employ functional forms where results can be evaluated with respect to presence or absence of a turning point and the significance of the parameters computed. The empirical evidence for the existence of an EKC has been found in various studies. These studies share some common characteristics with respect to data and methods employed. Most of the data used in these studies are cross-sectional panel data and time-

series analysis. The following reduced form models are used to test the various possible between environmental pressures ‘pollution levels’ and income per capita GDP. In this study the researcher investigates the existence of EKC at two different models showing the used of time-series model as it is formulated following de Bruyn et al. (1998), Dinda (2004) and Akbostanci et al.(2009) is given below:

$$E_t = \alpha + \beta_1 Y_t + \beta_2 Y_t^2 + \beta_3 Y_t^3 + \varepsilon_t \dots\dots\dots (2)$$

Here, for the environmental indicators ( $E$ ), we use CO<sub>2</sub> emissions per metric tonnes in Libya. The income variable ( $Y$ ) is the income per capita GDP in constant 2000 US Dollars. The subscripts  $t$  is time,  $\alpha$  is constant,  $\beta$  is the coefficient of the explanatory variable and  $\varepsilon$  is the error term.

The second model that is estimated in this study indicating the population density measured ( $Z$ ) as an explanatory variable that supposed to influence environmental degradation. This model is formulated as follows:

$$E_t = \beta_0 + \beta_1 Z + \varepsilon_t \dots\dots\dots (3)$$

See the first part of the chapter five which was based only on the findings of this phase.

## **2.2 Analysis of the Interviews Survey**

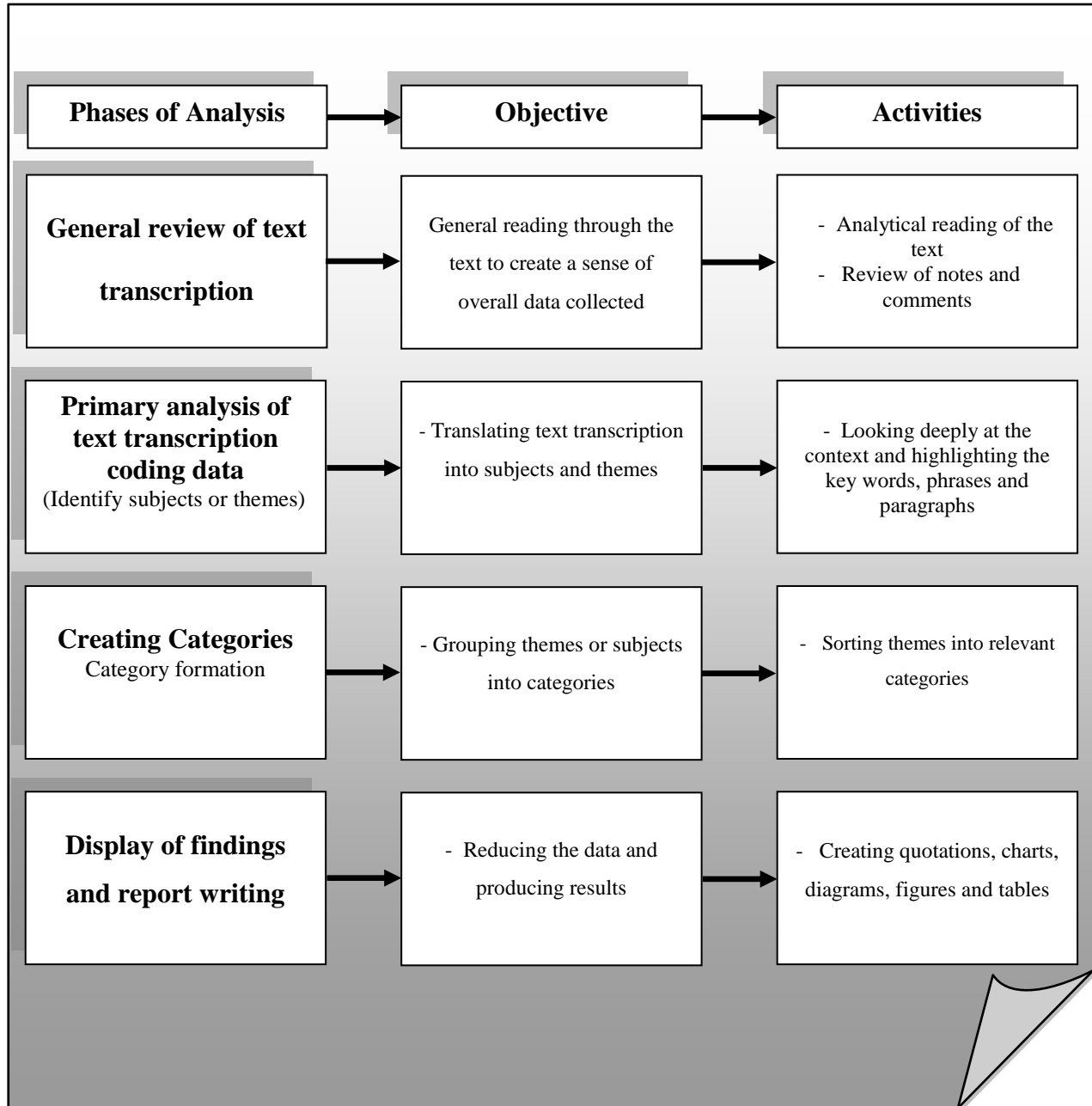
The analysis of this qualitative data was organised around content analysis, which allowed the ideas, opinions, perceptions and views of the interviewees to be extracted from the text. It has been emphasised that, one of the most common approaches to content analysis is thematic analysis, where the coding scheme is based on categories designed to capture the dominant themes (Cavana, Delahaye & Sekran, 2001). Lee and Fielding (2004, p. 530) state that ‘content analysis was one of the earliest approaches to the analysis of texts’. Lists of words are important tools in this tradition. One of the most familiar kinds of word list, the index, shows not only which words appear in a text but also their position. Thus, the ideas, opinions and views of the interviewees are extracted from the text. Owing to the intention to interview a significant number of regulators and participants in both the Libyan oil and cement industries, the questions and the structure of the interviews differed. As a result, after organising the interviews by aided computer program, then each interview was transcribed and analysed manually. The analysis of the interviews is described below.

The process of the management and analysis of data collected in the interview survey in this study was based on text transcriptions. As can be seen in the Figure 6.2, an attempt was made to synthesise the ideas, opinions, perceptions and views of interviewees through a process of inductive analysis. This figure has stated in chapter four and restated again in this appendix as



the process of analysing the qualitative data. It was believed that this process enabled salient themes and categories from the text to emerge and be identified. As explained in the figure below, the process comprises four main steps as follows:

**Figure 6.2:** The Process of Analysing Qualitative Data



Source: Adapted from Creswell (1998).

**The first step:** includes preparing a clear text transcription from the replies of the interviewees, and then a comprehensive reading was conducting several times in order to become familiar with the text, and to create general insights about the qualitative information, and to determine the general dimensions of the information. According to (Dey, 1993, p. 83):

‘The aim of reading through our data is to prepare the ground for analysis. We can compare the actions of reading the data with a bit of gardening. By digging over the ground, we loosen the soil and make it possible for the seeds of our analysis’.

**The second step:** is the analysis of the text transcriptions by which the key facts, words, phrases and paragraphs relevant to the enquiry are marked and highlighted in different colours. Moreover, paragraphs and sentences to be cited from the transcription are underlined and marked in a specific colour. Finally, relevant paragraphs and sentences are extracted and organised in tables under different headings. The main objective of this step is to summarise the transcriptions, to identify the relevant themes, to translate and classify interviewee ideas, opinions, perceptions and views into subjects and themes and to identify and overlapping themes or hidden meanings.

**The third step:** consisting of creating coding categories in to which themes or subjects are grouped. The central objective of this step is to group subjects under a particular title or a heading. In this context, Creswell (1998, p. 144) argues that ‘the category formation represents the heart of qualitative data analysis’. In addition, Marshall and Rossman (1999) see categorisation as a consequence of prolonged engagement with the data (the text transcription).

**The fourth step:** which is the final phase of the process is to display and present the findings of the analysis using many techniques, such as quotation, citation, charts, diagrams, tables and figures. The general objective of this step is to summarise the findings and make them more direct and clear.

The above procedures were employed to handle all of the interview data and information gathered. As a consequence, data and information of varying quality and quantity were generated from the analysis and categorisation. However, owing to the nature of the study, the type of research questions and the main purpose of the study, as well as time and financial constraints, it was decided to extract bits of data and information (citations) which are relevant to the key issues of the study from the text transcriptions. These were used as a means to present the results of the interviews, ideas, opinions, perceptions and views of interviewees and, finally, they were used to underpin the analysis, argument and discussion. Furthermore, the volume, validity and the quality of the information generated enabled suggestions for further research to be made. In this regard, (Hakim, 1987) has indicated that one of the characteristics of qualitative data is that it allows exploratory studies and more focused quantitative studies to be addressed. In this sense, the qualitative data offered good material for further research.

The findings of the interview were categorised under four broad issues or themes. These are: The emissions trading policy (definition, scope, emissions reduction policies, organisation, government, regulation, obstacles and future vision); the implementation of emissions trading policy (promoting GHG emissions reduction policies, the long and short term challenges, government reduction targets, obstacles, environmental and economic implications); sustainable development (emissions reduction policy and its contribution towards sustainable development, the investment in new technologies, clean production, the incentives to innovate and build sustainable infrastructure, obstacles constraining the industry's operations); and the GHG emissions (strategies to reduce GHG emissions particularly CO<sub>2</sub> emissions, scenarios involving reduction in GHG emissions, GHG emissions regulation and trading regime, commercial risks and opportunities). These categories are tabulated and discussed in more detail when introducing the process of categorisation in this study.

### ***3- The process of categorisation the findings***

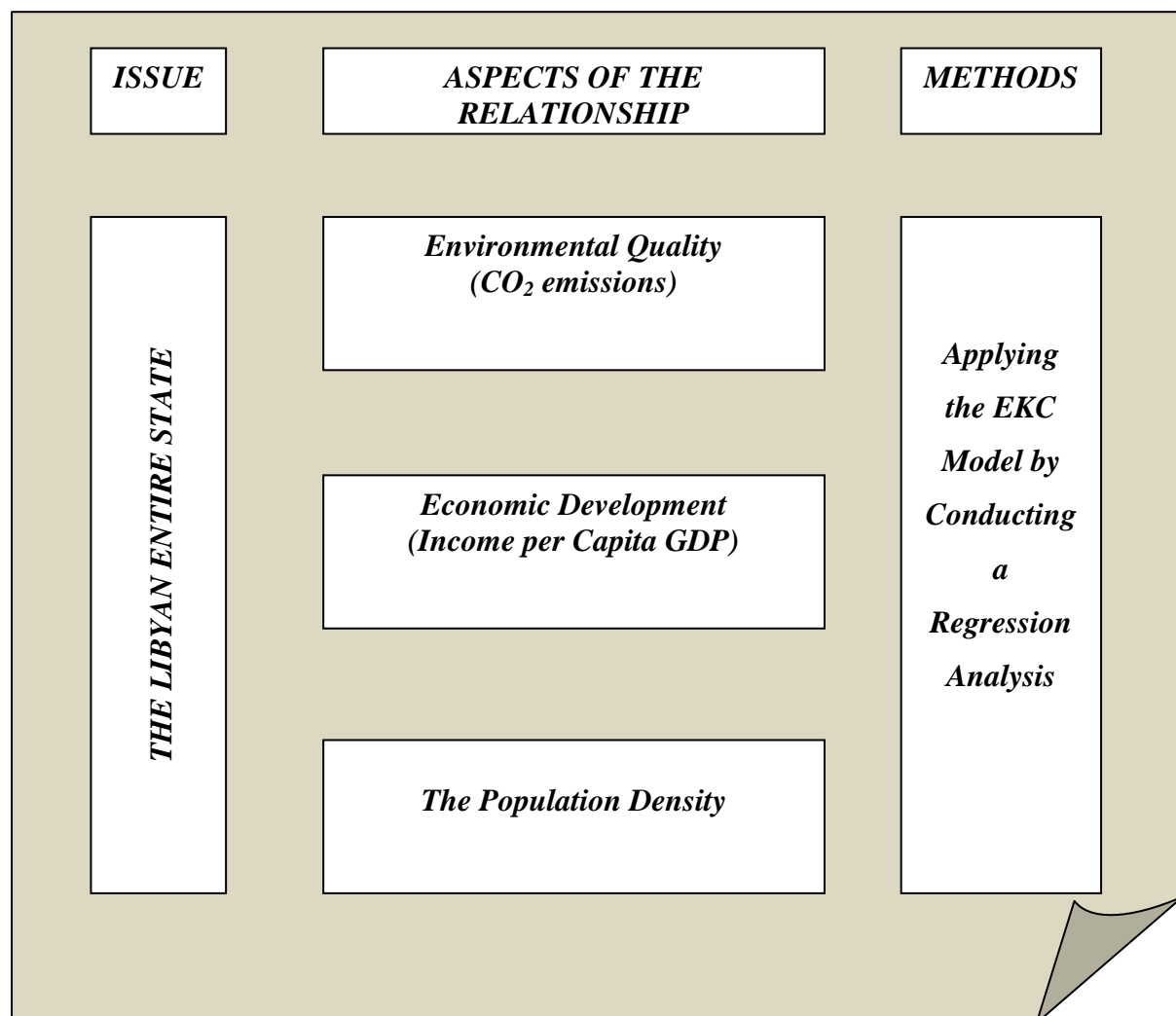
For the purpose of building up the basis for discussion and analysis in this study, it is therefore essential to set up some sort of categorisation for the findings of the study. Consequently, the process of the categorisation of findings is a crucial phase in the whole research process. It is the framework which guides and organises the process of discussion, interpretation and analysis of the results, and links the research aims and objectives with the study's findings. Furthermore, it enables the researcher to compare the results of the study, to identify differences and similarities and to make vital links between the results of the quantitative and the qualitative research. Finally, it allows the emergent issues and research variables to be integrated under key issues and indicators.

In this study, the process of categorisation depended on the purpose and the research questions of the study. Therefore, the information and findings which emerged were grouped and categorised into two broad sets: these are categorised under two main headings: firstly, issues and aspects based on the findings of the secondary data analysis (quantitative data analysis); secondly, issues and aspects emerging from the analysis of the interview survey.

#### ***Firstly: Issues and Aspects Based on the Findings of the Secondary Data Analysis***

The main objective of analysing the quantitative data collected was basically based on testing the EKC hypothesis in the case of Libya. The key issue was the entire country and the most important aspects were relied on analysing the key variables associated with studying the nexus between the environmental quality and economic development. These variables are described in more detail in chapter four. See Figure 6.3 below.

**Figure 6.3:** Key issue and aspects of studying the relationship between environmental quality and economic development



The above figure describes the key issue and aspects based on the findings of the secondary data analysis. The results indicate that Libya's position is located on unfavourable part of the EKC framework. In this regard, the findings have clearly demonstrated the non-existent inverted-U shape in the case of Libya. This was due to the lack and the absence of implementing such environmental regulations and the use of technological innovations. Based on its geographical location and the endowed of natural resources such as oil, cement and iron, the expectations for the long-term in the case of Libya are to some extent positive. Therefore, the implementation of environmental regulations in Libya will improve the environmental quality in the long-run and in this regard developed nations can play a fundamental role by transferring their technologies in order to protect the environment.

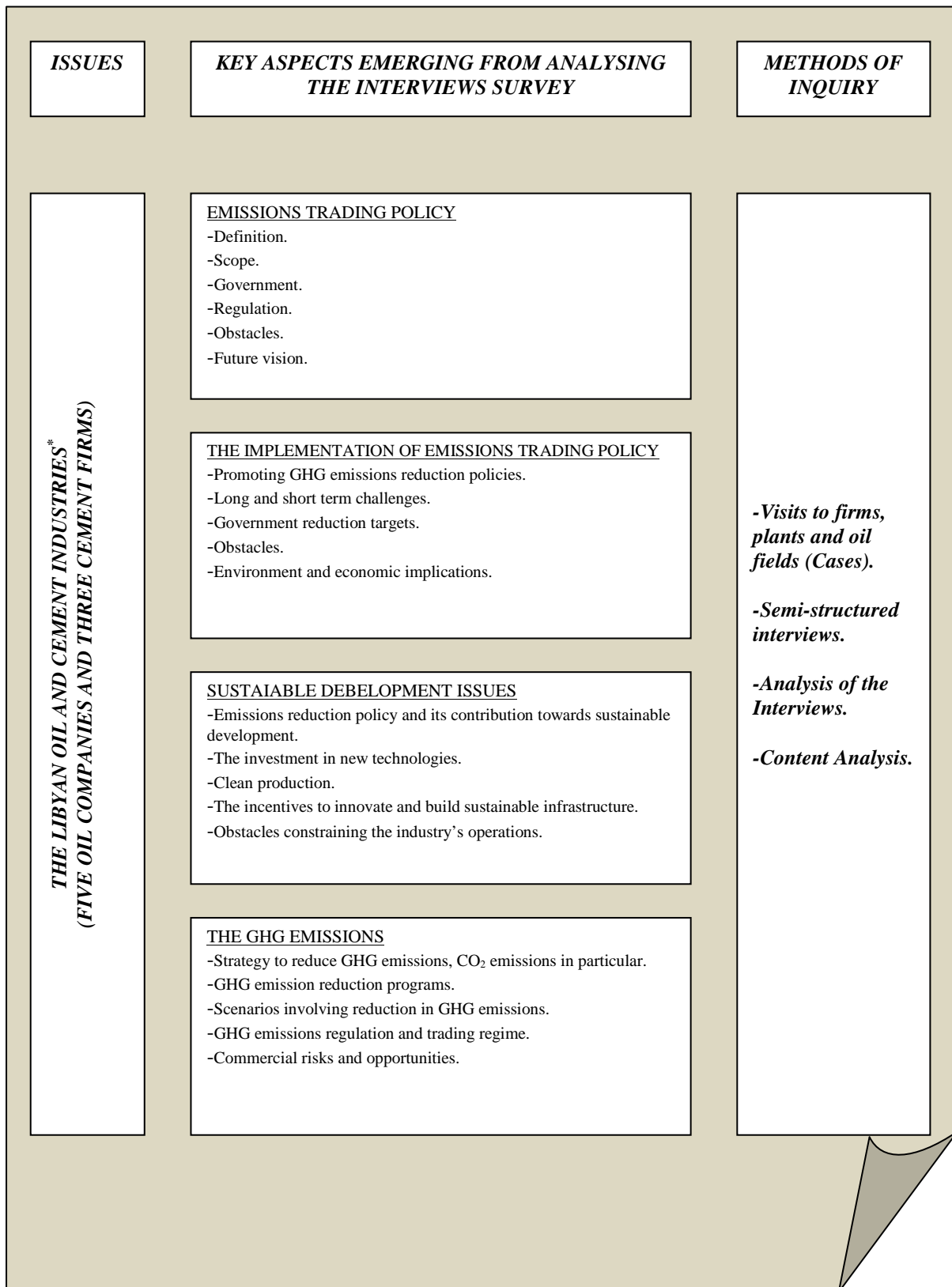
***Secondly: Issues and Aspects Emerging from the Analysis of the Interview Survey***

Methodologically, the organisation process was based on the analysis and discussion in chapter five which enabled the researcher to identify the key issues and aspects of the research to be investigated. The issues which emerged from the qualitative research are grouped under the issue ‘the Libyan oil and cement industries: to investigate the organisational or corporate context surrounding the potential adoption of emissions trading policy in order to reduce GHG emissions in Libya, particularly CO<sub>2</sub> emissions and then contribute towards sustainable development’. This includes key aspects and factors that influence the adoption of emissions trading policy in Libya as one of the key policy which can reduce the environmental damage caused by those industrial companies.

These aspects were grouped under four main headings: the emissions trading policy; the implementation of emissions trading policy; sustainable development; and the GHG emissions. Figure 6.4 illustrates these key aspects.

It was considered vital to employ information, materials and findings related to this issue in both chapter two and chapter four in which great emphasis was given to the general characteristics of these industries in terms of the Libyan environmental law, the applications of the environmental regulations in both oil and cement industries and information about the selected oil and cement companies in this study. In addition, issues and aspects relevant to the experience of those interviewed units were used to interpret and underpin the study’s findings.

**Figure 6.4:** Issues and aspects emerging from the analysis of the interview survey



\*To investigate the organisational or corporate context surrounding the potential adoption of emissions trading policy in order to reduce GHG emissions in Libya, particularly CO<sub>2</sub> emissions and then contribute towards sustainable development.

**APPENDIX (G): The Autocorrelation Results of Both Equations 2 and 3**

*First:* The autocorrelation results of the equation (2).

**Autocorrelations**

**Series: Income per capita GDP**

Lag	Autocorrelation	Std. Error <sup>a</sup>	Box-Ljung Statistic		
			Value	df	Sig. <sup>b</sup>
1	.725	.162	20.008	1	.000
2	.512	.160	30.311	2	.000
3	.344	.157	35.097	3	.000
4	.241	.155	37.525	4	.000
5	.179	.152	38.911	5	.000
6	.147	.150	39.873	6	.000
7	.134	.147	40.700	7	.000
8	.123	.144	41.425	8	.000
9	.106	.142	41.979	9	.000
10	.076	.139	42.277	10	.000
11	.035	.136	42.344	11	.000
12	.029	.133	42.390	12	.000
13	-.025	.130	42.429	13	.000
14	-.034	.127	42.501	14	.000
15	-.006	.124	42.503	15	.000
16	.020	.121	42.532	16	.000

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.

**Second:** The autocorrelation results of the equation (3).

**Autocorrelations**

**Series: The total population density**

Lag	Autocorrelation	Std. Error <sup>a</sup>	Box-Ljung Statistic		
			Value	df	Sig. <sup>b</sup>
1	.914	.162	31.814	1	.000
2	.822	.160	58.357	2	.000
3	.731	.157	80.002	3	.000
4	.641	.155	97.183	4	.000
5	.553	.152	110.391	5	.000
6	.468	.150	120.162	6	.000
7	.386	.147	127.058	7	.000
8	.309	.144	131.641	8	.000
9	.237	.142	134.443	9	.000
10	.170	.139	135.946	10	.000
11	.108	.136	136.575	11	.000
12	.050	.133	136.714	12	.000
13	-.005	.130	136.716	13	.000
14	-.058	.127	136.921	14	.000
15	-.107	.124	137.663	15	.000
16	-.154	.121	139.273	16	.000

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.



**APPENDIX (H): Some Photos that Compare the Status of the Cement Plants between Libya and the United Kingdom**

***Cement Plant in UK***



***Cement Plant in Libya***

