A critical investigation into the barriers and opportunities for environmental management systems ‘EMSs’ implementation for the delivery of environmental benefits to the Industrial City in Jeddah, KSA.

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Abstract

The first Industrial City (IC) in Saudi Arabia was established in Jeddah; it is now suffering from serious environmental problems. Environmental Management Systems (EMSs) represent an internationally recognised tool developed to provide a systematic, self-monitoring approach for making continual improvements to all the environmental aspects of a business in line with local environmental regulations and standards.

This research critically investigates the scope of the implementation of EMSs in this IC, which necessarily entails assessing the efforts of the Presidency of Meteorology and Environment (PME), which is the government agency responsible for environmental protection. This research also details the barriers and possible environmental benefits to be derived from EMS implementation. These objectives are achieved through a multi-method case study research design, involving questionnaires, semi-structured interviews and document analysis. 183 organizations (32% of all organizations in the IC) participated in the questionnaires, and two sets of interviews were conducted: 14 with environmental managers in the IC, and 12 with officials from various relevant government agencies.

The results show that the basic requirements of EMS are inadequately implemented, and that awareness of environmental legislation (and compliance with it) is extremely limited. The most important barriers facing the implementation of EMSs in this IC include lack of enforcement of existing legislation and low levels of environmental awareness. The cost of implementing EMSs is a further important obstacle, particularly for small- and medium-sized organizations (SMEs). Nevertheless, although the main motivations reported were economic, adopting an EMS in full can result in measurably improved environmental performance, through reducing natural resource consumption (chiefly energy and water). Those with an informal or partial EMS also experience environmental benefits relative to those who have no form of EMS. Improvements to operational safety are another benefit to be derived from implementing EMSs. It also argues that the widespread adoption of EMS could greatly assist the government in its drive toward sustainable development and improved management of natural resources.

Accordingly, recommendations are provided to enhance the implementation of EMS in the IC as well as to overcome the aforementioned obstacles in order to effect changes towards achieving sustainable development.

Keywords: Environmental management systems (EMSs); implementation of EMS; Sustainable development; Environmental awareness; EMSs; KSA.

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List of Acronyms and Abbreviations

CSP:	Concentrated solar power
EAD:	Environment Agency-Abu Dhabi
EIA:	Environmental Impact Assessment
EJ:	Environmental Justice
EMAS:	European Union’s Eco-Management and Audit Scheme
EMSs:	Environmental Management Systems
EPA:	the US Environmental Protection Agency
EWS:	the Emirates Wildlife Society
FEE:	the Foundation for Environmental Education
GATT:	the General Agreement on Tariffs and Trade
IC:	Industrial City
ISO 14000:	Series of standards related to environmental management
ISO 14001:	Environmental management systems—Requirements with guidance for use
ISO:	International Organization for Standardization
JREDS:	the Royal Marine Conservation Society of Jordan
KAU:	King Abdul Aziz University
KSA:	the Kingdom of Saudi Arabia
ME:	the Ministry of the Environment in Jordan
Modon:	Saudi Industrial Property Authority
NEPIs:	New Environmental Policy Instruments
OECD	the Organisation for Economic Co-operation and Development
PME:	The Presidency of Meteorology and Environment
PSD:	the Public Security Directorate
R&D:	Research and Development
RDEP:	the Royal Department for Environment Protection in Jordan
SEPA:	the State Environmental Protection Administration in China
SMEs:	Small and Medium-sized Enterprises
SPSS:	Statistical Package for the Social Sciences
UNEP:	United Nations Environmental Programme
WHO:	World Health Organisation

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Chapter 1:

1

Sustainable development; Saudi Arabia and its environmental problems; adopting EMS in Jeddah's Industrial City

1.1 Introduction

The purpose of this chapter is to present a justification for this study's critical investigation into the extent of the implementation of environmental management systems (EMSs) in the Industrial City (IC) in Jeddah, in the Kingdom of Saudi Arabia (KSA). This entails firstly describing the approach to sustainable development as well as the status of environmental degradation in KSA, and then assessing the role of Industrial Cities in causing this. A possible solution is then proposed in order to tackle the immediate causes of industrial pollution (Environmental Management Systems), in order to protect the local environment and to promote responsible and sustainable development. EMSs are not new but they face barriers to their adoption, which hinder opportunities for further industrial development. A detailed description of EMSs and their relationship with the industrial sector is also presented; this is extensively based on a review of the literature on the subject. Then, in order to elucidate the barriers and benefits to adopting an EMS, a case study is selected (the IC in Jeddah). The city of Jeddah has suffered from decades of industrial pollution (as well as pollution emanating from other sources such as domestic traffic); the air quality over the city is often poor and the coastal waters are now exhibiting signs of serious degradation caused by industrial effluent. Much industrial waste is sent to landfill, which has long-term consequences for the viability of that land, and which is not sustainable or compatible with future development. Accordingly, the Jeddah IC is described in detail, including its historical development and the many problems it faces in terms of environmental issues. Finally, research objectives are identified and the structure of the thesis is outlined.

1.2 Sustainable development

In the last two decades, environmental problems have increased worldwide and many have become serious enough to hinder sustainable development; environmental concerns represent a key element within the sustainable development paradigm (Gaughran *et al.*, 2007). This has led many countries to review their environmental management policies and improve their peoples' awareness towards environmental issues, not only regionally but also globally. The increase in environmental awareness generally, and the adoption of environmental management systems (EMSs) in particular, might result in more progress towards the achievement of sustainable development (Sakr *et al.*, 2010).

The late 1980's saw the publication of the World Commission on Environment and Development's report 'Our Common Future', more commonly referred to as the Brundtland Report (WCED, 1987). The report successfully managed to stimulate governments and international agencies into thinking about environmental issues. This was achieved by emphasizing the connection between economic development and the environment. The definition of sustainable development which came out of the Brundtland report is, "*paths of progress which meet the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs*" (WCED, 1987 p5). One of the reasons the report was so successful is that it changed the political landscape; it recommended that politicians and researchers should be primarily concerned with how our economy affects the environment. Eisenblatter *et al.* stated, "*We are now forced to concern ourselves with the impact of ecological stress – degradation of soils, water regimes, atmosphere and forests – upon our economic prospect* (Eisenblatter *et al.*, 2002 p26). ... *many present development trends leave increasing numbers of people poor and vulnerable, while at the same time degrading the environment... we came to see that a new development path was required, one that sustained human progress... for the entire planet into the distant future*" (Eisenblatter *et al.*, 2002 p26).

Since the publication of the report, there have been increased public and political pressures placed on governments and businesses alike to become more environmentally conscious and manage their environmental impacts. This culminated in the 1992 Rio Summit (United Nations Conference on Environment and Development 'UNCED'), which embraced the Brundtland definition in its agenda (Eisenblatter *et al.*, 2002). The importance of sustainable development is now recognised on a global scale. In 2001 the former United Nations Secretary General Kofi Annan stated, "*Our biggest challenge in this new century is to take an idea that sounds abstract – sustainable development – and turn it into reality for all the world's people*" (Kühtz, 2007 p166).

A holistic approach to sustainable development emphasizes the importance of enhanced eco-efficiency from government level to multinational corporations, from non-governmental organizations to medium-sized and small companies, and from aid charities to private individuals (O'Brien *et al.*, 2007). At the corporate level, even the smallest business is touched by issues relating to sustainable development, such as environmental regulations, standardization and business standards, occupational health and safety, traffic congestion, land and energy use, waste management and corporate social responsibility (Handfield *et al.*, 2005). The question is how far governments can impose regulations onto corporate entities to protect the citizenry from the unwanted consequences of corporate enterprise, i.e., the extent to which any regulatory framework should be mandatory or whether there are sufficient mechanisms available for self-monitoring and self-regulation. The strategies and practices that provide a more sustainable world, by delivering economic, social, and environmental benefits simultaneously, can be derived by identifying the global challenges associated with sustainability; these usually entail a risk-benefit analysis, assessing the economic benefits of development against any harmful effects on society and the environment, which in turn entail adopting some form of monitory or regulatory framework (Hart and Milstein, 2003). The rational exploitation and optimal utilization of natural resources with a long-term perspective may thereby be ensured, in order that the availability and use of resources may be constantly maintained. This will lead towards sustainable development, but it must be achieved in the context of frameworks that satisfy the needs of the local populace. This will then prevent ecological imbalance and social disorder, so that human well-being is maximized, and damage to the environment is minimized (Beigl and Salhofer, 2004).

Some authors, however, have argued that the concept of sustainable development is loosely used, vague and carries many interpretations; these explanations are mostly different, competing and even contradictory (Fowke and Prasad, 1996; Elliott, 2009). This must be addressed if nations are to cooperate in addressing their collective needs and goals pertaining to sustainable development.

Nevertheless, despite the increasing environmental concerns both at home and abroad, development enterprises in KSA take place without a great deal of concern being paid to the environment; organizations seem to pay limited attention towards sustainable development practices, reflecting the limited focus in this field on the part of the government. In KSA, organizations may also be aware that environmental awareness and public pressure do not heavily influence management decisions on whether or not to establish (or where to locate) new industrial plants (Magram, 2009).

The attendance of KSA at the UNCED in Rio 1992, which subsequently resulted in the establishment of the Saudi Arabian National Agenda 21 in 1995 and KSA's accession to the Kyoto Protocol (the United Nations Framework Convention on Climate Change 'UNFCCC') in 2005, in addition to fully endorsing and signing a number of international and regional environmental laws and agreements, demonstrate KSA's concerns regarding domestic and global environmental problems (Magbool, 2009).

Locally, due to its oil industry and the subsequent economic expansion, and due to the process of rapid industrialization and urbanization, KSA now faces many significant environmental challenges, such as water and air pollution, coastal development causing damage to ecosystems, and desertification and loss of biodiversity across the Arabian Peninsula. Industry is also a heavy consumer of water, resulting in increased water shortages, which means a heavier reliance on desalination plants to supply the domestic need.

The above context stresses the need for KSA to assess and deepen its commitment to sound environmental management practices in its industrial sector. This research will investigate the barriers and opportunities with respect to implementing environmental management systems (EMSs) for the delivery of quantifiable environmental benefits to the first Industrial City (IC) (as a case study) in KSA, specifically in Jeddah, which is the second largest city.

Before describing the environmental problems facing KSA in general and Jeddah in particular, it is first necessary to describe all the relevant aspects of the Kingdom, its resources and its economy.

1.3 Background to KSA

KSA is located in the southwest corner of Asia and occupies about 2.25 million km^2 (868,730 square miles). Saudi Arabia is the largest country by land area in the Middle East, the third-largest Arab country, and constitutes the bulk of the Arabian Peninsula (Rice, 2004) (see Figure 1.1).

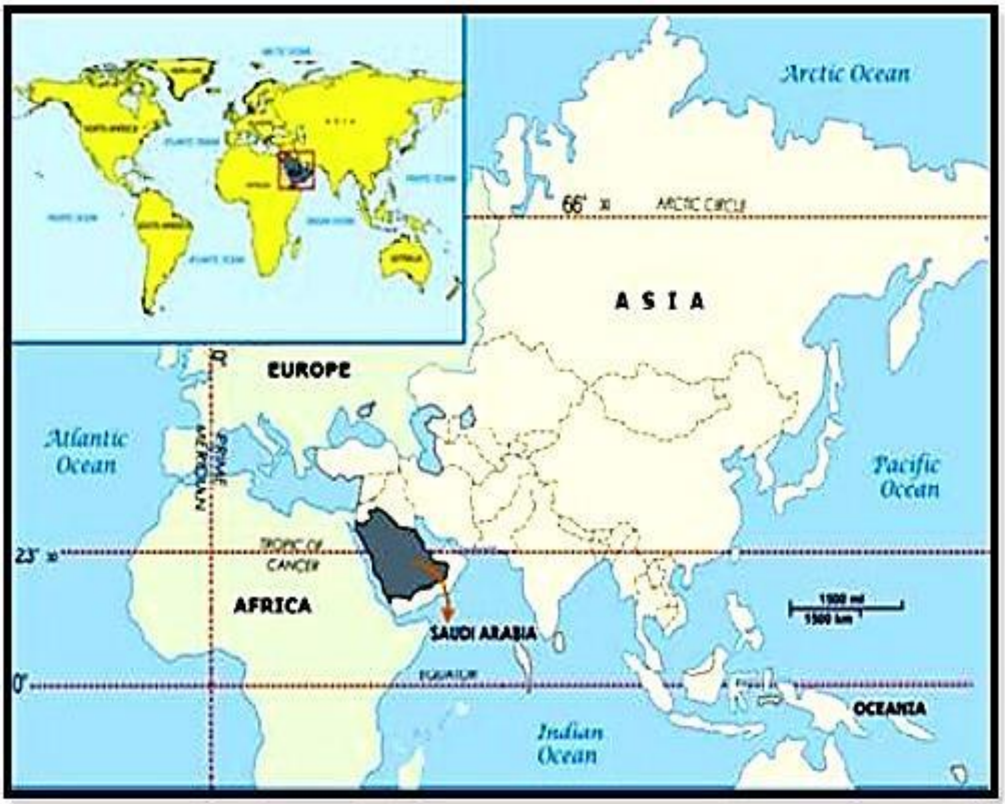


Figure 1.1: Location of Saudi Arabia
Source: (WorldAtlas, 2011)

The total Saudi population in 2014 was 30.8 million, 32.7% of whom are not citizens, and the growth rate of the total population in 2014 was 2.1%, while the population density was 15.3 people per km^2. The 2014 Gross Domestic Product (GDP) reached, with stable prices, 3.6%; the private sector contributed 39.5%, while the GDP per capita at current prices reached SR 91,703 (US$24,446) in 2014. GDP-composition by sector in 2012 was: agriculture (2.7%), industry (61.9%) and services (35.4%) (Centre of Statistics and Information, 2014). The unemployment rate among Saudis reached 11.7% in 2014.

For the sake of comparison, the UK population in 2014 was 63.74 million but the growth rate is only 0.54; the population density is much higher at 265/km^2. The GDP stands at 3.2%, while the GDP per capita is US$41,781.1. GDP-composition by sector in 2014 was: agriculture: 0.6%, construction: 6.4%, production: 14.6%, and services: 78.4% (2014 est). The unemployment rate for 2014 was lower at 5.7% (CIA, 2015; The World Bank, 2015).

KSA has an oil-based economy with strong government controls over major economic activities. The oil sector accounts for roughly 80% of budget revenues, 45% of

GDP, and 90% of export earnings (Al Turki and Faris, 2010). KSA has the world's largest known reserves of crude oil and (as of 2013) is the world's largest exporter, at over 12 million barrels per day; however, the government is keen to diversify. Accordingly, KSA is developing in various industrial sectors but principally in petrochemicals and refineries as well as in natural gas. Oil revenues and subsidised fuel have stimulated an economic boom, resulting in increased consumption of fossil fuels. However, there is a new drive for 50% of the energy consumption to be derived from renewable sources by 2020; this would represent some 60GW of solar energy by 2020, but in 2012, Saudi Arabia was only able to produce 0.003 gigawatts from its currently installed solar energy capacity (EIA, 2013). This represents a considerable challenge as consumption is rising with population growth (from 15.84 million in 1995 to 29.9 million in 2013) (Centre of Statistics and Information, 2014), resulting, for example, in increased use of transport, air conditioning and thermal desalination (EIA, 2013).

As of 2013, KSA is the world's sixth largest oil consumer at 2,861 million barrels per day, and the world's thirteenth largest consumer of total primary energy (8.506 Quadrillion Btu or British thermal units), of which about 60% percent is petroleum-based, with natural gas accounting for most of the rest, as of 2013 (EIA, 2013). The demand for energy in Saudi Arabia is increasing in line with its rapidly growing industrial sector, which places the Kingdom amongst the world's most highly industrialized nations (El-Katiri, 2014). Indeed, KSA consumes more oil than Germany, which has "*triple the population and an economy nearly five times as large*" (Plumer, 2012). KSA consumes a quarter of its own production, and has plans to increase its electricity generation capacity from 55GW to 120GW by 2020 to meet rising domestic and industrial demand; the growing industrial sector has led to the development of industrial cities on the outskirts of urban centres in which many of the petrochemical plants are located (EIA, 2013).

1.4 The state of the environment in KSA

Saudi Arabia has the highest concentration of industrial activities in the Gulf Cooperation Council (GCC) region; the GCC countries comprise Kuwait, Saudi Arabia, Bahrain, Qatar, United Arab Emirates and Oman. This leads to its having the highest level of CO_2 emissions from industrial processes, thus increasing environmental pollution as the Kingdom moves on to become a developed country from a developing one. Industrialisation and rapid economic growth go hand in hand with this development, meaning that natural resources are exploited increasingly, thereby increasing pollution. An example to illustrate this is that per capita income, energy production and energy consumption are increasing alongside the increase in environmental pollution caused by GHG and other waste by-products (see Figs. 1.2, 1.3 & 1.4). Unless stringent measures are implemented to deal with consumption patterns leading to environmental degradation, bigger environmental challenges are likely to arise in the future for Saudi Arabia with serious implications for future generations (Taher and Hajjar, 2014).

The vibrant economy and the availability of cheap subsidised fuel has had ramifications for greenhouse gas (GHG) emissions, given that there is a direct relationship between the consumption of any given amount of fossil fuel and the resultant pollution (Cançado *et al.*, 2006), with CO_2 being responsible for over 60 percent of this effect (Alkhathlan and Javid, 2013). The trends in CO_2 emissions highlight the important role played by energy production and consumption patterns, energy intensive processes, and the price and availability of energy. Energy is crucial to industrial development and economic growth (Ibid), while Sinton and Levine (1994) considered that the industrial sector is the main consumer of energy. It can be surmised that high living standards require high energy-consumption levels, the price for which is being paid by the environment because of the high carbon emissions caused by such a high consumption of energy (Alkhathlan and Javid, 2013).

The Presidency of Meteorology and Environment (PME, the primary government body responsible for environmental issues in KSA, which will be discussed in detail in Section 1.8), delivered its first report on GHG emissions in 1990 to the United Nations Framework Convention on Climate Change (UNFCCC); in this report CO_2 emissions were estimated at over 140,000,000 tonnes, 90% of which emanated from the energy sector, including electricity production, transport, desalination and refining (Rahman and Khondaker, 2012). In 2008, Saudi Arabia ranked 14th among the world's nations in fossil-fuel CO_2 emissions with about 410 million metric tons. These values, which represent only 1.4% of global emissions as of 2009, are low in comparison to those of USA, China and India (Liu *et al.*, 2012; Alkhathlan and Javid, 2013). In 2013, KSA was ranked 12th in terms of the world's worst nations for fossil-fuel CO_2 emissions, with about 513 million metric tonnes (EIA, 2013). It is stated that there is a direct relationship between the consumption of any given amount of fossil fuel and the resultant pollution (Cançado *et al.*, 2006). However, when measured as 'per person', CO_2 production in KSA is amongst the highest in the world, at 16.2 tonnes per person (Liu *et al.*, 2012). The aforementioned PME report also detailed the methane (CH_4) emissions, finding that KSA produced 787,000 tonnes in 1990, 77% of which emanated from the waste sector (agriculture and energy produced 11% each) (Rahman and Khondaker, 2012).

Thus, the GHG emissions in KSA are alarming; however, this is not surprising as pollution, according to the World Bank (2012), has a positive correlation with economic activity or industrial development (see Fig. 1.3); this is confirmed by the World Resources Institute (2011). Figure 1.3 incorporates the Comprehensive Environmental Pollution Index (CEPI) concept (or just EPI), which delivers a number that succinctly describes the environmental quality of any area under consideration; it considers environmental parameters such as air and water quality, ecological damage and visual environmental conditions; it also considers the source, pathway and receptor of pollutants. This means that on a per capita basis KSA has a slightly higher-than-average income and GDP but produces higher-than-average quantities of pollutants (particularly CO_2; by comparison, Qatar scores well but it has (per capita) a much smaller industrial base. Figure 1.4 illustrates the correlation between rising per capita income and increasing environmental pollution in KSA (Taher and Hajjar, 2014).

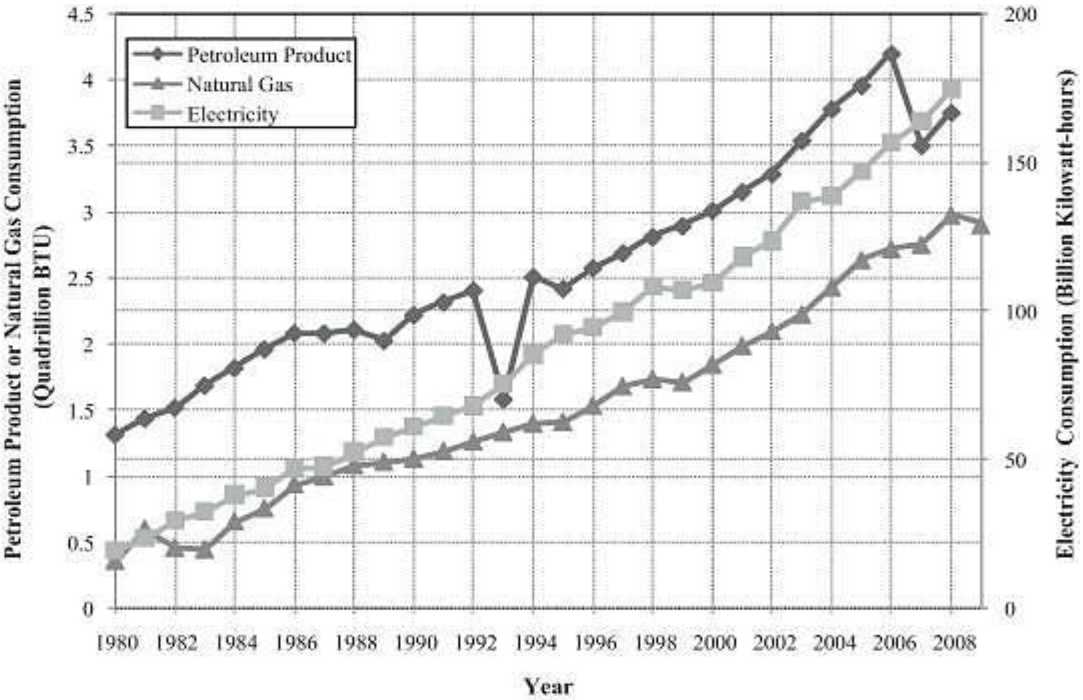


Figure 1.2: The annual consumption of electricity, petroleum and natural gas in Saudi Arabia. Source: (Rahman and Khondaker, 2012).

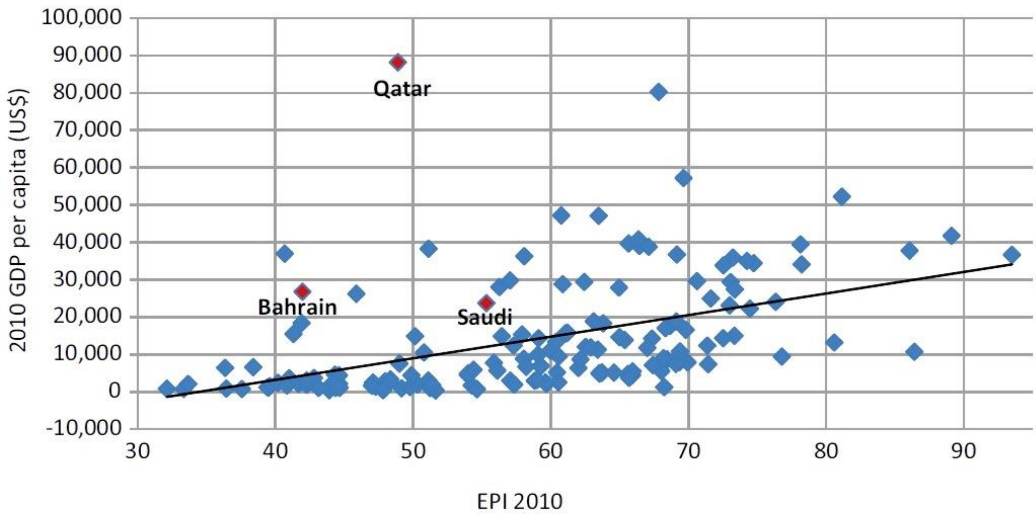
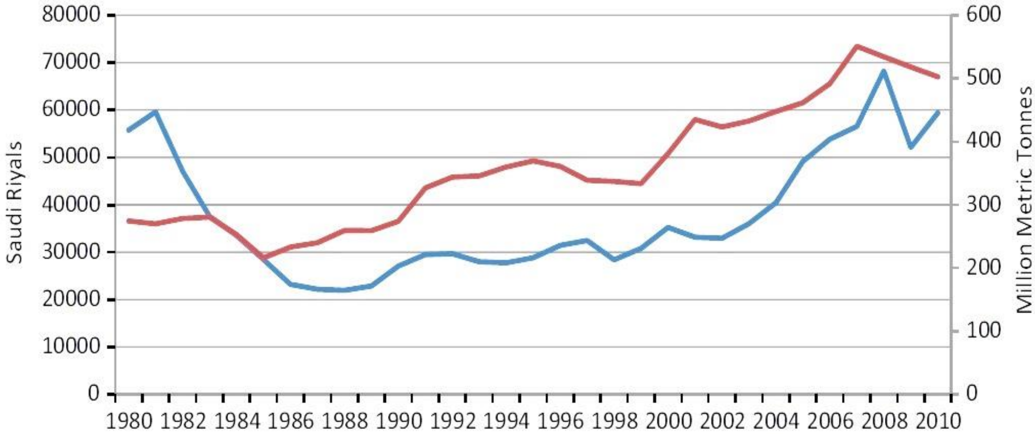


Figure 1.3: Correlation between per capita gross domestic product (GDP) and Environment Pollution Index (EPI). Source: World Bank (2012) in (Taher and Hajjar, 2014).



GDP per capita

CO_2 emissions in million metric tonnes

Figure 1.4: Per capita income and environmental pollution in Saudi Arabia. Source: World Resources Institute (2011) in (Taher and Hajjar, 2014).

Unfortunately, these trends are still on the rise with the increasing population (up by 3.2% between 2004 and 2010); vehicle fumes, which are a major contributor to CO_2 emissions, are increasing with the increase in the numbers of industrial activities and cars resulting from an increase in GDP. National fuel consumption has risen from 1.11 million barrels in 1970 to 1.02 billion barrels in 2008; the consumption of all types of oil products is also increasing. Consumptions of motor gasoline, jet fuel, kerosene, distillate fuel oil, residual fuel oil, liquefied petroleum gases, natural gas and electricity are all showing an increase. According to the United States Environmental Protection Agency (USEPA), CH_4 emissions from solid waste in KSA rose (between 1990 and 2000) from 12.4 to 16.8 million tons in terms of CO_2 equivalence ($MtCO_2eq$) (Rahman and Khondaker, 2012).

A sustainable energy supply is shown to be crucial for economic growth by the results of studies that link aggregate energy consumption (oil, gas and electricity) with economic growth. In the Saudi Arabian context, there is a strong dynamic (and causative) correlation between energy consumption and economic growth in the long term. The results also show an increase in aggregate carbon emissions (from all energy sources) both in the short and long term, according to total national energy consumption statistics. These results are therefore indicative of increased energy consumption due to industrialisation and rapid economic growth, resulting in increased environmental deterioration in the country (Alkhathlan and Javid, 2013).

Saudi Arabia's declining environmental quality could ultimately affect economic growth through its adverse effects on human health, agricultural productivity and water resources. These negative consequences can be addressed and reversed, as evinced in the industrial rivers of Europe; however strategic plans would need to be developed by policy makers to reduce carbon emissions and effluent volumes, and to conserve the environment for future generations (Börzel *et al.*, 2010). Low energy prices, which are a result of heavy subsidization by the Saudi government, could be primarily responsible for the abundance of energy intensive processes in the country. Effective implementation of energy conservation policies that include energy price reforms and fuel substitution may be a way of resolving this situation. An increase in energy prices could reduce energy consumption and encourage the use of, and further research and development in, energy-efficient technology that could reduce CO_2 emissions (Alkhathlan and Javid, 2013).

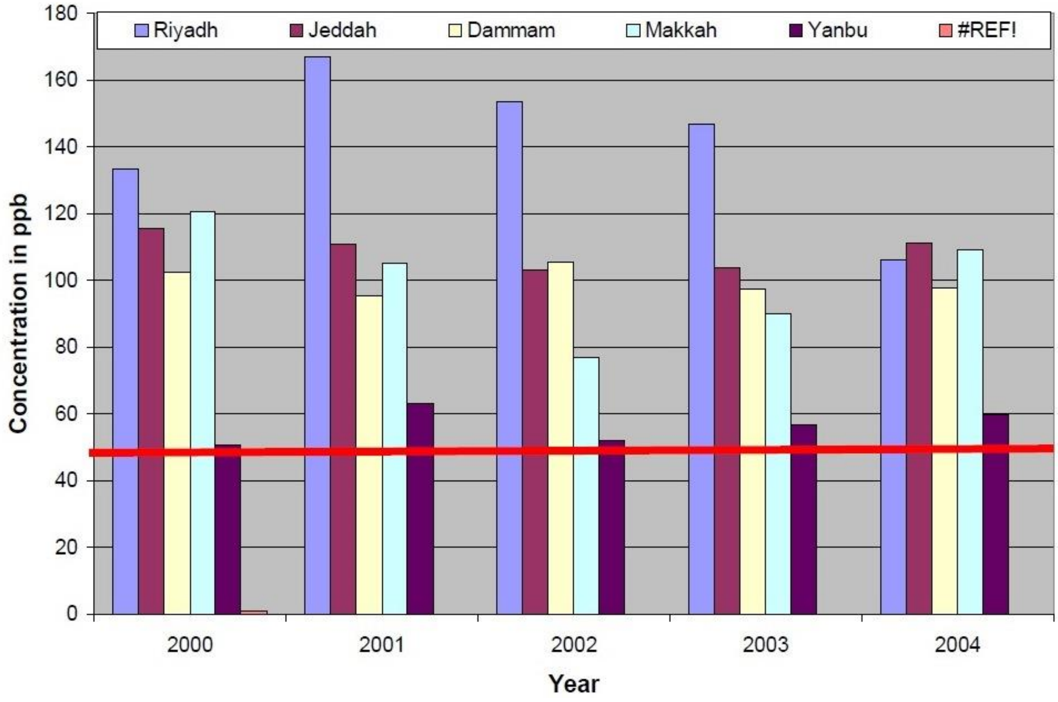
Thus, the growth in GDP and in energy consumption has implications for the environment and for the demand for domestic oil in the power, water and transport sectors. As oil is a non-renewable resource, the depletion of its sources in Saudi Arabia could result in the world's largest oil exporter having to import this commodity; therefore, credible energy efficiency and resource conservation policies are needed. Also, as fossil fuel (including oil) is not environmentally friendly, the increase in its domestic and industrial consumption in Saudi Arabia could hasten environmental degradation. There is widespread concern that if left unchecked, environmental pollution could increase along with Saudi Arabia's increasing industrialisation, to such an extent that it could retard economic growth and prosperity; China has had to curtail the operations of certain industries in and around Beijing owing to the unacceptably poor levels of air quality (Zeng *et al.*, 2005). These potential challenges clearly show the need for urgent comprehensive environmental management and policies on several fronts: these include promoting fossil energy efficiency and developing technology for harnessing renewable energy as well as measures for controlling the increasing volumes of industrial emissions. Wider policy goals to address the aforementioned problems could be achieved through a combination of incentives following global practices, and could include feed-in-tariffs, capital subsidies, investment credits and public investment and loans or financings in the renewable energy sector and in the recycling and waste treatment sectors (Taher and Hajjar, 2014). The adoption of EMS is therefore one way of complementing these wider policy efforts as well as directly addressing the need to control emissions.

Saudi Arabia's environmental pollution would therefore appear to be closely related to economic and industrial activity. Steps to increase economic growth and prosperity must be implemented in tandem with those to enhance environmental quality; measures to decrease environmental pollution and to implement environmental management initiatives as well as green innovations and investment strategies must be pursued alongside efforts whose objectives are to increase production and consumption whilst minimizing environmental impact. Environment monitoring and pollution control policies, waste treatment and management mechanisms, environment data collection and statistical analysis for effective modelling, planning, management and assessment of environmental quality must all be part of a holistic approach for addressing environmental degradation (Taher and Hajjar, 2014).

1.4.1 Industrial pollution and human health

Not surprisingly, this environmental degradation and the resultant hazards to human health are evident in the major cities of the Kingdom such as Riyadh, Jeddah and Dammam where fossil fuel-based industrial activity, automobile pollution, increasing population and environmentally unsustainable practices combine to bring about this phenomenon (Husain and Khalil, 2013).

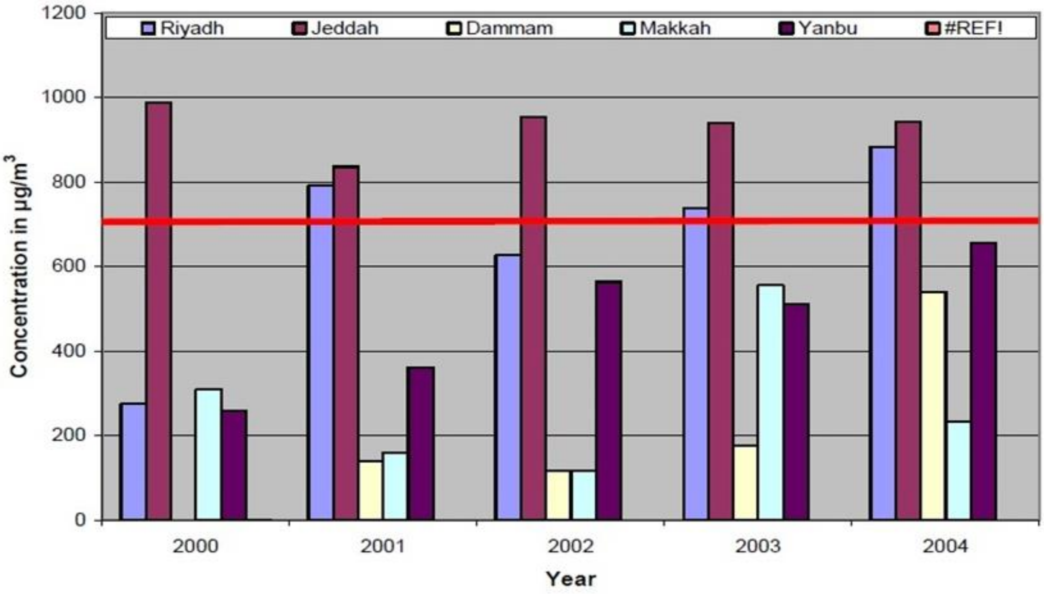
There are high levels of oxides of nitrogen (NO_x), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and inhalable particulates (PM_{10}) polluting the atmosphere in these cities; the petroleum sectors, which consist of refineries, terminals, and gas/oil separation plants (GOSPs), are party responsible for these. The use of heavy fuel oil and elevated amounts of sulphur by power and desalination plants also add to this air pollution. The graphs below (in Figures 1.5, 1.6 & 1.7) show the results of the Husain and Khalil (2013) study on air pollution (for NO_2, SO_2 and PM_{10}, respectively) in the major cities of Riyadh, Jeddah, Dammam, Makkah and Yanbu, clearly showing how the amounts of pollutants in these cases compare with the maximum permissible levels prescribed by PME (marked by a red line called 'Ref' by Husain in the key), and the recommended levels published by the WHO.



#REF: Annual mean of NO_2 level PME limits: annual mean 100µg/m^3 (50ppb).

- (WHO: NO_2 200µg/m^3 1hour mean - 40µg/m^3 annual mean).

Figure 1.5: Ambient annual NO_2 concentration trend in major Saudi Arabian cities. Source: (Husain, 2012; Husain and Khalil, 2013).

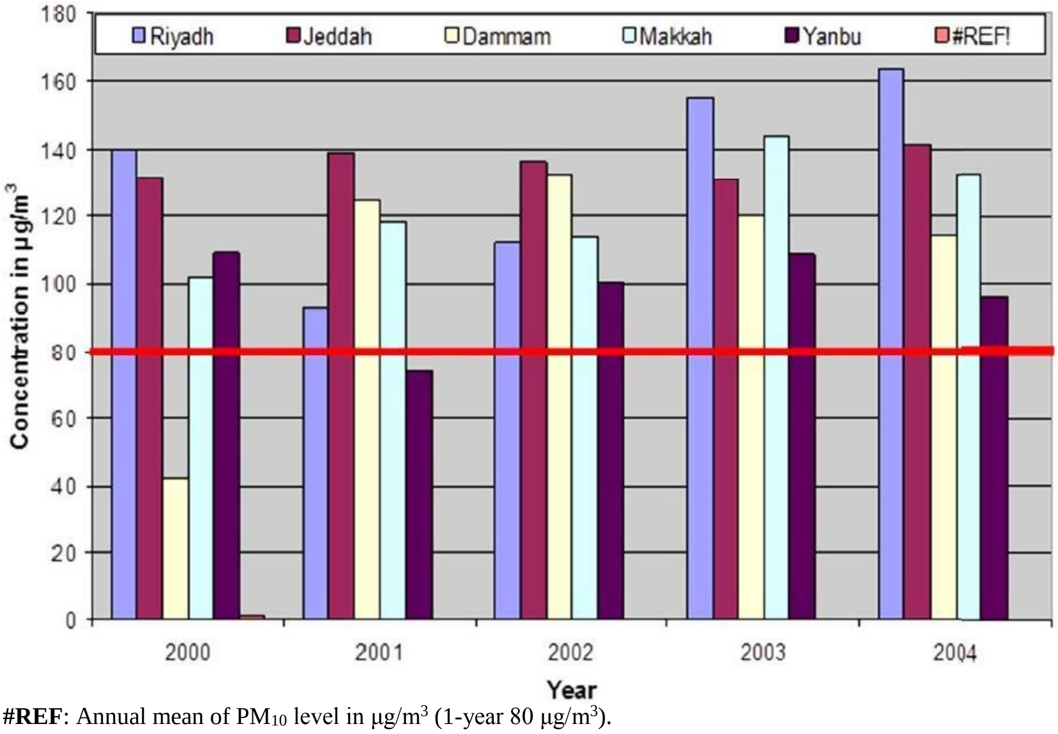


#REF: 730µg/m^3 (0.28 ppm) 1 hour twice per 30 days - 365µg/m^3 (0.14 ppm) 24 hours once a year.

- (WHO: SO_2 20µg/m^3 24-hour mean - 500µg/m^3 10-minute mean).

Figure 1.6: Ambient SO_2 concentration trend in major Saudi Arabian cities.

Source: (Husain, 2012; Husain and Khalil, 2013).



#REF: Annual mean of PM_{10} level in µg/m^3 (1-year 80 µg/m^3).

- (WHO annual mean of PM_{10} is 20 µg/m^3).

Figure 1.7: PM_{10} concentration trend in major Saudi Arabian cities.

Source: (Husain, 2012; Husain and Khalil, 2013).

In 2011 the World Health Organization (WHO) released a report on air quality in countries around the globe. Almost all of the countries with the worst air quality are major oil and gas producers and/or economies that are growing rapidly (WHO, 2011). The WHO's report "Urban outdoor air pollution database" studied air quality in 91 countries, according to the amount of PM_{10} particles per cubic metre (m^3) (Ibid). According to the WHO, the key particle size is 10 micrometres (PM_{10}) and levels above 20μg/m^3 represent a health risk and can cause various respiratory diseases, permanent DNA mutations, heart attacks and even premature death. The top ten most-polluted countries have exceeded the permissible level for PM_{10} by 6 - 14 times (Ibid). The KSA is ranked as the fifth most-polluted country among the most-polluted countries in the world by pollution level; it scored an annual mean in urban centres of 143μg/m^3 for 2003 (Ibid). However, the WHO report attributed this high level to the occurrence of sandstorms as well as to pollutants emerging from industrial activities and heavy traffic (Ibid).

In this context, a study conducted by Al-Ahmadi and Al-Zahrani (2013) correlates the incidence of various types of cancers and the amount of air pollution in various major provinces of Saudi Arabia, including Riyadh, Makkah (which includes Jeddah) and the Eastern Province (which includes Dammam). The results of the study suggest that cities with a higher number of diagnosed cancer cases per 100,000 of the population appear to have higher levels of NO_2 air pollution. Chemical industries and vehicle emissions could be a reason for the high concentrations of NO_2 in these major cities (Al-Ahmadi and Al-Zahrani, 2013). In the case of Riyadh and Jeddah, which are Saudi Arabia's largest cities, there are larger numbers of urban activities and cars because of the larger populations; this is statistically significant as these cities showed the highest concentrations of NO_2 air pollution as well as the incidence of the most common cancers diagnosed in Saudi Arabia. The fact that NO_2 is much more concentrated in these urban areas could explain this (Ibid).

The image below in Figure 1.8 shows global mean tropospheric NO_2 column density between 2003 and 2010 that Al-Ahmadi and Al-Zahrani (2013) use in their study. It uses measurements made by the SCIAMACHY imaging spectrometer on ESA's Envisat, the world's most frequently used satellite for environmental monitoring. SCIAMACHY's main remit is to measure the amount of trace gases in the troposphere and stratosphere in a global context.

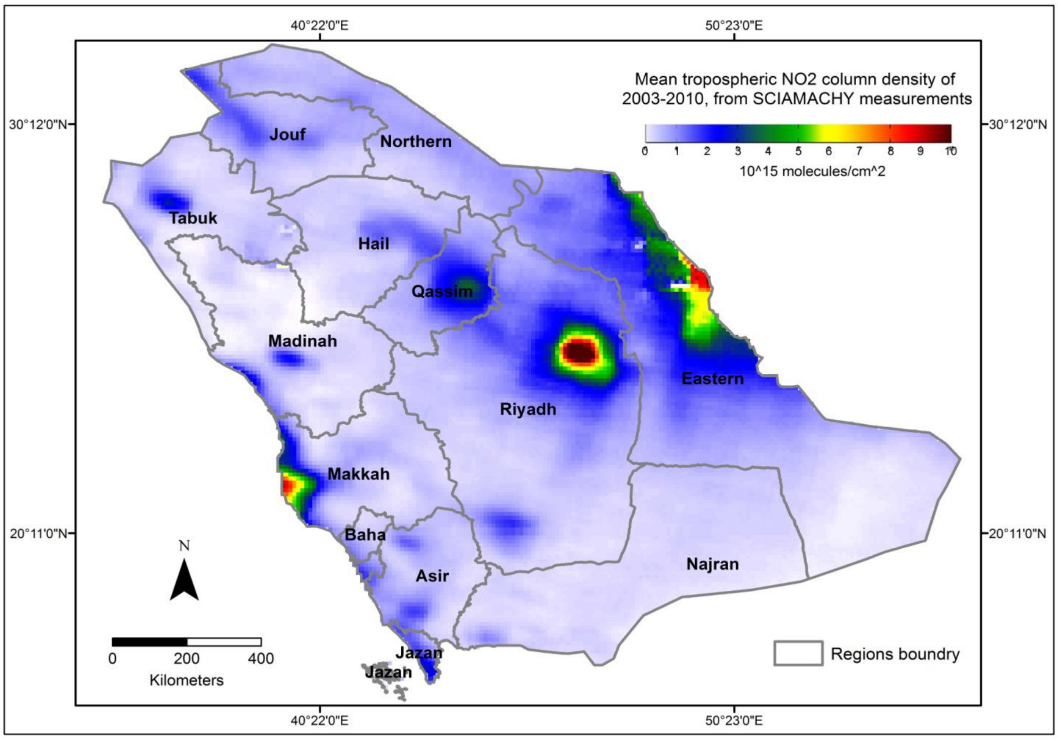


Figure 1.8: Distribution of mean tropospheric NO_2 column density, 2003–2010.
Source: (Al-Ahmadi and Al-Zahrani, 2013).

This study states that outdoor NO_2 air pollution is mainly the result of power plants, heavy industrial activities and vehicular traffic. These activities have significantly increased in Saudi Arabia over the last few decades and are highly concentrated in certain major regions: Eastern Province, Riyadh and Makkah (including Jeddah) (Al-Ahmadi and Al-Zahrani, 2013).

Ali and Al-Qahtani (2012) discusses Al-Rehaili's (2009) monitoring of the air quality in Riyadh city, and reveals that most sites in Riyadh had exceeded the recommended standards for SO_2 and NH_3. Air pollution can contain a wide variety of metals and chemical compounds, which are held in suspension and eventually fall on the soil; an assessment of heavy metals in vegetables, cereals and fruits in Saudi Arabian markets was conducted in Ali and Al-Qahtani (2012). This study was applied in 2011 on four major urban centres in the KSA as follows, Riyadh (in the centre), Tabouk (in the northwest), Dammam (in the Eastern Province) and Jazan (in the southwest). The study showed heavy concentrations of copper, zinc, lead, cadmium and mercury in various vegetables, fruits, cereals and legumes grown in these four major industrial and urban cities of Saudi Arabia. The results revealed concentrations in excess of the maximum acceptable levels proposed by the Joint

FAO/WHO Expert Committee on Food Additives. Leafy vegetables, especially parsley, were found to contain the highest metals content - 0.05µg of mercury/gm, while the acceptable maximum levels for mercury are stated by the Committee to be 0.03µg/g. Jew's mallow contained 33.22µg of Zn in a gram (the acceptable maximum level being 5µg/g); spinach had 4.13µg of cadmium in a gram instead of the permissible 0.1µg/g. In the legume group, peas maintained the highest zinc content of 71.77µg/g, instead of the permitted 5µg/gm; and cucumber had the highest lead content of 6.98µg/g, instead of the acceptable 2µg/g on a dry matter basis. Heavy metals being highly concentrated in different parts of the vegetables are indicative of the concentration of these metals in the soil; this is related to how much the air is polluted, as many of these pollutants emanate as air-borne particulates from the various industrial activities in the locality. Atmospheric depositions could play a significant role, according to that study, in elevating the levels of heavy metals in the soil and on the leaves of crops, thereby increasing the potential for health risks in consumers of locally produced vegetables. Riyadh and Dammam appeared to lead in this respect.

Heavy metal contamination in vegetables due to soil and atmospheric pollution is a great threat to the quality of life in industrialised areas, for both humans and animals, as regular dietary intakes of heavy metals pose huge health risks. Heavy metals such as cadmium and lead are known to be carcinogenic in nature (Trichopoulos, 1997 in Ali and Al-Qahtani, 2012). High concentrations of these metals in fruits and vegetables have been known to be related to upper gastrointestinal cancer (Turkdogan et al., 2002, in Ali and Al-Qahtani, 2012).

During the transportation of vegetables after harvest, air pollution plays a significant role in causing elevated levels of heavy metal content in them through the deposition of industrial and transportation pollutants over the locality (including vegetable markets) (Agrawal, 2003).

Alongside the comprehensive development that Saudi Arabia has made in living standards as well as in all industrial sectors, there has been an increase in the rate of growth in the country's population. It is therefore only natural that this increase is reflected in the demand for resources, not least of which is water. This demand is met chiefly through desalination and by tapping into the groundwater supply; there are no rivers and very few large bodies of water in the Arabian Peninsula. Whilst groundwater is non-renewable, there are still abundant seawater resources available to the country. Saudi Arabia, being the third-largest per capita water user in the whole world, has found ways (such as desalination) to address the gap between its relatively scarce potable water resources and its domestic demand (Ahmad *et al.*, 2008; Kajenthira *et al.*, 2012). According to the US Environmental Protection Agency (EPA), the KSA is thus the world's largest producer of desalinated water; 70% of the total water demand of the country is met by desalination and the remaining 30% is from ground water bores (Ahmad *et al.*, 2008). Unfortunately, owing to increased abstraction, ground water levels across the country have been falling, alarmingly so in agricultural areas such as the Qassim region, where farmers now need bore holes of over 100 metres in depth (Almisnid, 2005); indeed, Lake Layla (in the Riyadh region has entirely disappeared due to falling groundwater levels (Ibid).

Pollution of groundwater is a further problem; nitrate pollution (as NO_3) has reached levels above those recommended by WHO. NO_3 in Saudi Arabia is chiefly from agricultural sources, but poor sewerage systems and industrial wastewater also contribute to the problem. Alabdula'aly *et al.* (2010) conducted a survey of 1,060 wells in the Kingdom's 13 regions, and the results show that NO_3 levels ranged from 1.1 to as much as 884.0mg/L. The average levels in milligrams per litre were as follows: 65.7 (Jazan), 60.3 (Asir), 60.0 (Qassim), 51.3 (Hail), 41.8 (Makkah Al Mukaramma), 41.3 (Madina Al Munnawara), 38.0 (Al Baha), 37.0 (Najran), 30.7, (Tabouk), 25.2 (Eastern Province), 18.8 (Riyadh), 15.8 (Al Jouf), and 9.1 (Hadwed Shamalyah). The results show that 213 wells exceeded the maximum WHO recommended level for NO_3 (45mg/L) in different Provinces. In the worst Province (Jazan), 52.6% of all wells exceeded the recommended level for nitrates in drinking water. Al-Farraj *et al.*, (2013) support this through their analysis of a wide range of metal pollutants (iron, manganese, zinc, cadmium, nickel, lead, molybdenum, arsenic and boron as well as nitrate) in industrial wastewater, finding that the soils around and the groundwater under Riyadh are suffering from an accumulation of toxic metals (in the case of soil, up to 1km from point sources).

A potential answer to the above problems is to deliver potable water through desalination, and like many other Gulf countries, Saudi Arabia is becoming increasingly dependent on desalination. Desalination technology holds immense potential for water-scarce nations; on the other hand, the exploitation of vast quantities of seawater and brackish groundwater has been a reason for water and coastal area pollution. Saudi Arabia's utilisation of desalination facilities since 1938, with its desalination capacity now amounting to more than 30% of the world's total capacity, has risen to 3 million cubic metres (MCM) per day (690 million gallons per day (mgd)) (Husain, 2012; Kajenthira *et al.*, 2012). There are 25 desalination plants in the KSA, managed by the SWCC, the Saline Water Conversion

Corporation; 42% of the desalination capacity is produced by 21 plants, all of which are located on the Red Sea coast. On the Gulf coast in the east, there are four large plants, located in Al-Jubail, Al-Khafji and Al-Khobar. The desalination plant in Al-Jubail is the largest in the world and its capacity is 253mgd (Husain, 2012). These 25 desalination plants have produced pollution that has increased alongside the production of more and more potable water; 1.014 billion m^3 of potable water was produced in 2009 (Kajenthira *et al.*, 2012). The associated environmental impacts are substantial. Most desalination plants of Saudi Arabia are currently powered by fossil fuels, resulting in increased greenhouse gas emissions. Though alternative energy sources are being examined and assessed, they are unlikely to form more than a very small part of the total energy use for this purpose. It is therefore fossil fuel-based systems that will in all probability continue to dominate desalination for years to come (Ibid). Concentrated brine is also a result of desalination, and there are indications that coastal water quality and marine life are being and will continue to be affected. This is a result of the high discharge temperature of desalinated water and the exceedingly low concentrations of dissolved oxygen (Ibid).

Except in Riyadh, the capital, the rapidly developing coastal zones are the locations of most of the human activity in Saudi Arabia. Much of this activity relates to the oil industries, export and shipping, the refineries, the desalination plants, the power plants, and other industrial activities and factories, all of which increase the levels of turbidity in sea water. The waste being discharged into the coastal waters is heterogeneous, with varying adverse effects on the coastal environment and the sea (Al-Saif, 2011; Kajenthira *et al.*, 2012).

This results in almost the whole Saudi coast being polluted, with some areas showing greater pollution than others due to higher human activity. These include oil slicks, which easily become pushed towards the coast due to the dynamics of the surface tensions of oil and water; they then remain relatively motionless along the coast for long periods of time, causing harm to the ecosystem (Al-Saif, 2011). Hot water has an impact only in the immediate area where it falls after desalination, though this impact is greater than that of turbid water. Turbid water on the other hand becomes distributed over many square kilometres along the coast and into the continental shelf, though the adverse impact on the marine ecosystem is comparatively less than that of hot water (Ibid). Other aspects of littoral pollution have also been noticed, including chemicals (industrial and domestic) and wastewater (sewage) (Ibid). However, a comprehensive identification tool is required to quantify littoral pollution, since the impact is over wide geographic areas; littoral pollution is also dependent on diverse temporal and spatial changes, and is therefore dynamic in nature (Ibid).

1.4.2 ICs in KSA and their contribution to pollution and environmental degradation

The Kingdom plays a very important role in the world's economy, as it possesses about 24% of the world's proven oil reserves, and ranks as the largest exporter of oil (Al Turki and Faris, 2010). KSA holds the world's largest reserves of oil, is the main force for stability in the oil market, always trying to balance the needs of the oil producers with the demands of the oil consumers, and plays a leading role in the Organization of the Petroleum Exporting Countries (OPEC) (Ministry of Commerce and Industry, 2015).

Due to the large fluctuations in oil prices over the last two decades ($13.85 per barrel in February 1994, $10 in February 1999, $30 in January 2003, $87 in November 2010, $92.7 in November 2013, $60 in December 2014 and $55 in March 2015), (see Figure 1.9), a key factor in KSA government's economic strategy is industrial diversification, a process which has, as its primary objective, the reduction of the Kingdom's dependence on oil revenues. To this end, the government has encouraged the development of a wide range of manufacturing industries (Rice, 2004; Ministry of Commerce and Industry, 2015).

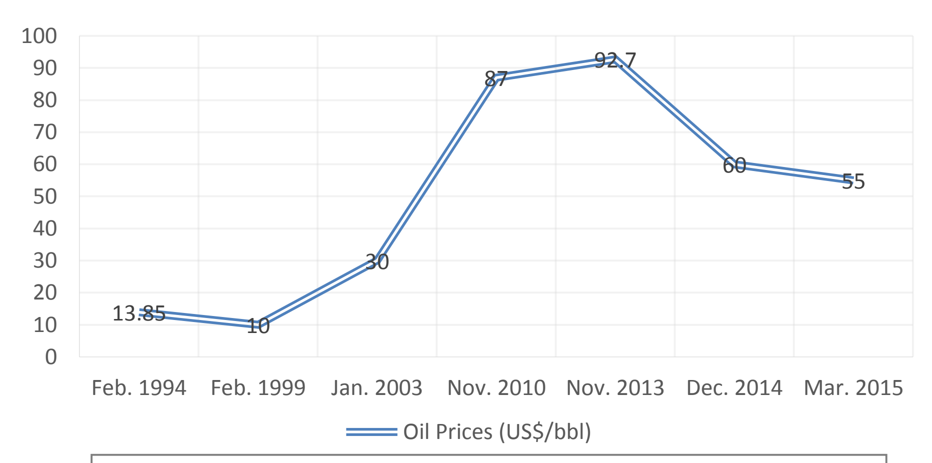


Figure 1.9: Crude Oil Prices
Source: (Rice, 2004; Ministry of Commerce and Industry, 2015)

The national strategy for industry in KSA reveals a national vision for the pivotal role of industry in growth and development, establishing and sustaining wealth-creation in the Kingdom by maximizing the proceeds of natural resources and investing in them for the benefit of all citizens (Ministry of Commerce and Industry, 2015).

The government has provided a range of incentives to encourage the private sector to participate in the Kingdom's industrial effort. Industry is considered the backbone of economic development in KSA, and many so-called ‘Industrial Cities’ (ICs) have been built in many regions of KSA, chiefly in the locality of densely populated areas (Modon, 2014) (see Figure 1.10). The Saudi Industrial Property Authority (Modon), which is responsible for the design, establishment, management and development of industrial areas and cities in KSA, currently oversees 29 established or under-development ICs, and the total area of developed industrial land until the end of 2012, (more than 142 million square metres) is home to over 4,700 businesses (Modon, 2014). These industrial cities provide private Saudi manufacturing companies with the necessary infrastructure and services at very low costs. Credit facilities on generous terms are readily available for such enterprises (Modon, 2014; Ministry of Commerce and Industry, 2015).

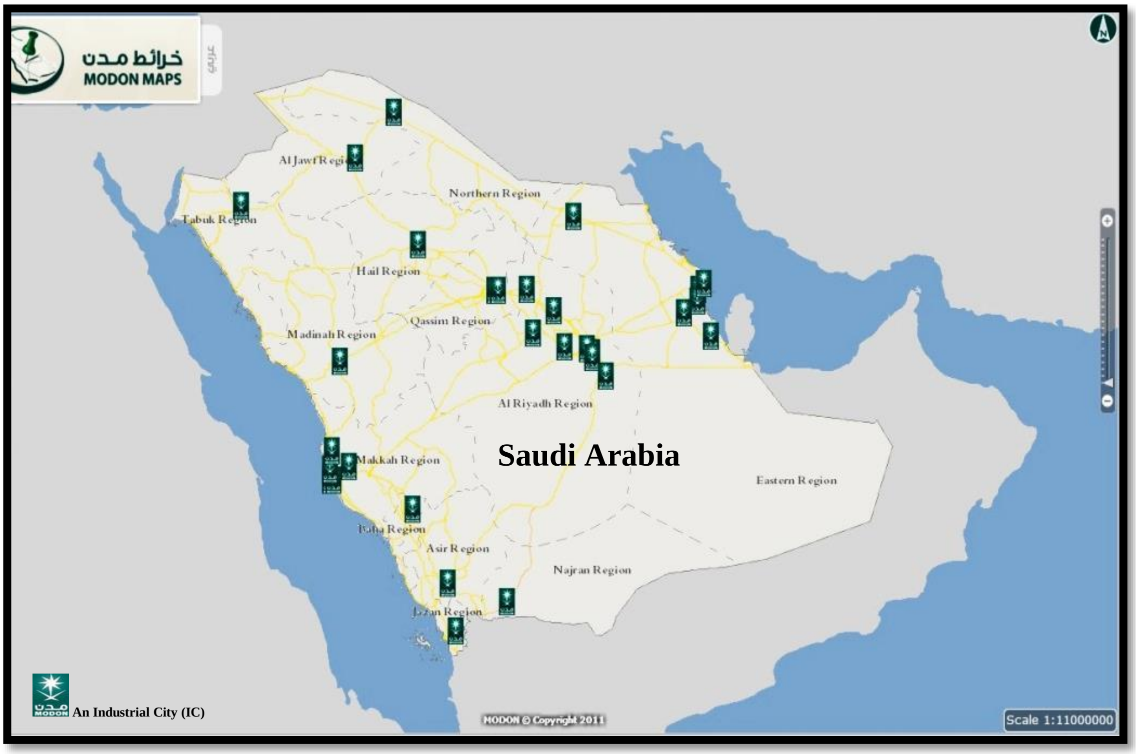


Figure 1.10: Industrial cities around KSA

Source: (Modon, 2014)

The disposal of industrial waste (of both the solid and liquid kinds) in the Industrial Cities can cause a great deal of environmental pollution; most plants within the ICs dispose of untreated liquid wastes via the sewerage system, and the solid waste through contractors. These wastes are likely to contain toxic chemical materials (Noweir *et al.*, 2013). The PME's Report No. NMEC-WQ (2006a) states that their inspection programme included a survey and the collection and analysis of samples of liquid industrial waste for 25% of all industrial plants, representing the three major industrial cities in Riyadh, Jeddah and Dammam. This was conducted in order to see whether the environmental standards for liquid waste in these industrial cities had been exceeded. Unfortunately, this programme did not include heavy industries such as oil and petrochemicals; even so, the results revealed that the liquid industrial wastes contained high levels of hazardous and toxic chemical elements such as cyanide, mercury, arsenic, lead, cadmium, ammonia, copper, zinc, phosphorus, chlorine, nickel, dissolved grease and hydrocarbons. The President-General of PME stated that the levels of these hazardous and toxic elements in the IC in Jeddah exceeded their environmentally allowable limits by unacceptably high margins, which reached to some thousand times above the acceptable limit in some cases, and would doubtless have serious environmental, health and economic consequences for KSA (PME, 2006a). For example, the level of approval of Chromium in liquid waste is 50µg/Litre and in some organizations in these ICs, the amount of Chromium reached 70.1mg/Litre, 70,000% above the approved limit (PME, 2006a p:43).

Furthermore, a number of recent studies have stated that the industrial city in Jeddah is considered as one of the most significant sources of air pollution in Jeddah (Vincent, 2003; Magram, 2009). In the early 1980s, Nasralla (1983) warned of a serious air pollution problem over the city of Jeddah resulting from the rapid industrialization and urbanization in the city. The highest rates for PM were recorded in the industrial zone to the south of Jeddah and within the commercial centre; Nasralla found the range concentration of total suspended particulates for the 24-hour mean to be 150 - 630µg/m^3, whereas the PME standard for 24-hour mean is 340µg/m^3. That study highlighted the high concentrations of photochemical oxidants in the Jeddah area; more than 0.1mL/m^3 results in photochemical smog (Nasralla and Shakour, 1981). Thus, Jeddah is now prone to the smog that used to typify Los Angeles, which is caused by the increasing number of motor vehicles and the local petroleum industry as well as other industrial processes (Nasralla, 1983). This situation has not been adequately addressed by the regional government, and control measures and environmental planning are thus needed to prevent occurrences of serious future air pollution episodes in the area.

In a study conducted by Khodeir *et al.* (2012) in 7 locations across Jeddah over two weeks at each site in June and September 2011, it was found that the concentration of particulate matter (specifically $PM_{2.5}$ & PM_{10}) in the atmosphere exceeded quantities prescribed as the permissible maximum annual mean by World Health Organization (WHO) guidelines (10μg/m^3 for $PM_{2.5}$ and 20μg/m^3 for PM_{10}) (Khodeir *et al.*, 2012), and the annual mean for national standards as stipulated by the PME (15μg/m^3 for $PM_{2.5}$ and 80μg/m^3 for PM_{10}) (PME, 2014), for these particulates. The overall mean mass concentration was 28.4 ± 25.4μg/m^3 for $PM_{2.5}$ and 87.3 ± 47.3μg/m^3 for PM_{10}, with readings showing significant temporal and spatial variability (Khodeir *et al.*, 2012).

As the most harmful form of atmospheric pollution, particulates are able to penetrate deep into the lungs and bloodstream unfiltered, causing permanent DNA mutations, heart attacks and premature death. In Europe, the average decrease in life expectancy due to atmospheric fine particulate matter (PM2.5) is 9 months, as estimated by the European Environment Agency. As mentioned above, the levels set for Jeddah by the PME are substantially higher than those stipulated by the WHO (at 15μg/m3, rather than 10μg/m3). Further, particulates, particularly those of the small PM2.5 size, could be a better indicator than PM10 for the presence of suspended particles that are a result of human activity (Aburas et al., 2011).

Aburas *et al.* (2011) analysed samples from four locations across Jeddah between December 23, 2008 and April 6, 2009, finding that the average concentration of $PM_{2.5}$ in the air was 50.8μg/m^3; in 14 sampling events out of 24, this was higher than the 10μg/m^3 and 25μg/m^3 permissible maximums prescribed for $PM_{2.5}$ by the WHO (WHO, 2006) for annual and 24-hour period means, respectively. Also, it was higher than the PME annual and 24-hour period means (15μg/m^3 and 35μg/m^3), respectively (PME, 2014). Aburas *et al.* (2011) also found the average lead concentration for all samples to be 0.07μg/m^3 (which is lower than the current WHO standard of 0.5μg/m^3). Different sampling locations within Jeddah showed variations in readings; notably, the two southern locations showed higher readings than the two northern locations, suggesting that the IC of Jeddah is responsible for the higher concentrations. These higher concentrations are more likely to be the result of the industries in the area than arising from automobile exhaust because leaded petrol was phased out from Saudi Arabia in January 2001, 7 years prior to the study (Aburas *et al.*, 2011).

Industrial fuel combustion in the IC of Jeddah appears to be one reason for lead emissions into the air. In 2008, the Saudi industrial sector consumed in total 3 million tonnes of diesel fuel and 8.5 million tonnes of heavy fuel oil (Aburas *et al.*, 2011). If uncontrolled, Jeddah's industrial sector, according to some calculations, could add about 28 tonnes of lead into the atmosphere (Ibid). The average lead concentration in the atmosphere in Jeddah is higher than that of Helsinki, Budapest, São Paulo and Sydney (Ibid).

The findings of Aburas *et al.* (2011) are supported by those of Khodeir *et al.* (2012) and Hussein *et al.* (2014); both add some new information. Khodeir *et al.* (2012) found that contributions from heavy oil combustion (69%), followed by re-suspended soil (8.2%) (soil that has been subjected to some industrial activity and becomes airborne elsewhere and characterized by high concentrations of Ca, Fe, Al and Si), industrial sources (8.6%) and traffic (3.7%) dominated the $PM_{2.5}$ mass in Jeddah. In the case of PM_{10} the contributions were from re-suspended soil (64%), heavy oil combustion (18%), industrial sources (18%) and marine aerosol (9.3%) (Khodeir *et al.*, 2012). A further problem is that of sandstorms, which carry considerable volumes of PM_{10} particulate matter (incorporating various pollutants), but these events are sporadic and the topic is beyond the remit of this study.

In this context, Hussein *et al.* (2014) investigated the temporal variation of PM concentration during year 2012 in Jeddah city. They found that PM_{10} and $PM_{2.5}$ concentrations are an overall mean value 104 ± 162μg/m3 for PM_{10} and an overall mean value 34 ± 45μg/m^3 for $PM_{2.5}$. These concentrations are in excess of the permissible maximum annual mean stipulated by WHO and PME, as stated above. In this regard, it is noteworthy that Hussein *et al.* (2014 p.1383) assert, "*the emissions from the industrial city (located in the south of Jeddah) are the main source of PM in Jeddah*".

Table 1.1: Summary of some studies on air pollution ($PM_{2.5}$ & PM_{10} concentrations) in Jeddah

Authors	$PM_{2.5}$ concentration	PME annual standard	WHO annual standard	PM_{10} concentration	PME annual standard	WHO annual standard
Aburas et al., 2011 (Dec 2008 – April 2009)	50µg/m^3	15µg/m^3	10µg/m^3	NA	80µg/m^3	20µg/m^3
Khodeir et al., 2012 (June 2011 & Sept 2011; 2 weeks)	28.4±25.4* µg/m^3	15µg/m^3	10µg/m^3	87.3±47.3* µg/m^3	80µg/m^3	20µg/m^3
Hussein et al., 2014 (2012)	34±45* µg/m^3	15µg/m^3	10µg/m^3	104±162* µg/m^3	80µg/m^3	20µg/m^3

* Standard Deviation figure

Figures from the Saudi Arabian Ministry of Commerce and Industry show that the number of manufacturing plants in the Jeddah IC has nearly tripled during the last two decades (Noweir *et al.*, 2013). Therefore, there is no doubt that the PME Report mentioned above (and other studies) justify the determination of PME to demand that all industrial organizations obtain environmental licences, conduct environmental assessments of all their facilities, and eventually force all organizations to introduce the required environmental modifications and interventions for controlling their pollutant sources.

All of the aforementioned problems necessitate the adoption of a holistic approach if the continual pollution and degradation problems are to be addressed, and one possible measure in this regard is for each plant within an IC to adopt some form of Environmental Management System (EMS). To a certain extent this is now happening, albeit in a somewhat haphazard and inconsistent manner.

1.4.3 The evolution of the need for EMS

In the last third of the 20th Century, given the continual degradation of the environment and the increasingly severe exploitation of natural resources (chiefly as a result of industrial activity), environmental laws have been established and are rapidly evolving (Szymanski and Tiwari, 2004; Watson and Emery, 2004). Since the aforementioned WCED (1987) report, governments and international agencies have become more assiduous in developing approaches that specifically address these phenomena, and many organisations have begun to improve the management of their processes and facilities (Szymanski and Tiwari, 2004). In the early 1970s, governments in many countries started to apply environmental rules and regulations by forcing organisations to adopt new practices without consulting the organisations on their possible ramifications (Aalders and Wilthagen, 1997; Arimura *et al.*, 2008). This was a command-and-control or top-down approach, in which governments dictated to organisations what actions or particular technologies they had to adopt or discontinue, otherwise there would be punishments such as fines, closure and even jail terms for those who infringed the regulations (Dietz *et al.*, 2003). However, the command-and-control approach has been increasingly criticized for stifling creativity and limiting flexibility, and for being too costly to administer (Aalders and Wilthagen, 1997; Dietz *et al.*, 2003; Szymanski and Tiwari, 2004; Arimura *et al.*, 2008). On the one hand, this traditional approach might have been necessary at some previous stages of economic development due to the many serious problems that were threatening the environment and human wellbeing, such as the London smog events of the 1950s (Szymanski and Tiwari, 2004). On the other hand, the nature of environmental problems is different now, and there are a huge number of small, hard-to-detect and diverse sources that contribute to an overall pollution problem (Holling and Meffe, 1996; Jordan *et al.*, 2003). Moreover, these problems may cause difficult trade-offs, and may involve balancing costs and risks (Jordan *et al.*, 2003). Nevertheless, many authors feel that command-and-control resource management is not fully appropriate for dealing with all these new problems because this type of system is inflexible to external perturbations, which may result in environmental, social, and economic crises and surprises (e.g., Holling and Meffe, 1996; Dietz *et al.*, 2003; Folke *et al.*, 2007). Resource management agencies under a command-and-control framework focus on efficiency of control rather than on original purposes, such as specifying goals to be achieved and how they are to be done, and research and monitoring (Holling and Meffe, 1996), although it may be argued that this mechanism is appropriate under certain circumstances, chiefly where market mechanisms do not play a part, i.e. in state-run monopolies.

Many authors have criticised the command-and-control approach, resulting in a set of new environmental policy instruments (NEPIs) being introduced, largely because of corporate dissatisfaction with top-down regulations. NEPIs include market-based instruments; these have grown significantly since the mid-1980s, and include eco-taxes, tradable permits and licences, eco-labels, and environmental auditing (Jordan *et al.*, 2003; Szymanski and Tiwari, 2004; Watson and Emery, 2004; Jordan *et al.*, 2005). Such environmental auditing was the nucleus from which environmental management systems (EMSs) or self-regulation emerged, as an internal environmental management instrument, in the USA during the 1970s (Watson and Emery, 2004; Jordan *et al.*, 2005; Koontz and Thomas, 2006). By the beginning of the 1990s, the support from governments and international agencies for the adoption of EMSs as a self-monitoring or voluntary approach had rapidly grown worldwide (Szymanski and Tiwari, 2004; Watson and Emery, 2004; Jordan *et al.*, 2005). Since then, several EMS standards have been issued, including EMAS (the European Union's Eco-Management and Audit Scheme (established in 1993)) and ISO 14001 (created by the International Standardisation Organisation (ISO) in 1996) (Jordan *et al.*, 2005). This voluntary approach has encouraged organisations to adjust their systems and processes by themselves in order to comply with EMS standards and to meet their own policy objectives (Szymanski and Tiwari, 2004).

Effective and sympathetic management of natural resources is necessary if sustainability is to be achieved; this may involve the application of voluntary approaches that involve innovative technologies, more flexible processes, more self-monitoring within industries, and more participation of all sections of society. These may be deemed onerous by certain sectors within corporate management but many authors agree that it is the responsibility of government to ensure that the needs of the populace are not compromised by the profit motive or corporate greed; thus, management and industry should be included in the development of sustainability frameworks (Holling and Meffe, 1996; Szymanski and Tiwari, 2004). "*If the 20th Century was the era of the administrative state, then the 21st Century may be the era of the collaborative state*" (Koontz and Thomas, 2006 p111).

Increasing our resource efficiency is one of the ways to move forward towards a more sustainable society, and there is now a consensus that EMSs, which consist of policymaking, planning, implementing, checking, verifying and reviewing environmental policies, are a good example of such voluntary and self-monitoring approaches; these should improve the use of natural resources, help organisations to reduce their environmental impacts, and lighten the heavy hand of government (Szymanski and Tiwari, 2004; Watson and Emery, 2004; Arimura *et al.*, 2008; Chan, 2008; Cordano *et al.*, 2010; Sakr *et al.*, 2010). As EMSs have been given such a dominant role in achieving environmental improvements within the business and industry sectors, and, given the importance of increased resource efficiency for achieving sustainable development, the requirement for sound environmental management has become evident (McDonach and Yaneske, 2002; Zorpas, 2010).

Furthermore, the pressure of international environmental agreements such as Rio 1992 'UNCED', Rio +10 2002 in South Africa, and the Kyoto Protocol, is driving the global business community, as a primary cause of environmental damage, to be more proactive and to become more involved in resolving environmental challenges. These agreements all recognise that the business sector can and should play a key role in halting and treating environmental degradation (Utting, 2000; Mitchell, 2003). This has encouraged businesses to adopt environmental management initiatives that enhance environmental responsibility, and embrace modern technologies in order to improve their environmental performance (Nash and Ehrenfeld, 1997). Recently, there has been increasing interest in environmental management systems (EMSs) that are compatible with international policies and standards, such as ISO 14001 and EMAS, which are considered by consultants as the most appropriate and applicable for the global business community in the progression towards sustainability (Watson and Emery, 2004).

However, MacDonald (2005) has argued that the EMS standard does not inherently provide a clear and understandable planning strategy for true sustainability to organizations because it focuses on the impacts of non-sustainable activities without identification of the principles behind those activities. Moreover, ISO 14001 is a general management standard, which emphasizes the importance of managing those company activities, products and services that may impact on the environment, whereas the planning and operational functions are afforded limited attention. Thus, the principles of sustainability, such as quality and environment, are not often involved as indicators in the EMS auditing process; this is especially the case in developing countries (Lam *et al.*, 2011).

In developed countries, however, the business sector has realised that they shoulder responsibility vis-à-vis environmental concerns. Businesses are now seeking a continuous development of processes, techniques, policy instruments and schemes that they can adopt in order to improve their environmental performance. This has been attributed to increased environmental awareness, public pressure and the competitive market (Nash and Ehrenfeld, 1997; Utting, 2000; Morrow and Rondinelli, 2002).

On the other hand, in developing countries and particularly those dependent on the oil industry, such as the Kingdom of Saudi Arabia (KSA), there is a general belief that concern for the environment should not result in serious economic consequences. Nevertheless, KSA has made it clear that, although its first priority is national economic development, this should be consistent with international and regional environmental laws and conventions (Swazo, 2010).

1.5 Review of EMS

1.5.1 Background to EMS

The integration of environmental approaches, such as protection policies, programmes and practices, has increased rapidly among organizations worldwide. This increase in adopting various management systems and standards led to a rise in the use of EMSs as a management process between 1992 and 2002 (Morrow and Rondinelli, 2002).

An EMS may be defined as a management system, "*which provides a structured and systematic approach to incorporate environmental protection in all aspects of the company*" (Sakr *et al.*, 2010 p211). In other words, an EMS is a systematic approach to the management of all environmental aspects when operating a business, organization or any entity that has an impact on the environment. An EMS is regarded as a continual improvement process that reduces negative environmental impacts (Darnall and Edwards, 2006; Sakr *et al.*, 2010).

In 1992, the first EMS standard (BS 7750) appeared in the UK; it was later followed by the appearance of other local and regional standards, such as EMAS: the European Union's Eco-Management and Audit Scheme, developed in 1993 (Hillary, 1997; Hillary, 2004). The International Organization for Standardization (ISO) issued ISO 14001 in 1996, the first EMS standard on an international scale, and updated this in 2004. The aim of adopting and implementing a clear and fully-integrated environmental management system such as ISO 14001, is that it should motivate organizational environmental improvements, and further, raise environmental awareness among both managers and employees. This environmental understanding should improve "*facilities transparency and play a significant role in developing an appropriate systems approach to facilities management*" (Walker *et al.*, 2007 p50), which should then be reflected positively in environmental performance. Consequently, it is not surprising that many organisations that obtain certification of a formal EMS, such as ISO 14001, have more impact on environmental performance than organisations that do not possess an EMS certificate (Melnyk *et al.*, 2003; Gavronski *et al.*, 2008; Nishitani, 2009; Heras-Saizarbitoria *et al.*, 2011).

Obtaining certification of EMS means that the organization's EMS has been successfully audited by one of the accredited certification bodies (Price, 2007); in the KSA, there are numerous private companies auditing the activities of a wide range of commercial enterprises. Certification auditors need to be accredited by the International Registrar of

Certification Auditors. Furthermore, the certification body must be accredited by the ANSI-ASQ National Accreditation Board in the USA, the United Kingdom Accreditation Service in the UK or the National Accreditation Board in Ireland.

However, many other commercial entities work towards the same goal, and achieve high levels of environmental performance merely by responding to market demands, for example, commercial manufacturing organizations and retail outlets in the fashion and cosmetics industries, often chided for the use of potentially dangerous chemicals, now compete in their advertising on the basis of being ‘environmentally friendly’ (Manley *et al.*, 2008). Notwithstanding this, many large multinational organizations are seeking EMS standards registration in order to achieve their environmental and management objectives, whilst entering into a competitive global market. These organizations are also subject to many other pressures such as government regulations, community participation, market demand and improving the organisation’s image. However, gaining entry into the international market is the primary motivation for most organizations around the world for adopting EMS standards and gaining certification by ISO 14001 (Tan, 2005).

From another point of view, some authors argue that EMSs pay more attention to creating and documenting environmental policies and procedures, rather than requiring companies to improve their actual environmental performance (Darnall *et al.*, 2008). Further, others argue that any increase in a company’s environmental performance leads to a reduction in its financial performance, as its profitability is influenced by compliance with environmental regulations costs (Watson and Emery, 2004). Moreover, organizations are drawing on their efforts in managing environmental resources to promote their environmental performance, away from core areas of the market. In this case, the organisations cannot both improve their environmental impact and still remain competitive (Klassen and McLaughlin, 1996; Hull and Rothenberg, 2008; Heras-Saizarbitoria *et al.*, 2011). As Heras-Saizarbitoria *et al*. put it: “*One view is that firms face a trade-off between social responsibility and financial performance*” (Heras-Saizarbitoria *et al.*, 2011 p5).

1.5.2 Need for EMSs

Environmental management implies the modification of the organization’s various management systems in such a way as to render environmental performance an important consideration. This is achieved through the employment hierarchies within the organization, the definition of responsibilities and duties, and the execution of environmental planning and auditing systems, together with the most suitable environmental policies that aim to improve performance and limit negative environmental effects (Hilal, 2004).

Whether to facilitate ISO or EMAS, many organisations are now introducing more modern and much cleaner technologies (in various industrial sectors) in order to obtain EMS accreditation. These are considered to be the cornerstone of successful environmental policy. In this respect, Radonjič and Tominc (2007) have argued that the EMS standard ISO 14001 seems to be particularly important in creating better conditions for the required technological changes. As evidence for its comprehensiveness and integration, there are five requirements that have to be established in order to implement ISO 14001(2004): (a) Environmental Policy, (b) Planning, (c) Implementation, (d) Checking, and (e) Management Review (see Figure 1.11) (Sakr *et al.*, 2010). Also, others have argued that well-implemented EMS standards under EMAS conditions most definitely have a positive influence on a company's environmental performance and technical innovation (Iraldo *et al.*, 2009), which, in turn, can be associated with financial performance (Zahra, 1993; Rais and Goedegebuure, 2009; Ferron *et al.*, 2012).

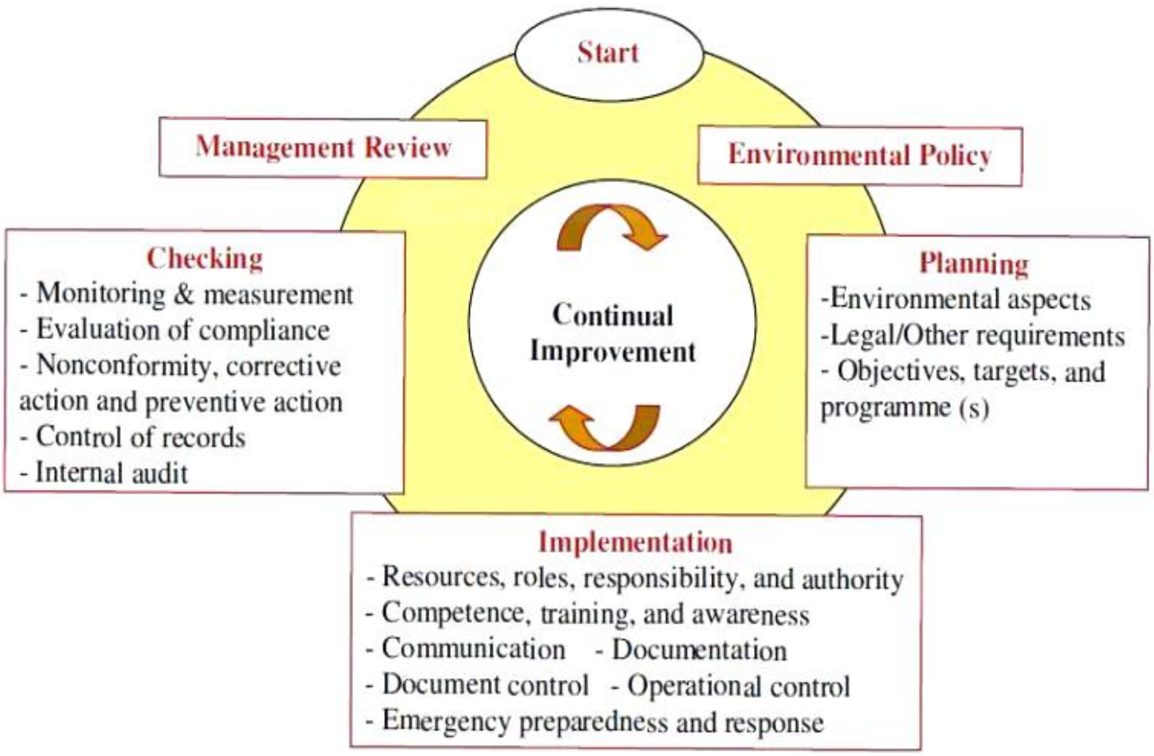


Figure 1.11: EMS model for ISO 14001

Source: (Sakr *et al.*, 2010)

Nevertheless, regardless of the means of implementation, EMSs can offer improvements in environmental performance and could possibly improve market competitiveness in the longer term. The systematic and integrated documentations and procedures (consisting of legislation, planning, implementation, monitoring and management audit in accordance with most EMS formal standards) are designed to lead to environmental performance improvements for most organizations (Morrow and Rondinelli, 2002). This point of view is often inferred, whilst the opposing view could be the more realistic; for example, an organization that has achieved a satisfactory level of financial performance, seeks to certify its facilities as a sort of luxury administration. In this case, environmental management might be affected positively by economic performance, which means the financial ability of the organization could provide more opportunities and conditions for further environmental initiatives (Heras-Saizarbitoria *et al.*, 2011).

Integrated environmental management systems are generally considered the first step in any programme of sustainable development. They represent a practical and effective way of introducing the environmental perspective, not only in the plans and policies, but also in managerial behaviour and organizational culture within both public and private sectors. Due to the necessity of providing integrated systems for monitoring and controlling environmental effects and for improving environmental and financial performance and productivity, many organizations around the world prefer to adopt their EMS under ISO 14001 instructions (Morrow and Rondinelli, 2002; Gavronski *et al.*, 2008). In general, academics are agreed that adopting ISO 14001 leads to improved operational safety and more environmental monitoring of business processes and practices (Sayre, 1996; Christensen and Rasmussen, 1998; Pun *et al.*, 1998; Tan, 2005).

However, this integration between EMSs and their implementation is not fully recognised in some corporate management aspects such as: research and development (R&D), supply chain management, etc. (Iraldo *et al.*, 2009 p1451). This leads to the benefits being sometimes very far from quantifiable or even really perceivable. Thus, questions remain about whether EMSs lead to significant improvements outside organizational boundaries (Darnall *et al.*, 2008).

Furthermore, it has been emphasized by some authors that adoption of the ISO 14001 EMS standard is often in response to market demands, to customer requirements, or to the fact that their competitors have already adopted it (King *et al.*, 2005; Potoski and Prakash, 2005a). It must be said that the adoption of an EMS standard by some organizations is purely a cosmetic exercise, an attempt to improve their image, enhance their reputation and raise their level of competitiveness, without actually reducing their impacts on the environment (King *et al.*, 2005; Darnall *et al.*, 2008). Unfortunately at the present time, ISO 14001 does not have a strong mechanism in place to impose sanctions; the body issuing ISO certificates (International Organization for Standardization) rarely rescinds the certificates of those certified companies when they fail to apply the standard, or even to publish a simple statistic about their valuations (Potoski and Prakash, 2005b; Darnall and Sides, 2008).

1.5.3 Industrial sector and EMSs

The industrial sector is a major cause of environmental problems. Depletion of natural resources and polluting emissions from various processes are the consequences of industrial development. The emissions can seriously threaten both human health and the environment. There are vast differences in the prevention approaches employed by industrial organizations, and the quantities of emissions and the sources of waste are still difficult to assess accurately (Baas, 1998; Baas and Boons, 2004). A possible solution for addressing the problem of industrial emissions is for government bodies to legislate to enforce reductions. Such an approach may have its merits but many commercial enterprises may feel that burdensome legislation is unwelcome in a competitive environment. Furthermore, this 'command and control' approach has been criticized for stifling creativity and limiting inflexibility as well as being costly to administer (Aalders and Wilthagen, 1997; Dietz *et al.*, 2003; Szymanski and Tiwari, 2004; Arimura *et al.*, 2008). An alternative way to overcome such problems is through a comprehensive approach of environmental management aimed at decreasing the consumption of natural resources, controlling polluting emissions, and limiting the generation of hazardous waste. Such a system could be adopted by organizations within a timeframe that would suit their own particular industrial circumstances, and through this, both better economic performance and conservation of the environment could be realized; they are not mutually exclusive (Saleh, 2003).

Although many industrial organizations are engaging proactively in environmental management schemes, the sector the organization operates in has an effect on the level of the organization's commitment to apply environmental initiatives. Typically, heavy metal and chemical industries are more likely to take this responsibility seriously than organizations in the service and furniture sector, for example (Burns, 2000; Howarth and Melton, 2001; da Silva and De Medeiros, 2004; Darnall and Ytterhus, 2005; Magbool, 2009).

In engaging proactively in environmental management schemes, decision makers are seeking complete openness in the relationship between pollution and industrial activity. There needs to be itemized knowledge of those stages of industrialization that are responsible for the production of industrial pollutants. Such a deep understanding should help to create safer ways of using energy resources, and to improve the quality and quantity of production whilst minimizing environmental impact (Cole *et al.*, 2005). In other words, issuing and implementing environmental policies and approaches should aim to modify the organisation’s system of dealing with natural resources, thus leading to the rationalization of their use in order to reduce the volume of pollutants and emissions.

It is clear that energy use is one of the main factors implicated in pollution, and the industrial sector is one of the main consumers of energy, particularly in developing countries (Sinton and Levine, 1994); there is a direct relationship between the consumption of any given amount of fossil fuel and the resultant pollution. The environmental impacts of industrial activities have, on the international level, led the United Nations Environment Programme (UNEP), for example, to adopt the concept of Cleaner Production (Radonjič and Tominc, 2007). This is an approach to environmental management that encourages organizations in industrial sectors worldwide to reduce their environmental impacts, and to improve and clean up their processes through the use of the latest technologies. In addition, both eco-efficiency and waste reduction need to be well managed by EMSs in all industrial units, regardless of scale. The use of new, innovative production processes is also an important factor in reducing waste and pollutant emissions, and in designing new ways of recycling waste or reusing discarded products (Cole *et al.*, 2005).

On the other hand, some authors have argued that, in spite of the positive impact of EMSs on the industrial sector, optimal environmental performance in some industries may not be achieved by implementing EMS standards alone; some issues may need the involvement of external bodies or stakeholders. Therefore, the attempts at coordinating EMS with other tools and programmes, for example, Environmental Impact Assessment, Eco-labelling, and Voluntary Environmental Programs, represent the best solution for solving this problem (MacDonald, 2005; Lam *et al.*, 2011).

The increasing use of EMSs worldwide, in both developed and developing countries, has many benefits for both the environment and the manufacturing sector. There is no doubt that manufacturing companies worldwide are looking to their customers' needs and requirements, and therefore they need to have flexibility in their drive to satisfy their customers' desires as well as address their concerns whilst remaining competitive. This flexibility lies, for example, in product design, manufacturing processes, product use information, product distribution and waste management. Because of the spread of environmental awareness, the protection of the natural world has become an important demand for many customers worldwide, and thus, in order to meet the requirements of global competition, manufacturing firms are trying to increase their flexibility in all operational and production processes (Klassen and Angell, 1998).

1.5.4 Industrial location and the influence of regulation

Choosing an industry's location is not a simple process; there are many factors influencing this decision. Industrial location takes into account considerations such as investment possibilities, availability of suppliers, locational trade-offs, government regulations and legislation, availability of raw materials, presence of seaports and airports (and their facilities), ease of accessibility (transport infrastructure), cost of transport, presence of specialized manpower, accessibility of markets and distribution places, and historical reasons (Nijkamp and Perrels, 1988; Tarantini *et al.*, 2009). Industrial areas, particularly those located close to cities, have negative environmental implications on all local communities (Tarantini *et al.*, 2009). Choosing the location for industrial activity is a crucial aspect in meeting the requirements of environmental modifications in management and production processes (Cole *et al.,* 2005).

Communities comprising disadvantaged minorities, for instance ethnic and low-income inhabitants, are called 'Environmental Justice' (EJ) areas, as stated by Edwards and Darnall (2010). When industrial companies are located in these areas, the communities within them are often exposed to environmental risk. Therefore, these companies should shoulder some responsibility towards these communities; they may otherwise be accused of discrimination. In developed countries, which generally have well-established rights institutions, these organizations may be subject to legal accountability. Consequently, companies located inside EJ areas tend to adopt EMS to avoid greater governmental scrutiny, by at least creating the appearance of environmentally friendly behaviour (Edwards and Darnall, 2010). Notwithstanding this motivation, the companies that adopt EMS tend to be characterized by systematic and well-organized business processes, and accordingly tend to be better placed than those without EMS for improving their environmental performance (Ibid).

1.5.5 Benefits of, and obstacles to, EMSs

This research is concerned with assessing the extent of the adoption and implementation of EMS in Jeddah IC, and as part of this, a number of benefits and obstacles have come to light from the literature review. Some of the suggested benefits derived from the literature, on the adoption and implementation of EMS standards (including ISO 14001), are as follows:

- Providing a harmonized standard for managing a corporation's environmental impacts.
- Identifying the environmental aspects of its operations.
- Defining environmental objectives and targets.
- Attaining environmental performance goals.
- Monitoring and measuring effectiveness.
- Correcting deficiencies and problems.
- Reviewing its management systems in order to promote continuous improvement (Morrow and Rondinelli, 2002; Gavronski *et al.*, 2008).

In addition, researchers have identified other motivations for adopting and implementing EMS standards, these include preventing potential negative environmental impacts, improving employee environmental awareness, responding to customer demands, improving corporate image, and gaining market access. Perhaps the most important motivators, however, are internal: to integrate pollution prevention programmes, improve environmental capability, and enhance employee participation in environmental management activities (Morrow and Rondinelli, 2002).

On the other hand, there are important obstacles that influence the implementation of EMS standards. Zeng *et al.* (2005) highlighted the significance of five obstacles in developing countries such as China; these are: lack of environmental awareness of top leaders; lack of environmental awareness of middle management; lack of well-defined responsibility for environmental management; lack of an effective legal system and lack of legal enforcement (Zeng *et al.*, 2005). In Italy, which is considered as being an industrially developed country, the main obstacles to EMS standards, as shown by research into small and medium-sized enterprises (SMEs), are as follows:

- High cost of EMS adoption.
- Lack of awareness and knowledge of environmental issues.
- Poor access to environmental information.
- Shortage of planning for training within the company.
- Constrained financial support and human resources.

(Tarantini *et al.*, 2009).

However, of the above obstacles, arguably the most important is awareness because without a sense of the importance of environmental sustainability, it is unlikely that any motivation to adopt an EMS will emerge. Thus environmental awareness and EMS adoption are inextricably linked.

1.5.6 Awareness of the environment and EMS

The lack of awareness and resistance amongst company employees, particularly in developing countries, is generally considered a major obstacle facing EMS implementation (Sakr *et al.*, 2010). The application and adoption of EMS standards can only be completely achieved by raising environmental and EMS awareness among organization employees, and further, among the general public. This will eventually prove beneficial to society at large because the benefits of EMS awareness are not necessarily limited to protecting the environment, but can also extend to improving the health of employees and consequently their productivity. This could have positive ramifications for corporate budgets, although the latter would need to be weighed against the costs involved in EMS administration and procedures (Sakr *et al.*, 2010). In this respect, integrated information and understanding is needed; this is considered to be a strategic approach for achieving sustainable development, whereas any development without stakeholder participation or feedback, particularly in large industrial areas, is likely to be ineffective in terms of environmental protection (Baas, 1998).

In the absence of environmental awareness, environmental group pressure, and government policies and controls, the strains between the environment and development can be very acute. To give a realistic example, in China, which is the largest developing country in the world and is in the process of a great industrial revolution, the pollutant levels are far worse than international standards, and are now having a measurable influence on people's health (Zeng *et al.*, 2005). The issuing of new local laws and strict monitoring have been appropriate solutions, but the most important approach to alleviating this problem is 'self-monitoring' by organizations, by encouraging them to implement EMS standards under ISO 14001 and obtaining certification (Zeng *et al.*, 2005). The adoption of an EMS standard often offers legal compliance, reduces pollutant levels, and improves an organization's environmental performance (Zobel, 2008). In developing countries, environmental compliance depends solely on the effectiveness of official monitoring (Yasamis, 2007), which supports China's experience of the concept of 'self-monitoring'. The situation in China demonstrates the necessity and urgent need to spread environmental awareness, which will increase the pressures emanating from local environmental groups, thereby making government policies and controls more effective.

However, the actual implementation of EMS standards such as ISO 14001 in developing countries needs to be supported by government, and this could be achieved through utilizing the following three policy strategies: mandatory policy, which entails the government instituting the appropriate legal structure and regulations in order to establish a sound foundation for ISO 14001; encouraging policy, which entails offering soft loans or short-term subsidies; and supporting policy, which entails offering training in order to raise the general level of environmental awareness within industry (Zeng *et al.*, 2005 p655).

In general, as a result of raising environmental and EMS awareness, pressures from many sources, such as government regulations, community participation and market demand, have been increasing on companies, encouraging them to be more engaged in environmental initiatives. In order to identify the critical factors that play a role in encouraging companies to create environmental management measures, Zhang *et al.* (2008) studied 89 firms in Wujin County in Jiangsu Province in China, where they revealed that pressures from the supply chain, customers and communities have all played a positive role in promoting organizations' environmental performance, thus emphasizing the importance of spreading environmental consciousness. Their findings also showed that larger organizations are more likely to employ environmental management initiatives than SMEs.

1.5.7 Pressures for EMS adoption

There are growing pressures on organizations to adopt and implement EMSs. These pressures can be summarized in four aspects: regulatory pressures, market pressures, social pressures, and ownership pressures (Potoski and Prakash, 2005a; Darnall *et al.*, 2008; Zhang *et al.*, 2008; Cordeiro *et al.*, 2009).

Regulatory pressures involve compliance with legal mandates for organizations to control and reduce their impact on the natural environment by implementing pollution control technology (Davidson and Worrell, 2001; Jiang and Bansal, 2003; Darnall *et al.*, 2008). Fundamentally, organizations embrace environmental initiatives in order to avoid legal sanctions that might include forfeiture of operating permits and financial fines and penalties that hamper business activities. These regulatory pressures, in other situations, might increase the opportunities for competitiveness (Darnall *et al.*, 2008).

Market pressures result in an incremental relationship between an organisation's environmental reputation and image, and its customers' awareness of the natural environment; whenever customers' environmental concerns increase, organizations suffer competitive pressures. This relationship encourages organizations to adopt EMSs in order to be able to market their products (Bansal and Bogner, 2002; King *et al.*, 2005; Potoski and Prakash, 2005a; Darnall *et al.*, 2008). For example, in the USA "*overall, 15 percent of US consumers routinely pay more for green products, and another 15 percent seek green products if they do not cost more. While these findings suggest that markets are creating opportunities for environmentally-friendly organizations, the majority of consumers are still not influenced by a company's proactive environmental practices*" (Darnall *et al.*, 2008 p37).

Social pressures come from social constituents such as community groups, environmental organizations, trade unions and trade associations. These social constituents bring important pressures to bear on organizations to become more environmentally friendly and proactive in environmental initiatives, which, subsequently, might drive those organizations to adopt more comprehensive EMSs (Bansal and Bogner, 2002; Jiang and Bansal, 2003; Anton *et al.*, 2004; Zutshi and Sohal, 2004; Darnall *et al.*, 2008). In addition, organizations are actively seeking to achieve social legitimacy in order to address the mobilization of public sentiment, originating from environmental and community groups, and from media reports concerning environmental disasters (Hansen, 1991; Darnall *et al.*, 2008).

Ownership pressures, due to the expectations of shareholders and investors, play a significant role in organizations' decision-making and in adopting comprehensive EMSs. According to Zutshi and Sohal (2003; 2004) investing in environmentally responsible organizations is of interest to shareholders because of their understanding of the financial consequences associated with organizations with a poor environmental reputation. In addition, involving stakeholders is directly associated with financial success. Therefore, organizations that attract such financial resources undertake EMSs to improve their environmental performance and control their environmental impacts proactively (Buysse and Verbeke, 2003; Zutshi and Sohal, 2004; Darnall *et al.*, 2008).

1.5.8 Costs of EMS adoption

There has been extensive research conducted into EMSs in industry in an attempt to quantify the costs and benefits associated with implementing an EMS. EMSs can play a significant role in the financial performance of organizations (Klassen and McLaughlin, 1996), and most authors agree that an EMS is a tool that can improve an organization's environmental performance; it can monitor, control and help to clean up an organization's processes. However, some suggest that, owing to the costs inherent in an EMS, a company's profitability can be negatively influenced by improved EMS practices (Watson and Emery, 2004); others however, claim to have evidence of increased profitability, particularly in terms of market valuation (Klassen and McLaughlin, 1996). Darnall and Edwards (2006) and Aragón-Correa *et al.*, (2008) found that publicly listed companies benefited more (in terms of asset value or profitability) from EMS adoption than public bodies or small and medium–sized enterprises (SMEs). SMEs' lack of resources are usually assumed to be the main reason why proactive environmental policies do not achieve full regulatory compliance (Dahlmann *et al.*, 2008; Murillo-Luna *et al.*, 2011). This has also been strongly supported by previous studies whose findings have shown that larger organizations are more active in employing environmental management initiatives and green innovations than SMEs (Howarth and Melton, 2001; Darnall and Ytterhus, 2005; Utting, 2005; Chen, 2008; Zhang *et al.*, 2008).

Many industrial organizations are seeking to adopt EMSs but they cannot afford to ignore the economic implications. These costs can be classified into:

- Start-up costs, which cover establishment expenditure such as documentation and expert advice.
- Implementation costs, which contain modifications (or improvements) to the organization's processes and structure, equipment for controlling and monitoring, staff training, hiring consultants, designing compatible environmental conditions and determining the types of pollutants.
- Certification costs, which include charges for certification and registration from accredited bodies (which will probably reflect the organization's size).
- System maintenance costs, which involve training key personnel, testing any emergency plans, monitoring and measurement, checking control procedures, organizing preventive and/or corrective actions, reporting, and management review meetings (Alberti et al., 2000; Watson and Emery, 2004; Darnall and Edwards, 2006; Johnstone and Labonne, 2009).

These costs are dependent upon a number of variables that will determine the overall cost for EMS implementation, which include:

- Size of organization.
- Nature and range of activities, business and production.
- Type of pollutant and size of polluted area.
- Management structure.
- Full knowledge of internal and external auditing processes.

(Feldman et al., 1997; Alberti et al., 2000; Watson and Emery, 2004; Darnall and Edwards, 2006).

Although there is the potential for increasing a company's expenditure through the adoption of an EMS, EMS-derived improvements can lead to reduced levels of risk for the company; this risk reduction is significant in financial markets, being considered the cornerstone of any investment opportunity. Risk reduction can also lead to reductions in the returns required, which means reduced needs in the financing of company activities (Feldman *et al.*, 1997).

It is expected that environmental regulations will become more stringent in the future. This is largely due to international environmental agreements, pressure exerted by society, market demands etc., and therefore, effective monitoring and control, as provided by EMS implementation, should afford some competitive advantage to any organization that adopts it (Alberti *et al.*, 2000). It should increase the organization's flexibility (in manufacturing processes), improve the manufacture of particular products (product design and product use information), and make distribution of finished products, as well as waste management, more efficient, and as a consequence of these outcomes, the organization's overall running costs will be reduced. Therefore, the adoption of an EMS should be encouraged (Alberti et al., 2000), even though, the start-up and implementation costs of any EMS adoption are expected to be high. Governments may need to contribute towards part of these costs by providing financial support, technical assistance, training, etc. (Johnstone and Labonne, 2009). In spite of that, the cost of adopting formal standards of EMS is still the primary challenge facing companies today (de Oliveira et al., 2010).

Furthermore, although cost savings can easily be achieved by taking some simple measures, the most ambitious environmental initiatives involve costs that might exceed the savings to be derived from them (Heras-Saizarbitoria et al., 2011).

1.5.9 EMS implementation

The implementation of environmental regulations in an organization is at the heart of any environmental management system, through the use of environmental aspects, goals and management programmes. In Sweden, Zobel's (2008) study concluded that the implementation of environmental policy is strictly controlled by the specifications found within EMS standards. However, according to Iraldo *et al.* (2009), the application of many EMS schemes, not solely in Europe, never reach the point of completion, and there are vast differences in the prevention applications in industrial organizations; the emissions and waste sources in some are still not accurately known (Tarantini et al., 2009).

Implementation of EMS is negatively influenced by a lack of knowledge, skills, and relevant qualifications of many practitioners of EMSs; they do not know how to implement EMS's basics and concepts. Consequently, the greatest predicted problems in the implementation of EMSs in industry is the scarcity of qualified staff (Gunningham, 2007; Chan, 2008; Lam *et al.*, 2011), in particular in developing countries (Massoud *et al.*, 2010b).

Smaller organizations may be forced to implement environmental policies that are inappropriate for them. Measuring environmental goals and determining them over long-term time periods also seems to be difficult for some organizations. Thus, EMSs, although voluntary in nature, represent a considerable responsibility for an organisation, consisting (as they do) of policymaking, planning, implementing, checking, verifying and reviewing environmental policies and assessment processes (see previous references by Szymanski and Tiwari (2004), Watson and Emery (2004), Arimura *et al.* (2008), Chan (2008), Cordano *et al.* (2010) and Sakr *et al.* (2010)).

Moreover, the study conducted by Frondel *et al.* (2008) revealed that organizations do not involve their employees to a large extent in the implementation of their environmental policy. It is frequently hypothesized that an EMS may improve an organization's environmental innovation performance (Frondel et al., 2008), however, a German study indicated that environmental innovation activities are not associated with EMS implementation or any other single policy instrument, and innovation behaviour was found to be mainly correlated with the stringency of the environmental policy (Frondel et al., 2008). "*The most important reason for inadequate performance is the lack of an effective national and local environmental compliance management system*" (Yasamis, 2007 p575).

Nevertheless, many studies agree that there are two essential phases in EMS standards application: installation and usage, where the usage phase is much more difficult than the installation phase. The usage phase is more important and needs to be internally monitored but there tends to be a lack of maintenance of the EMS standards and their specifications after their adoption and installation within the organization. Nevertheless, improving organizational processes and consequently, the environmental benefits that this affords, is a higher priority than merely obtaining some EMS policy documents and certifications as a cosmetic exercise (Balzarova and Castka, 2008). Thus, most researchers agree that EMS implementation should be beneficial for most organizations in theory; however, in practice EMS implementation has not always delivered the anticipated results. Moreover, other means are available by which an organization can meet its environmental objectives (Frondel et al., 2008). A comprehensive contractual framework, in addition to detailing the routine requirements under EMS, is important for giving clear and precise direction in environmental matters, leading to improved environmental performance results (Lam et al., 2011).

One other key tool is deemed efficacious in the implementation of EMS in order to gain optimal environmental performance; this is Environmental Impact Assessment, which is discussed in the subsection below.

1.5.10 Environmental Impact Assessment (EIA)

Environmental Impact Assessment (EIA) is "*a decision tool employed to identify and evaluate the probable environmental consequences of certain proposed development actions in order to facilitate informed decision-making and sound environmental management*" (Cashmore *et al.*, 2004 p295). EIA is fundamentally an evaluation technique, being developed through consultation with external stakeholders (other organisations, pressure groups and government agencies), whereas EMS is a management tool, designed through internal processes to manage environmental risk and to mitigate the effects of polluting emissions (Marshall, 2002). They entail many similar procedures but differ in their application; generally they include policymaking, planning, implementing, checking, verifying and reviewing environmental policies and assessment processes (as previously referenced).

In the context of this research, EIA is an obligation imposed by the PME upon all industrial organisations in the Industrial City in Jeddah and in the KSA in general, subject to which licences are approved (should the evaluatory process be satisfactory, which entails meeting a number of impact criteria relating to the applicant company's activities). Thus, each EIA seeks to assess the impact of a project through reviewing any proposed facilities and activities, and assesses how the potential environmental impacts will be controlled; this is all in accordance with the environmental rules, standards, criteria and procedures, as laid down in the General Environmental Regulations in KSA (PME, 2006b).

In order to remain compliant with the demands of the relevant legislation (including EIA), many of the organisations have adopted some form of EMS in order to deliver continual environmental improvements, especially given the current need to increase resource efficiency and to achieve sustainable development. However, it is important that any environmental assessment makes a contribution to sustainable development, and this cannot be achieved without such assessments taking the perspectives of the stakeholders vis-à-vis sustainability into consideration (George, 1999; Cashmore *et al.*, 2007; Song and Glasson, 2010).

EIA has rapidly spread worldwide since its establishment in 1969 through the US National Environmental Policy Act (NEPA), which was one of the most innovative environmental policies of the 20th Century (Cashmore *et al.*, 2004; Bond *et al.*, 2010). Much EIA research has been focused on its effectiveness as a tool to aid decision-making (Bond *et al.*, 2010); there is a general belief that EIA contributes more in theory than in practice, and therefore, its ability to deliver sustainability has become uncertain. The interpretations by research teams of the term 'effectiveness' and their identification of EIA's purposes are various; these have not been categorically addressed by the research community as a result of the diversity of scientific contexts that EIA includes, and because of the changing relationship between humans and the environment (Cashmore *et al.*, 2004).

Furthermore, recent research considers sustainable development as one of EIA's goals due to the matching of their principles. NEPA's Section 101 states that promoting welfare, maintaining man-nature harmony, and attaining the social and economic requirements of recent and future generations are the responsibility of government and of public and private organisations (Bond *et al.,* 2010). These EIA principles are in line with the sustainable development definition as stated in the Brundtland Report 'Our Common Future' (see Page 12); they both consider the general welfare and wellbeing of present and future generations. Additionally, as with environmental assessment, the concept of sustainable development has been variously interpreted, and this represents a major obstacle to its application. Furthermore, this difficulty in identifying sustainable development complicates the conceptual, methodological and analytical aspects of EIA's purposes, having consequences for its effectiveness (Cashmore *et al.*, 2004; Bond *et al.*, 2010). Therefore, in order to enhance the role of EIA in achieving sustainable development, any research must first deliver clear interpretations and statements vis-à-vis EIA's purposes and effectiveness (Cashmore *et al.*, 2004).

Recent research has shown that, for any environmental assessment scheme to be fruitful, it must be context-specific, where all the criteria for sustainable development are decided within the context of that particular development in mind. This entails identifying the perspectives of all the stakeholders involved in a development, together with the socio-economic context in which it occurs, thereby taking into consideration the culture of the locality (Cashmore *et al.*, 2007). Theoretically, a comprehensive EIA report should contribute to building a strong, integrated system of environmental management, balancing the environmental issues with the interests of the organization. Therefore, a complete EIA report, together with knowledge of the organization's future needs, should broaden the perspective of stakeholders, thereby changing an EIA report from being simply a report to being a statement of the real objectives of the organization (Sebastiani *et al.*, 2001).

EMS takes a systemic approach to pollution management but it is informed by the specifics of EIA, and the strategies and priorities of EMS are derived from the findings of EIA; thus, EMS may be viewed as an internal mechanism, whereas EIA is an external one, being informed by national legislation and public pressure. Should an EIA be successful and a development be given permission to proceed, then, in all likelihood, that new development will subsequently establish an EMS (Marshall, 2002).

A PME environmental licence is one issued by the PME (a government department) and depends on the PME's approval of an EIA; such an EIA can only be conducted by private environmental consulting offices that are accredited and authorised by the PME. The EIA reviews each organization's facilities and activities and assesses how their environmental impacts will be controlled in accordance with the environmental rules, standards, criteria and procedures, as laid down in the General Environmental Regulations in KSA (PME, 2006b). Thus, EIA in the Saudi context differs somewhat from EIA in its generic form; in the KSA, EIAs are conducted on facilities that are already operational (as well as planned ones), whereas EIA is generally understood to form part of the planning (i.e. pre-operational) process only. The PME environmental licence lasts for just two years and remains conditional. Organizations requiring continued accreditation must be regularly subjected to further EIA studies through these authorised offices. It should be mentioned that there is competition between these offices which are run on a commercial basis. This leaves open the possibility that competition for the work could influence the way these studies are carried out.

However, businesses may decide to embrace EMS of their own volition, i.e. without having had any form of EIA imposed upon them beforehand. Unlike EIA, EMS does not have a statutory basis; rather, adopting one reflects the decision of management to accede to legislative and public pressures, which in turn reflect an awareness of the importance of sustainable development, the threat of liability, and adverse media attention. EMS can also serve management as a mechanism for adapting to prescriptive and often punitive legislation. Although EMSs tend to be designed internally to fit the particular needs of the business, most companies around the world adhere at least in part to BS EN ISO 14001 or the European Union's Eco Management and Audit Scheme (EMAS) (Marshall, 2002).

Thus, EIA is a process that reflects the demands of external stakeholders but EMS is a process that reflects the business objectives. Of itself, EIA does not deliver environmental objectives; rather, it is EMS that implements the findings of management research or EIA. Indeed, an organisation's EMS must be designed such that it is primarily a proactive management tool, one that is sensitive to EIA and that can be easily adapted to manage risk, which in the modern business environment is itself an aspect that is in need of continuous review (Marshall, 2002).

Saudi Arabia is a rapidly developing country and has the resources to aspire to the highest of international standards. Its economy is developing apace and its rate of industrialization is significantly greater than other countries in the Middle East. Saudi Arabia is thus a pioneer in the region and, together with an increasingly well-educated population, it is becoming imperative that the Kingdom adopts environmentally sustainable initiatives in its drive to increase its industrial base whilst seeking to control polluting emissions and generating hazardous waste as well as reducing the consumption of natural resources (fossil water and/or fossil fuels). Thus, the adoption of EMS (and EIA) is becoming a critical issue in the KSA at this juncture in its economic development. The Kingdom has adopted a free market economic model. The financial, industrial and trade sectors of the economy have made rapid progress, enabling the private sector to play an increasingly important role in the development and diversification of the economy, especially in the fields of construction and farming. Unfortunately, during the rapid development of the industrial sector in Saudi Arabia, many activities took place without any particular concern for the environment (Magram, 2009; Ministry of Commerce and Industry, 2015).

However, this rapid economic and industrial expansion (represented by the establishment and expansion of Industrial Cities in the KSA), has caused many environmental problems in the absence of any comprehensive application of effective environmental management. A seminar on the Saudi Experience in Environmental Management recommended reinforcement of the role of environmental management systems (EMS) in all industrial projects, with the application of environmental impact assessments (EIA), in addition to adherence to environmental standards (Alsolei, 1998).

In the context described earlier, the importance of the adoption and implementation of EMS standards lies in their utilisation of voluntary self-monitoring tools that could play a useful role in achieving sustainable development, particularly in developing countries such as KSA. EMS standards could improve the management of natural resources, help organisations to reduce their environmental implications, and assist industry in KSA in complying with the government’s environmental policies. The adoption and implementation of EMS standards could also aid in the diversification of the economy, as

EMS standards represent a blueprint for the means of generating safe economy and industrial expansion; these include the mechanisms for effective management and guidance on legal positions (Szymanski and Tiwari, 2004; Watson and Emery, 2004; Arimura *et al.*, 2008; Chan, 2008; Cordano *et al.*, 2010; Sakr *et al.*, 2010). Thus, EMS would appear to be an appropriate tool for managing environmental problems stemming from the ICs in KSA, and accordingly the study context is described in some detail in the following sections.

1.6 Study context

Given the importance of EMS as an appropriate tool in managing the environmental impacts stemming from industrial development, this research shall focus on this concept. However, it would be ill-advised to attempt to examine its efficacy in all the industrial cities in KSA, and therefore a representative case study is needed, ideally one that is located within a representative city.

When the government of KSA began to diversify its sources of income in the early 1960s, they turned to industry as an alternative source to oil; however, it was not understood at the time that industry needs specific industrial areas equipped with the necessary facilities. In the mid-sixties, the government published studies on three industrial cities to be built next to the Kingdom's three main cities, which are Riyadh, Jeddah and Dammam. As mentioned above, Jeddah was by then regarded as the key industrial and commercial centre; indeed, the first industrial city in the Kingdom was founded there. Accordingly, this city is selected for the purposes of this research, and Jeddah's IC will be its case study.

1.6.1 Location and geography of Jeddah

As shown in Figure 1.12, Jeddah is located on the western coast of KSA, at latitude 21º92' North and longitude 7º39' East (Jeddah Chamber of Commerce and Industry, 2013). To the east, lie the Tehama steppes, which represent a depression in the Al-Hejaz heights. To the west, there are parallel coral reef chains at some distance from the shore, which extend to the north and the south with a length of 58km. The urban area of Jeddah is 1,765km², with the total area of the municipality being 5,460km² (Jeddah Municipality, 2013). The general area where Jeddah is located is free from any significant topographic relief. Only gentle swells occur and ancient coral rock appears where erosion or man-made cuts affect the topographic surface (Talyer and Ghazi, 1994).

Figure 1.12: Jeddah's location.

Source: (Magram, 2009)

1.6.2 Climate

Jeddah's climate is directly influenced by its geographical location, where temperatures and humidity both increase during summer; average summer temperatures often exceed 40ºC at noon and 30ºC at midnight as the area is under the influence of the seasonal Indian depression. This depression is a hot and humid air mass, and humidity reaches very high levels in summer as a result of increases in sea temperature; humidity decreases in winter as the region is affected by temperate air masses. The winter months are characterized by mild temperatures; daily values are around 23ºC with an average maximum temperature of 33ºC and an average minimum of 16ºC at night. This great difference in temperature between day and night plays an important role in the formation of thermal solstice, especially during autumn (PME, 2014). In general, low wind speeds and low rainfall are the norm and the predominant wind direction for the city is north-by-northwest, with a high percentage of calms during the night (Zerbonia *et al.*, 1986).

Thus, the prevalent meteorological conditions of KSA are associated largely with anticyclones, resulting in high solar radiation, high temperature, low wind speed and low rainfall; these are favourable for tropospheric ozone (O_3) formation. These meteorological conditions, in combination with primary air pollutants emitted by motor vehicles and industrial activities, such as carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and heavy metals, are favourable for photochemical reaction. Photochemical processes entail mixing these pollutants in the catalytic presence of sunlight, creating what are known as secondary pollutants, such as ambient ozone (O_3), peroxyacetyl nitrate (PAN) and a brown haze above cities (photochemical smog). These pollutants have an impact on the environment, human health, and crops and forest ecosystems (İm *et al.*, 2006; Hassan *et al.*, 2013; EPA, 2015b), and are poorly dispersed owing to the low daytime wind speeds and night-time calms.

1.6.3 History

According to Pesce (1977), Jeddah was an insignificant site until it was established by the Caliphate Uthman as the main port for the Holy city of Mecca in about the year 646. It replaced Shuaibah as the coastal outlet for Mecca trade because Jeddah was closer and afforded a safer natural harbour. Jeddah then maintained a hold over the profitable Red Sea spice trade. By the time that the Caliphate had been transferred to Baghdad and Damascus, Jeddah had developed into a walled city and centre of trade (the wall was rebuilt by the Mamluk Sultan of Egypt, Hussein Al-kurdi). In 1517, the town fell under the power of the Ottoman Turks, as part of the domain of the Sharif of Mecca (Pesce, 1977). The opening of the Suez Canal in 1869 led to an increase in commercial activity within Jeddah, as the volume of trade between Europe, Arabia, Africa and the Far East expanded greatly, creating wealth for Jeddah merchant families. There were many changes in the control and running of the city and of the western region of KSA (Al-Hejaz), however, the functions, character and size of the city remained virtually unchanged for centuries (see Figure 1.13). Jeddah did not witness any significant development until the beginning of 1955, when the late King Abdul Aziz Al Saud ordered the demolition of the city wall, so that construction development could expand in all three directions (north, south and east). Since that time, the city has witnessed unprecedented growth and is now a thoroughly modern city (Jeddah Chamber of Commerce and Industry, 2013).

Figure 1.13: Jeddah 1938
Source: (Facey, 2005)

1.6.4 The Importance of Jeddah

Jeddah is the second largest city in KSA and the busiest port on the eastern coast of the Red Sea (Vincent, 2003). In the past, Jeddah's importance lay as a transhipment port in the spice trade and luxury items between Europe and the Far East, and as a centre of commerce for incense and spices in the Arabian Peninsula. This was well documented as early as 1650 by the Persian poet, Nasre Khusruow, who reported in his travels that Jeddah was a great city surrounded by a strong wall with a population of five thousand (Talyer and Ghazi, 1994). As time passed, Jeddah's importance continued to increase until it became one of the largest and most important cities in Saudi Arabia, and, added to this, it became the most distinguished city, renowned for its economic, industrial and tourism activities, developing and establishing many economic projects. However, the key to the city's success was as a centre for international trade. Jeddah is an enduring and highly-active centre for trade, and is a national leader in all trade and service fields but it is also a major centre for industry, and has become an important centre for financial services (Jeddah Chamber of Commerce and Industry, 2013). As an example of the city's recent growth, about 150,000 tonnes of cargo were imported through the Port of Jeddah in 1946. This increased to over 8 million tonnes in 1977, and in 2009, approximately 28 million tonnes of cargo were imported into the country through the port. The total port throughput (imports and exports combined, bulk cargo excluding crude oil) was approximately 41 million tonnes in 2009, which is equivalent to almost one third of the total of all eight Saudi ports, which handled over 142 million tonnes in the same year (Saudi Ports Authority, 2014).

1.6.5 Population growth

Figure 1.14 indicates that Jeddah has witnessed a marked population increase over the past few decades; its population in the early 1940s was fairly stable and is estimated at ranging from 10,000 to 25,000. At that time, the population started to increase rapidly; it was recorded at 404,650 in 1971, 595,900 in 1974, and by the end of 1978 it was close to one million. By 1986, the one million barrier had been broken and the population stood at 1.4 million, but by 1993 the city had passed the two million mark and by 2004 the population stood at 2.9 million (Abdulgani, 1993; Vincent, 2003; Al-Sefry and Şen, 2006). The last census was conducted in 2010 and the population of Jeddah had risen further to 3.43 million (Centre of Statistics and Information, 2014).

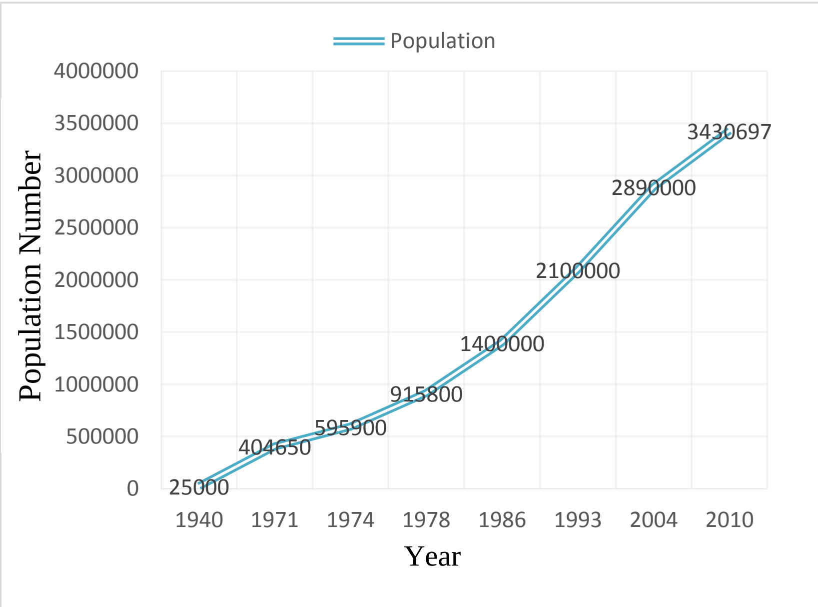


Figure 1.14: Population growth of Jeddah city

Source: (Abdulgani, 1993; Vincent, 2003; Al-Sefry and Şen, 2006; Centre of Statistics and Information, 2014)

Figures 1.15 and 1.16 show that the spatial development of Jeddah over the last sixty years has been rapid. Due to the lack of proper care or foresight, development activities were accompanied by severe environmental degradation (Magram, 2009). The failure of the infrastructure to keep pace with the rapid population growth has led to serious environmental problems, particularly associated with the now highly saline water table, and the lack of a modern sewerage system (as detailed in Section 1.4) (Vincent, 2003).

The city has mushroomed from 18,315 hectares in 1964 to 54,175 in 2007; residential development rose from 1,945 hectares in 1964 to 21,365 in 2007, and commercial land use rose from 298 hectares in 1964 to 1,555 in 2007. Consequently, in 2009, the Jeddah Municipal Strategic Planning Department adopted plans to control development in order to reduce development costs and promote mass transit systems. This new approach includes stringent residential development zoning (with new centres in high-density residential areas) for the next 20 years, (see Fig. 1.16 below), (Abdulaal, 2012; Aljoufie, 2014).

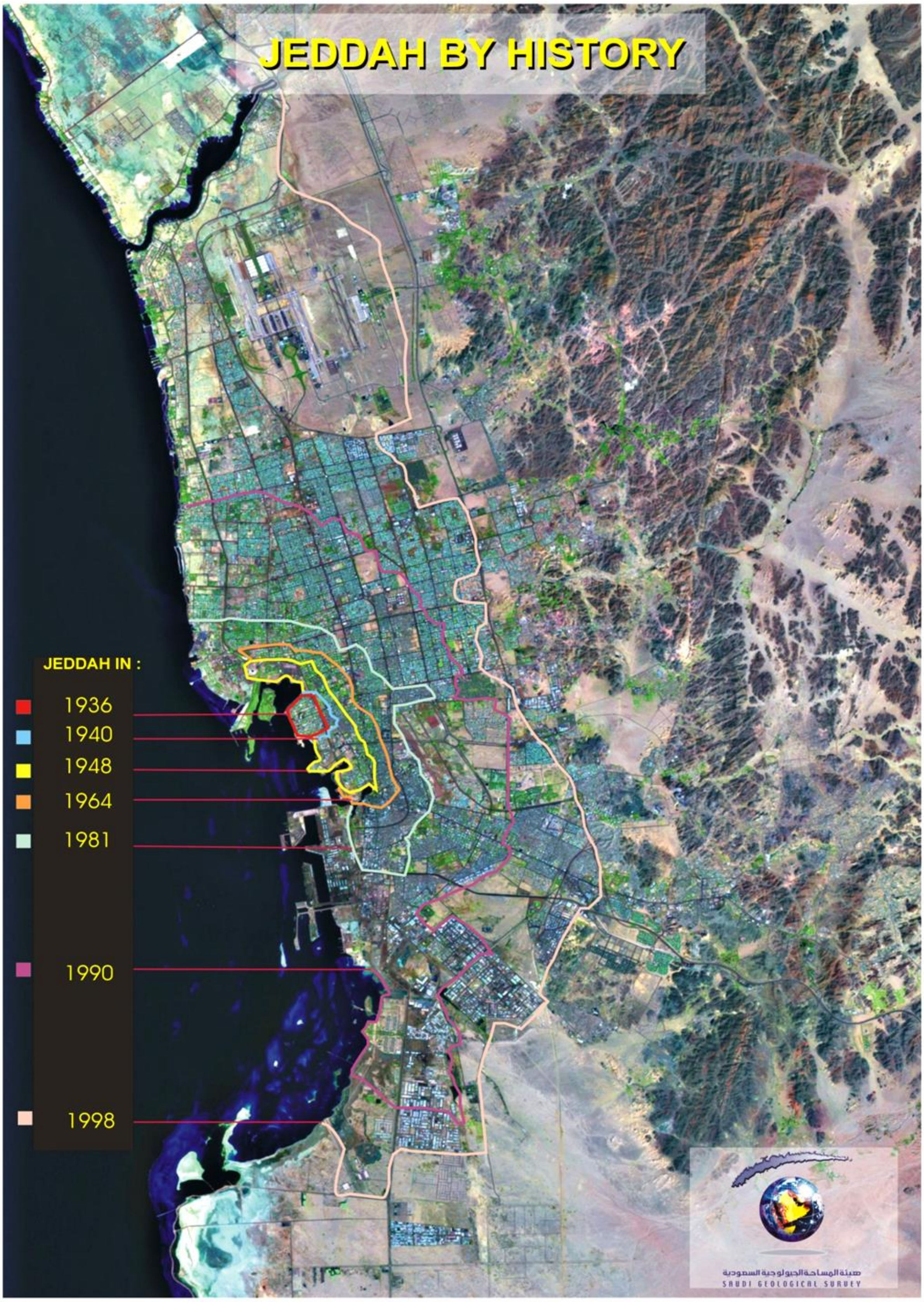


Figure 1.15: The historical expansion of Jeddah (1936 – 1998). Source: (SGS, 2014).

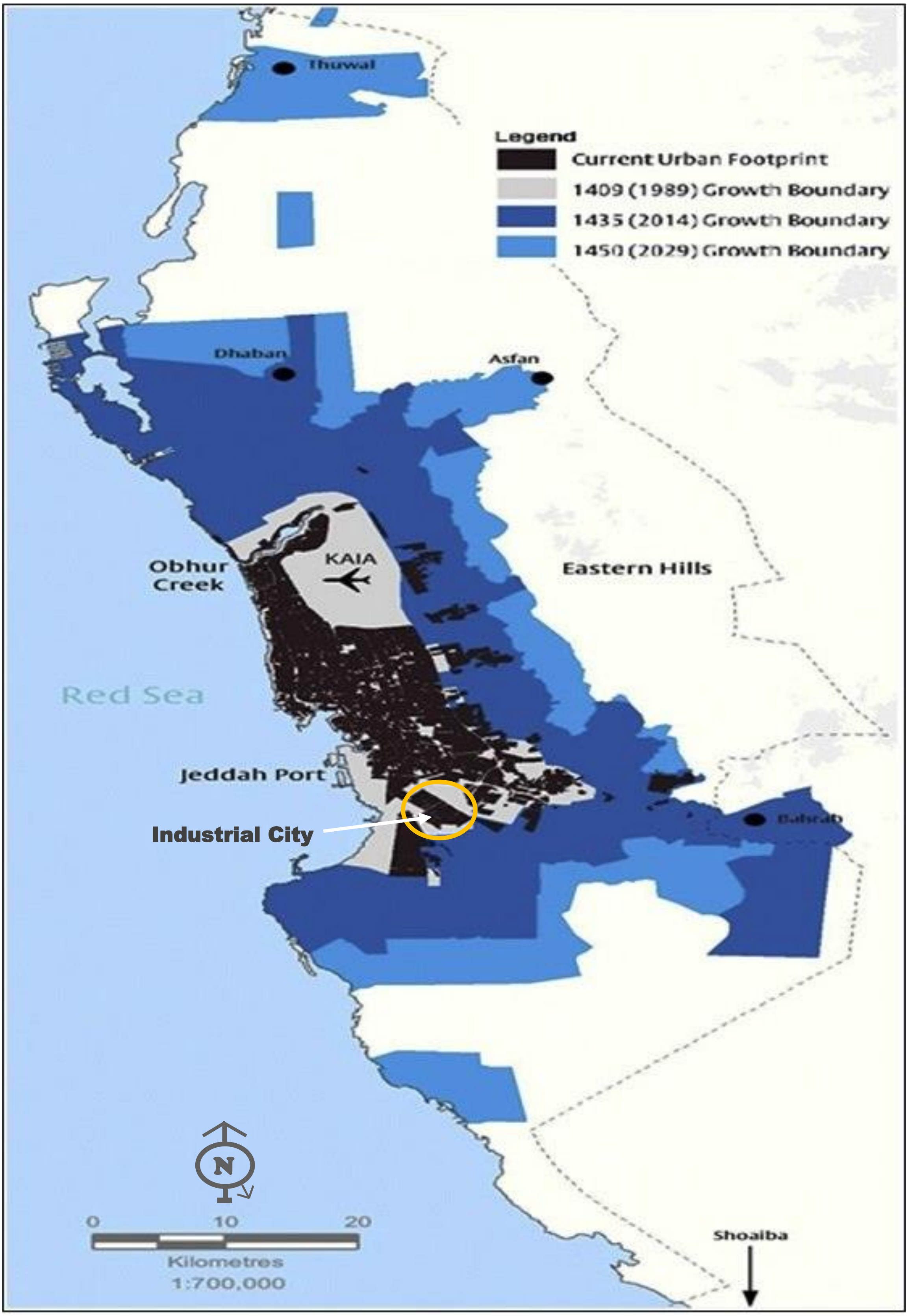


Figure 1.16: The 2009 Jeddah strategic plan (by the Jeddah Municipal Strategic Planning Department). Source: (Abdulaal, 2012; Aljoufie, 2014)

1.7 Case Study - Industrial City in Jeddah

By the end of the 1960s, the industrial city of Jeddah was ready to receive new industries; the surface area of the completed first phase was 0.5 million m^2. In the early 1970s, the first of a new wave of factories was built in the industrial city; this coincided with the implementation of the First Five-Year Development Plan instituted by the government. By 1975, 30 new factories had been built in this area, however the growth demand in the industrial city began to escalate, prompting the Ministry of Industry and Electricity to construct the second phase in the same location with an area of one million m^2. However, even this increase in the total area of the industrial city could not keep pace with the increasing demand for industrial investment, prompting the ministry to add a third, later a fourth, and more recently a fifth phase (these are presented in Figure 1.17); the total area of the industrial city in Jeddah is now 12.7 million m^2 (Ministry of Commerce and Industry, 2004; Modon, 2014).

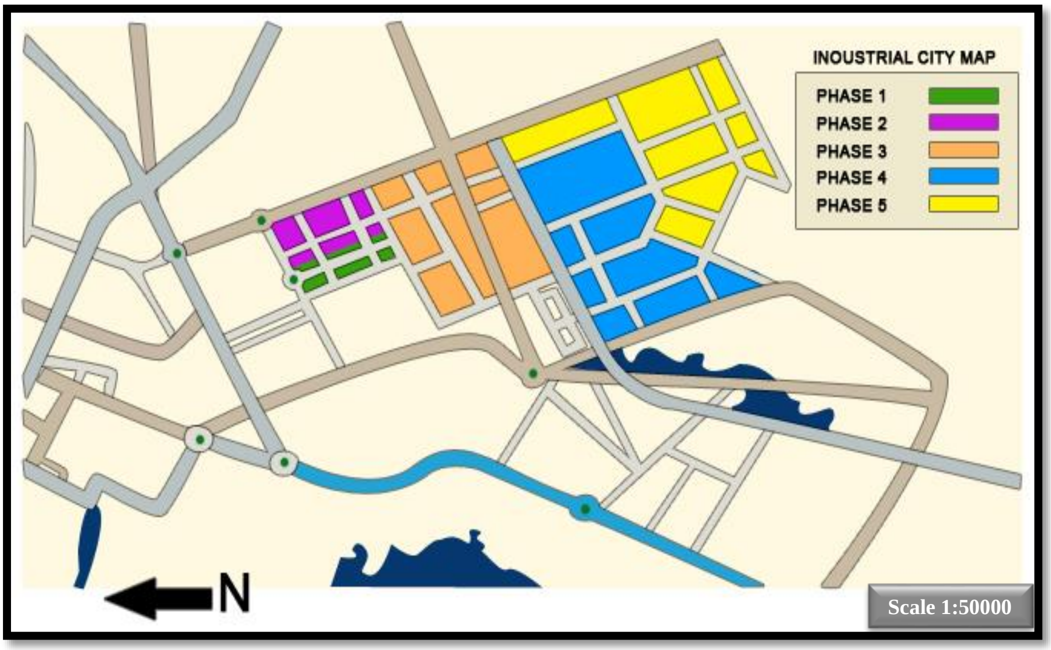


Figure 1.17: The phases of the Industrial City in Jeddah
Source: (Modon, 2014).

Figure 1.18 shows that the Industrial City in Jeddah lies in a southern region of the city. This industrial city was originally planned to be adjacent to Jeddah but over time, due to the rapid population expansion of Jeddah City, it is now surrounded by residential neighbourhoods.

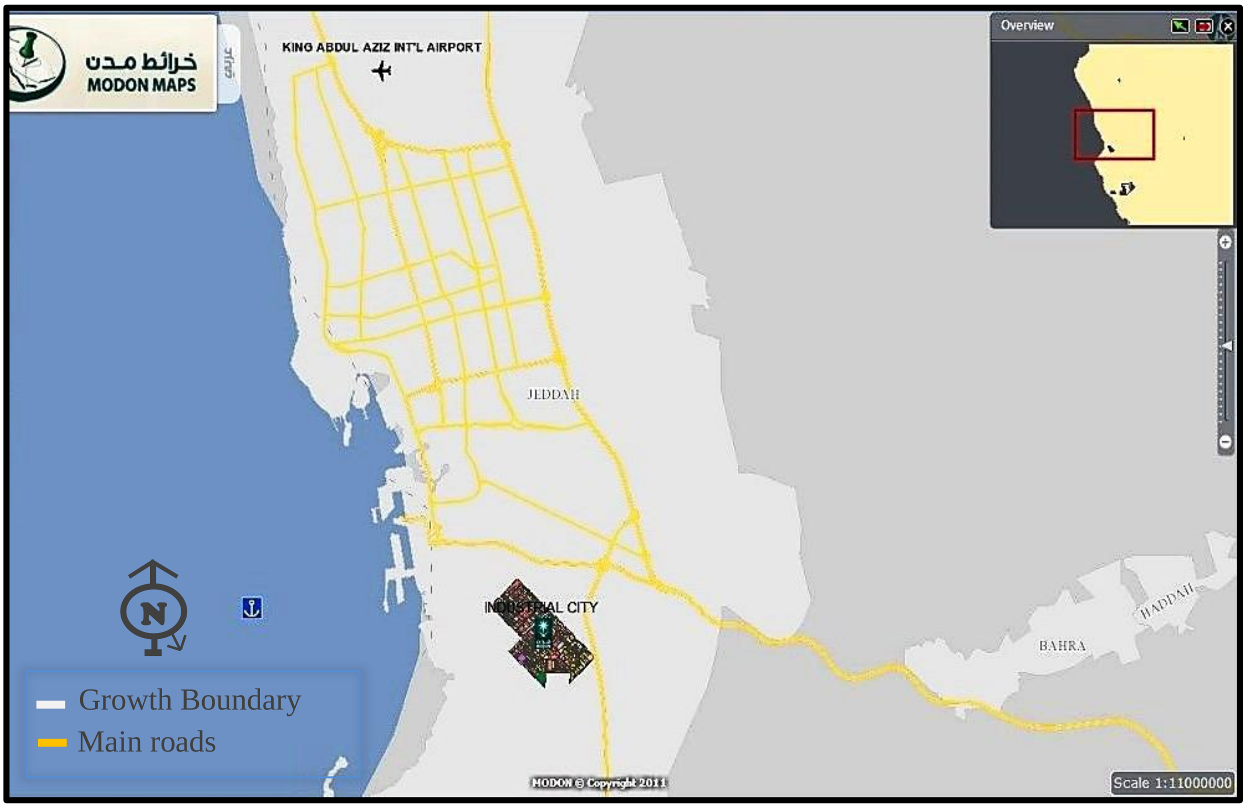


Figure 1.18: Industrial City location

Source: (Modon, 2014)

Today, the industrial city has an adequately functioning infrastructure in place i.e. it currently meets the needs of the organizations located there in terms of electrical supplies, road networks and water availability. Water is supplied by three networks, and a comprehensive sewerage system collects, treats and recycles sewage for the industrial water supply. Additionally, an independent administrative building, a clinic, a civil defence unit and a police service, as well as banks, restaurants and fuel stations are all available within the industrial city (Ministry of Commerce and Industry, 2004).

1.7.1 Number of factories and industrial activities

The total numbers of factories for each phase and for the whole industrial city are presented in Table 1.2:

Table 1.2: Numbers of factories by Phase within the IC in Jeddah

Phase	Number of factories
First	34
Second	50
Third	138
Fourth	175
Fifth	176
Total	573

The main industrial products and activities consist of food, health and medicines, petrochemicals, textiles and leather, furniture, paper, construction, chemicals, plastics, jewellery, aluminium utensils, pipes and pumps, foundries, and some heavy industry (Ministry of Commerce and Industry, 2004). As shown in Table 1.3 below, these industrial activities are not physically separated; this is due to the industrial city being built in five stages, each with their own timeframe. The establishment of new companies, together with the expansion of the existing ones, was not based on the particular type of industrial activity, so it is possible to find a food factory beside a petrochemical factory, for example.

Table 1.3 shows that the largest number of factories is in the chemical sector, followed by the metal sector, and that each phase of the industrial city's development contains a different combination of industrial activities. This variation in industrial activity across the phases means that each phase has its own characteristics, demands (in terms of infrastructure) and emission levels; this presents challenges for the design of an effective waste treatment strategy for the industrial city as a whole, regardless of the efficiency of the equipment in each part of the industrial city. Moreover, the climatic conditions of the Jeddah region, typified by light winds and high temperatures (as mentioned in Section 1.6.2), raise the potential for serious air quality problems (Zerbonia *et al.*, 1986).

Table 1.3: Categories of industrial activity in the IC's phases

Industrial activity	First phase	Second phase	Third phase	Fourth phase	Fifth phase	Total
Metals	3	16	46	49	59	173
Chemicals	16	18	40	55	48	176
Wood and furniture	2	2	3	9	8	24
Textiles and clothing	1	2	1	10	16	30
Paper and printing	3	2	6	16	10	38
Food	9	9	26	30	26	100
Building materials and glass	-	1	16	6	9	32
						573

1.8 The Presidency of Meteorology and Environment (PME)

All industrial activity in Jeddah is overseen by the Presidency of Meteorology and Environment (PME), which awards licences on the basis of environmental performance. The genesis of this organisation was in defence; the KSA established the Directorate General of Meteorology as a small department within the Ministry of Defence in 1950. The Directorate was subsequently restructured in 1981 to become the Department of Meteorology, Environmental Protection and Administration (MEPA) and given the role of the agency responsible for the environment in the Kingdom at the national level as well as retaining its role in the field of meteorology (PME, 2014).

In 1992 Saudi Arabia took a major step towards preserving its wildlife and sustaining its resources. Pursuant to Article 32 of the constitutional system of Royal Decrees, the main ruling stated that the State should preserve and protect the Environment. MEPA was given unlimited support from the Government to optimize the utilization of natural resources within the Kingdom of Saudi Arabia, to spread environment awareness among all members of Saudi society and to provide protection for present and future generations. MEPA regarded protection of the environment as an integral part of good development planning. Its role was to balance the need for development which can result in pollution and degradation if expansion is too rapid, with conservation of the environment

(PME, 2014).

The Presidency of Meteorology and Environmental protection (PME) was formed in 2001 after a decision was taken to rename MEPA. There is at least one PME office in each of the Kingdom's Provinces, including the Western Province where Jeddah is located; the PME branch in Jeddah is the primary one for the whole of KSA.

The introduction of environmental management in the industrial sector in KSA became legally enforceable when the 'General Environmental Regulations and Rules for Implementation in the Kingdom of Saudi Arabia' were instituted on 15/10/2001 by Royal Decree (No. M34). These defined the PME's measurement standards and had been available since 1989 (PME, 2006b) but were reissued in 2001. All organizations were expected to apply these regulations and follow these rules.

> "*The General Environmental Regulations and Rules for Implementation are intended to:*
>
> 1. *Preserve, protect and develop the environment and safeguard it from pollution.*
> 2. *Protect public health from activities and acts that harm the environment.*
> 3. *Conserve and develop natural resources and rationalize their use.*
> 4. *Include environmental planning as an integral part of overall development planning in all industrial, agricultural, architectural and other areas.*
> 5. *Raise awareness of environmental issues and strengthen individual and collective feelings of the sole and collective responsibility for preserving and improving the environment, and to encourage national voluntary efforts in this area*" (PME, 2006b p20).

The PME is charged with disseminating information as well as enforcing the legislation, thereby ensuring maximum protection of the environment, and enhancing the level of environmental knowledge among employees. Moreover, any application of environmental management should be in accordance with the General Agreement on Tariffs and Trade (GATT) requirements (KSA has recently become a member).

Firms in KSA are now seeking to obtain EMS standards and ISO 14001 certification, although EMS adoption may be financially onerous in the short term. Many organizations are now pursuing this route owing to increased media attention, reduced public acceptance of pollution and a greater awareness of the need for sustainable development on the part of the public. Firms also need to be prepared for any future punitive environmental legislation, and for the possibility of litigation. Most companies have voluntarily developed their EMS in line with the international standards. Furthermore, firms in KSA are now aware of the penalties that will be imposed upon them by the PME (should they fail in meeting the environmental standards); as of 2001 and as per the General Environmental Regulations and Rules for Implementation, the PME has imposed fines of SR10,000 (US$2,665) for each violation of an environmental standard or criterion. KSA firms are now also more aware of local and international competition, and of the challenges that they are expected to meet by commercial markets, and thus EMS is an option that is now being taken more seriously in order to satisfy the PME's requirements.

At this point, it is worth clarifying the distinctions between a PME licence, the application of EMS and an ISO 14001 licence. The latter is an internationally accredited licence but environmental management systems (EMSs) have not been precisely defined in the KSA. Organizations that claim to 'do EMS' are trying to be environmentally responsible but do not always carry out the five basic environmental procedures (policy, planning, implementation, monitoring and reviewing), which are considered to be fundamental to any full form of EMS (see previous references by Szymanski and Tiwari (2004), Watson and Emery (2004), Arimura *et al.* (2008), Chan (2008), Cordano *et al.* (2010) and Sakr *et al.* (2010)).

As previously mentioned, the General Environmental Regulations and Rules for Implementation in KSA were adopted in 2001. The PME has been the primary body responsible for environmental protection affairs and for the enforcement of the environmental regulations in coordination with the appropriate agencies at national level since 2003 (PME, 2006b). Since then, PME has been paving the way to implement these regulations by forcing both new and existing firms to obtain the now-mandatory environmental licence. Furthermore, PME obligates the owners of new and existing projects who request loans from lending agencies for establishing, modifying or expanding their projects, to submit an environmental licence that demonstrates compliance with these environmental regulations, standards, criteria and guidelines. This obligation is now an essential pre-condition when considering the approval of loans or their payment.

1.9 Study justification and research objectives

Environmental licences are issued by the PME, depending on its approval of an EIA. As mentioned above, an EIA assesses how environmental impacts will be controlled in accordance with the General Environmental Regulations (PME, 2006b). The PME environmental licence lasts for just two years and remains conditional. According to Article 15 of the General Environmental Regulations, "*Projects existing at the time of the issuance of the General Environmental law shall be given a maximum term of five years as grace period before enforcement, so that these projects can organize themselves accordingly. If the said term is not sufficient for projects of a special nature then an extension may be granted by a decision from the Council of Ministers based on the proposal of the Competent Minister*" (PME, 2006b p46).

This grace period finished on 15/10/2006, therefore, all companies should now have obtained an environmental licence, otherwise loans or their payments will be barred and they will be fined (as detailed above); in case of recurrence, the violator will be punished by increasing the maximum limit of the fine (but not exceeding double the limit), and will be required to address the stated violations within a specified time. Additionally, the facility may be closed down for a period not exceeding ninety days (PME, 2006b). Unfortunately, the industrial city in Jeddah was established 31 years before the adoption of these General Environmental Regulations. It is thus axiomatic that there are a great many environmental challenges facing many companies in the industrial city in order to bring them up to date with these rules and regulations. The PME, as a legislative and regulatory body, has the responsibility of pursuing and monitoring each organization's environmental situation and also of fining them for non-compliance, which is no easy task, as the environmental problems are varied in the scope and significance of their effects (as detailed in Section 1.4.2).

For many years, the PME claims it has been inspecting, enforcing, and cajoling those organizations yet to do so to obtain the environmental licence; however, they say the majority of the organizations operating in the industrial city in Jeddah are still in the process of installing their environmental modifications. Although they are subject to penalties for delay, only about 15% have so far obtained the licence (PME, 2014). This may be a reflection of the lack of attention to environmental issues paid by the organizations, and of the weakness of PME's control efforts.

Together with the severe environmental impact caused by the industrial city, Jeddah city as a whole suffers from many other serious environmental problems, such as:

- Air quality deterioration resulting from increased population levels, local industries and increasing numbers of vehicles (Abdulgani, 1993; Vincent, 2003; Magram, 2009).

- Soil pollution for which industrial activities and automobiles are one of the major polluters (Kadi, 2009).

- Lack of a comprehensive sewerage system – approximately 70% of Jeddah's area does not have access to central sewerage treatment facilities (Adel Faqih, 2009). All sewerage treatment facilities are working to their full capacity (Vincent, 2003; Magram, 2009).

- It has been assessed that the sewerage network services cover only 35% to 40% of the total population. The rest of the areas are not connected to the sewage network and use septic tanks that are regularly emptied by sewage trucks. These trucks transport the raw sewage to the treatment plants. However, it has been noted that a certain number of these trucks arbitrarily dump their untreated load into the desert (Al Saud, 2010; Ramboll, 2013).

- Lack of a rainwater drainage system, causing flooding, which threatens both human safety and also the economy, due to the damage caused to private and public property and infrastructure (Vincent, 2003; Al-Sefry and Şen, 2006; Magram, 2009). The last two floods occurred on 28/11/2009 and 26/1/2011, and resulted in at least 125 deaths, countless injuries, and material losses estimated at about SR 4 billion, equivalent to US$ 1.1 billion (see Figures 1.19 and 1.20) (Jeddah Municipality, 2013).


Figures 1.19 and 1.20: Jeddah’s floods (Jeddah Municipality, 2013)

- It is clear that the Arabian Peninsula is being affected by new climatic conditions, represented mainly by torrential rainfall. There have been frequent natural disasters such as the floods of 1996 and 2009 and noticeably intensive rainfall over different parts of the region. The degree of impact is found to be high and rarely do such events pass by without negative consequences for human beings and nature (Al Saud, 2010).

- Rising groundwater, which results in threatening the health of the general public, flooding of house basements, deterioration of roads and highways, damage to building foundations, soil contamination, offensive smells, and breeding mosquitoes (Vincent, 2003; Al-Sefry and Şen, 2006; Magram, 2009).

- Lack of adequate solid and hazardous waste management throughout KSA has led PME to develop a programme that aims to introduce a national strategy for dealing effectively with these wastes at a future date (Vincent, 2003; Magram, 2009).

These serious environmental problems have been amassing over the last 50 years and are mainly the consequences of increased oil revenues, rapid population growth and the resultant dramatic urban growth. The rapid growth in the economy and the urbanization of KSA has resulted in significant unplanned development activities with little concern for the sensitive desert environment in which they are constructed. Consequently, a sharp increase in the consumption of natural resources, in particular the use of water from aquifers (Al-Sefry and Şen, 2006), together with poor regulation of construction and industrial activities, have caused severe damage to Jeddah’s environment (Vincent, 2003; Al-Sefry and Şen, 2006; Magram, 2009).

Effective environmental management does not simply cover the availability of clean water, clean air and domestic waste removal; indeed, environmental management far exceeds such notions. It involves a comprehensive philosophy that aims to address the consequences and underlying factors in a holistic way in order to achieve sustainable development, as stated in the Brundtland report 'Our Common Future' (see Page 12). In this respect, all urban municipal services, public health and safety, economic growth, sustainable resources, the social benefits of recreation, public education and awareness, and community participation are all involved in environmental management. This holistic approach to environmental management should be the first stage in any programme that aims to protect the environment and achieve sustainable development (Alshuwaikhat and Aina, 2005; Magram, 2009).

In KSA, however, the prevailing political and administrative culture deeply influences the adoption and implementation of environmental management practices. The political and administrative status quo in the Kingdom is an absolute monarchy that applies a centralized decision-making process. The Council of Ministers, in which the King is also the Prime Minister, is the only body authorized to make such decisions. This centralization of power limits any public contribution in the environmental decision- making process, thereby giving the government and its agencies complete responsibility for environmental protection (Al-Gilani and Filor, 1999; Vincent, 2003).

In addition, the political culture in KSA has also placed restrictions on the environmental institutional framework. The distribution of authority and the institutional structures have influenced the relations between government agencies, including PME, Saudi Industrial Property Authority (Modon) and environmental agencies that are connected to the following ministries: Ministry of Agriculture (MOA), Ministry of Water and Electricity (MOWE), Ministry of Municipal and Rural Affairs (MOMRA), and Ministry of Commerce and Industry (MOCI), all of which have responsibilities for resolving environmental problems. The authorities often conflict and overlap in their mandate and in the scope of the work granted to them, and this may be a factor hindering the implementation of official environmental management and law (Al-Gilani and Filor, 1999). The lack of co-ordination and the complex and challenging interrelationships between the agencies are evidenced in a number of environmental issues in Jeddah, for example, rising groundwater, poor rainwater drainage, inadequate sewerage treatment, poorly controlled industrial waste, and rampant urban development (Al-Gilani and Filor, 1999; Magram, 2009). The above authors argue that there is an urgent need for all agencies to fully understand and become fully informed of their individual roles and responsibilities in order to deal effectively with such inter-disciplinary challenges and make appropriate decisions concerning these issues. Furthermore, Magram (2009) found that Jeddah does not have a single agency with authority to manage the environment, and neither does it have a regulatory body or group to co-ordinate environmental management in the city (Magram, 2009).

The PME, the primary body responsible for environmental protection affairs and the main coordinator for enforcing environmental regulations and standards, has faced a number of serious difficulties and problems, including a lack of power and influence, and insufficient resources for coordinating environmental activities and for monitoring the implementation of its environmental standards. Consequently, financial penalties are rarely applied in instances of the violation of environmental laws in KSA (Al-Gilani and Filor, 1999; Tortell, 2004).

The main difficulties facing the implementation of environmental management in Jeddah can be summarized as follows:

- Lack of a common information base about development activities and their impacts on the national environment.
- Lack of knowledge about how various industrial activities impact cumulatively on the local environment.
- Lack of knowledge about the interrelationships between the various government departments and agencies vis-à-vis private sector development.
- Lack of communication between the government departments and agencies.
- Unclear governmental goals and priorities in dealing with environmental problems.
- Uncoordinated budget allocation for environmental issues.
- Lack of any well-defined authority to undertake responsibility for enforcement, and lack of the means to enforce existing environmental regulations.
- Lack of monitoring of compliance with regulations and standards.
- Lack of training for staff to identify and address the problems effectively.
- Lack of public awareness campaigns to inform citizens of their own roles and responsibilities towards environmental management in the city.

(Magram, 2009).

The degree of public participation in the decision-making process in KSA is controlled by the prevailing political culture. According to the current level of environmental awareness in Saudi society, the public are unable to play a significant role in the environmental debate; awareness of environmental issues across all sectors and walks of life is generally quite low in KSA (Tortell, 2004; Zabin, 2010). Public sensitivity to environmental values, in most cases, is localized and citizens are not aware of how development activities impact on their health, environment and the future. Given the lack of environmental awareness, some government agencies apply or approve development activities which actually cause damage to the environment. Additionally, KSA lacks a clearly structured strategy for environmental awareness. Therefore, raising environmental awareness is a critical factor in achieving effective environmental management (Al-Gilani and Filor, 1999; Alshuwaikhat and Aina, 2005; Zabin, 2010).

However, KSA's global and regional position as the largest oil exporter worldwide and one of the leading countries in the Middle East, should lead KSA to accept the now well-established international norms for protecting the environment and managing natural resources effectively. KSA has engaged in many international environmental meetings and conferences, which have resulted in obligations to implement regulations and rules. The adoption of Agenda 21 in KSA (1995) is a good example of this (Magbool, 2009). The approval of such agreements, together with the increasing power of international agreements, are the most influential factors for raising environmental awareness, adopting effective environmental management, and changing the political climate towards environmental issues in the future (Al-Gilani and Filor, 1999; Magbool, 2009).

Moreover, research activities have contributed little to the process of environmental decision-making in KSA (Al-Gilani and Filor, 1999). The lack of clear plans, and programmes by government agencies that have no obvious vision of what is needed, and to what extent such research can help in promoting and implementing environmental management practices, are the most pressing environmental research problems today. In addition, a lack of comprehensive environmental data, research plans, clear aims and assessment studies at the national level, have exacerbated the situation. In this respect, several authors argue that basic environmental inventories as well as assessments of all potential environmental impacts should be supported (Al-Gilani and Filor, 1999; Alshuwaikhat and Aina, 2005; Magram, 2009).

1.9.1 The research objectives

This research focuses on the implementation of EMSs for the delivery of quantifiable environmental benefits to the first IC in the KSA, located in Jeddah (as a case study). This critical investigation is particularly important, as the General Environmental Regulations and Rules for Implementation in the KSA were adopted in 2001, affording a five-year grace period before the enforcement of this environmental law for existing organizations, so that they may organize themselves accordingly. EMS implementation represents a systematic approach for providing continual environmental improvements for the organizations in the IC to fully adhere to the new regulations and to reduce their negative environmental impacts. Accordingly, the most efficacious path would be for them to adopt and implement an EMS that suits their business objectives. Thus, this research aims to determine the extent to which organizations in the IC actually implement EMSs, as a first and main step in this critical investigation.

It is evident from the literature review (see sections 1.2.8 and 1.2.9) that EMS implementation depends largely on the effectiveness of legal monitoring and environmental awareness among organization employees and the public. Therefore, this study assesses the current level of the PME's (the primary body responsible for environmental protection affairs and for the enforcement of the environmental regulations) awareness and control efforts.

This critical investigation shall also detail the barriers to adopting and implementing EMSs and the possible environmental benefits to be derived from implementing EMSs in the IC.

Finally, recommendations will be made to improve the opportunities for implementing EMSs by the organizations in the IC in order to increase their environmental performance and to control their industrial activities.

Following on from the issues detailed above, this research aims to conduct a critical investigation into the barriers and opportunities for EMS implementation for the delivery of environmental benefits to the industrial city (IC) in Jeddah, KSA. In order to achieve these aims, a number of objectives have been set:

- Determine the current scope of EMSs in the various industrial plants.
- Assess the current level of the PME's awareness raising and control efforts.

- Identify the obstacles facing the implementation of EMSs.
- Identify the possible environmental benefits to be derived from implementing EMSs.

1.10 Outline of the thesis

Chapter two discusses various methodologies and their approaches. It describes and justifies the techniques chosen, quantitative and qualitative methods using questionnaires, semi-structured interviews and a review of relevant documents, focussing on a case study of the IC in Jeddah. It discusses the design of the questionnaire and the structure of interview questions. It then reviews the process of data analysis and considers the ethical problems involved in this research.

Chapter three presents the results of the analysis of the quantitative data derived from the questionnaire. It covers the background of the respondents and the organizations that they represent with questions on existing EMSs. It then presents the data analysis of the findings, much of this in statistical form according to the objectives of this research with a summary at the end.

Chapter four presents the results of the analysis of the qualitative data from two sets of interviews, one with environmental managers of industrial plants and the other with experts from related government and private bodies, and a review of relevant documents. From their answers it analyses the current scope of EMS implementation in various plants, presents the obstacles facing the implementation of EMS and possible environmental benefits from its implementation. From the answers received it analyses the level of PME's control and awareness efforts. It then summarises the findings in relation to the objectives of this study.

Chapter five discusses the results obtained from the quantitative and qualitative data. The combination of the two types of data enhances the validity of the results. It comments on results showing the limitations of the current scope of the EMS, evidence of lack of awareness as well as noncompliance with environmental regulations, weaknesses in the PME's efforts and particularly the lack of legal enforcement and monitoring of these regulations. It considers the possible environmental benefits derived from implementing EMSs and discusses the difficulties of their implementation.

Chapter six summarises the findings of this research and draws conclusions relating to its objectives. It makes recommendations, discusses its limitations and suggests areas for further studies.

Chapter 2: Methodology

2

This chapter justifies the design and methodology of this research and describes in detail the methodology employed to achigeve the research aims outlined in the previous chapter. It describes various social sciences approaches and covers the theories underpinning this mixed research (qualitative and quantitative) as well as the main stages involved in undertaking the study. It addresses the particular research design, objectives and methods, and identifies the instruments employed (interview, questionnaire and documentation); it also details the population sample to be investigated and the criteria upon which that selection is made. Importantly, this chapter describes the data analysis approach to be adopted in this study. Finally, it presents the need for a pilot study, and addresses ethical issues.

2.1 Introduction

Methodologies are explicit mechanisms and processes that contain procedures, definitions and explanations of techniques used to collect, store, analyse and present information as part of a research process for helping to solve 'problems'. However, as soon as researchers have more than one methodology for solving problems, they have additional problems of choice, which one should be followed? (Holden and Lynch, 2004).

Therefore, choosing an appropriate research design is critical to any part of independent investigation in which a substantial amount of analytical and/or critical thinking may be demonstrated. Even though there is substantial literature on choosing and designing research methods, no consensus has emerged as to a universally applicable best method of finding things out (Holden and Lynch, 2004). The design for conducting fieldwork should not be decided simply on technical grounds, but on the basis of what is considered to be the best way of providing both an explanation and an understanding of the technical and social issues with which the study is faced (Hall and Hall, 1998).

The choice of data collection methodology is of great importance as it has significant consequences for the type and quality of information that will be collected. Research methodology concerns choosing the most appropriate techniques to collect the data for research aims, whereas the nature of the data to be collected determines the research method or methods that should be applied (Holden and Lynch, 2004).

2.2 Social Science Research

Social science is the field of studying society. The term 'social science' is used to refer to fields outside of the natural sciences (Flyvbjerg, 2001). Theoretically, the philosophy of social science depends on making assumptions about the world, about knowledge and about the relationship between them. Those assumptions shape what can be known and therefore the way that the research of knowledge can be done; which is the way that a sociologist considers it possible to produce knowledge about the social world that is both reliable and valid (Greene and Caracelli, 2003). Only by recognising those assumptions can researchers fully understand the different approaches to social research and the knowledge claims that they produce (Winch, 2002; Greene and Caracelli, 2003).

Two key dimensions constitute a philosophy of social science, namely: Ontology and Epistemology. Ontology is a theory of what is there (social entities) and involves the fundamental beliefs that someone holds about the nature of the social world and its relationship to individual social actors. Epistemology is a theory of knowledge and what proof will be accepted about what constitutes reliable and valid knowledge. This level of proof relates to what is believed exists and how it is possible to study it reliably and validly (Holden and Lynch, 2004).

The task of producing reliable and valid knowledge requires consideration of how to promote and build this theoretical knowledge about the social world, which can be called Methodology (Holden and Lynch, 2004). The methods encompass how to actually and physically collect data to test this theory, e.g. questionnaires, interviews, experiments, participant observation and so forth.

However, there are four basic principles of scientific paradigms involved in major sociological methodologies, namely: Positivism - Interpretivism – Pragmatism – Realism (Perry, 1998).

2.2.1 Positivism

This is a theory that argues that objective knowledge (facts) can be gained from direct experience or observation, and is the only knowledge available to science, and unobservable or theoretical entities are rejected. Generally, the empirical sciences separate facts from values, seeking 'value free' data. Science is largely based on quantitative data, and uses strict rules and procedures, rather than 'common sense'. Scientific propositions are founded on facts, and hypotheses are tested against these facts. The purpose of science is to develop universal causal laws. The search for laws involves finding empirical regularities where two or more things appear together or in some kind of sequence (a 'constant conjunction' of events). Cause is established through demonstrating such constant conjunction – which is all that causal relations are. Explaining an event is therefore merely the act of relating it to an established law. Through such a procedure, it is possible to transfer this scientific approach of the natural sciences to the social sciences (Willig and MyiLibrary, 2001; Gasson, 2003).

2.2.2 Interpretivism

Interpretivism is synonymous with constructivism (Lincoln and Denzin, 1994); the latter is built upon the premise that reality is a social construction (Baxter and Jack, 2008). This principle includes a range of approaches, e.g. phenomenology, hermeneutics, symbolic interaction and grounded theory but at the heart is the concept that comprehending the real world is a subjective activity, based on one's perspectives, i.e. on the interpretations of the observer. Interpretivism is thus a method for seeking to explain phenomena through established concepts. This is in contrast to the scientific empirical approach above, and phenomena are explained in relation to each other; this is principally a relativistic methodology (Gasson, 2003).

"*Sociology, unlike natural science, stands in a subject relation to its 'field of study', not a subject-object relation: it deals with a pre-interpreted world, in which the meanings developed by active subjects actually enter into the actual constitution or production of this world; the construction of social theory thus involves a double hermeneutic that has no parallel elsewhere.*" (Giddens, 1993 p146).

Features of relativist approaches can be summarised as the following (Gasson, 2003; Mackenzie and Knipe, 2006; Creswell, 2009; Denzin, 2010):

- Scientific accounts and theories are not accorded privileged status; they are equivalent to other accounts, i.e. observation and interpretation are equally valid.
- Different approaches, be they deductive or inductive, experimental or descriptive, are simply alternative ways of looking at the world (perspectivism) and should not be evaluated in terms of their predictive power.
- Furthermore, interpretivism does not accept that there are rational and objective criteria for choosing among the various theoretical frameworks; it also blurs any delineation between quantitative and qualitative methodologies.

Reality in this principle is represented through the subjective perspectives of the participants, and therefore, the role and meaning of language is emphasised (Gasson, 2003). It stresses the importance of comprehending the meaning of any real-world experience or behaviour in a given context. The research process is viewed as generating working hypotheses rather than immutable empirical facts, and the emergence of concepts (generated from the collated data) are emphasised, rather than the imposition of *a priori* theories (Gasson, 2003; Mackenzie and Knipe, 2006; Creswell, 2009; Denzin, 2010).

2.2.3 Pragmatism

Pragmatism is an approach that seeks to interpret an action, behaviour or event through identifying practical ramifications (Baert, 2005). In the field, circumstances may dictate the approach to be adopted by the researcher but this does not make that choice any less valid. This principle means that the truth is 'what works'. In other words, use whatever seems most appropriate for a particular problem (Denzin, 2010). "*A pragmatist turns away from abstraction and insufficiency, from verbal solutions, from bad a priori reasons, from fixed principles, closed systems, and pretended absolutes and origins. He turns towards concreteness and adequacy, towards facts, towards action and towards power"* (James, 1907 p93). Therefore, he sees qualitative/quantitative research methods as compatible in satisfying the needs of the research; this principle underpins much mixed-method research (Mackenzie and Knipe, 2006; Denzin, 2010).

2.2.4 Realism

Realism argues that there is no unquestionable foundation for social science, i.e. no facts are beyond dispute. Knowledge is a social and historical product. The task of science is to invent theories to explain the real world and to test these theories by rational criteria. Explanation is concerned not simply with the observation of phenomena and events but with real structures and mechanisms that exist in the real world (Carlsson, 2006; Reed, 2008).

Realism makes a firm distinction between causal mechanisms and empirical regularities: "*... what causes something to happen has nothing to do with the number of times it happens*" (Sayer, 2000).

A law is a characteristic pattern or tendency of a mechanism. Laws are what are 'really' happening but may not be expressed at the level of events. The social world is complex and stratified into different layers: individual; group; institutional; societal. In this principle, causation is a reflection of the fact that all entities only act as a function of their basic needs. Explanation is showing how some events happened in a particular case – events are to be explained even when they cannot be predicted (Robson, 2002).

Realism incorporates epistemological scepticism and ontological realism, i.e. researchers need to identify and understand both the external reality and the social construction of that reality to explain the relationships between social phenomena. Realism acknowledges some of the critique of positivism without accepting relativism; it distinguishes more valid from less valid explanations (Patomäki and Wight, 2000; Sayer, 2000; Reed, 2008).

These paradigms are both ideologies and world-views, which involve identifying the most appropriate dependent values and means in order to study and produce valid knowledge with respect to some social world (Mangan *et al.*, 2004; Krauss, 2005).

2.2.5 Scientific Paradigm for this Research

Notwithstanding the relative advantages of the first, third and fourth paradigms, the preferred paradigm for an in-depth exploration and understanding of social phenomena is interpretivism (Baxter and Jack, 2008). This appropriateness of interpretivism is derived from recognizing that comprehending the real world is a subjective activity (but does not reject outright some notion of objectivity), and that it is dependent on one's perspective (Gasson, 2003; Baxter and Jack, 2008). Interpretivists believe that the truth is relative and "*the reality is socially constructed and the researcher becomes the vehicle by which this reality is revealed*" (Andrade, 2009 p43).

Given the practical difficulties of real-world conditions as well as researcher limitations, interpretivism often involves the use of more than one method of data collection, employing 'triangulation' to obtain an in-depth understanding of the observations of that reality which often lead to interpretive investigations in order to construct theories (Andrade, 2009).

Accordingly, interpretivism is the appropriate scientific paradigm for case study research (Kelliher, 2005; Baxter and Jack, 2008; Brown, 2008; Andrade, 2009; Yin, 2009). Interpretivism is embraced by key writers in the area of case study research such as: Yin, Stake (Kelliher, 2005; Baxter and Jack, 2008; Brown, 2008) and Merriam (Brown, 2008), the case study research process usually depends on describing and exploring contemporary real-world phenomena, such as individual or group behaviours, in order to better comprehend, for example, inter-organizational relationships or internal organizational dynamics. Such research usually necessitates the construction of inductive theories, as deductive reasoning from established principles or in accordance with some accepted paradigm may prove problematic in a context that has received little attention to date (Andrade, 2009).

In case study research (based on interpretivism), the research problem(s) to be addressed tends to be descriptive, rather than prescriptive, and so positivist empirical experiments or cause-and-effect analyses are not required. Thus, the research problem usually addresses how something is done, rather than how it should be done, which avoids the positive-normative dichotomy; case study research is the investigation of real-world phenomena as they are found by the researcher, rather than by conducting experiments or making value-laden judgements (Kelliher, 2005; Andrade, 2009; Creswell, 2009). Moreover, an interpretive case study involves the building of theories rather than testing them, and accordingly, this thesis is designed to present findings and conclusions. However, it remains the case that any findings, conclusions or theories built thereon will have to be tested for statistical generalizability, possibly in later, more quantitative research (Kelliher, 2005; Andrade, 2009).

As this research is based on an exploration and investigation of a real-world phenomenon, which can be described as being a social construction, the researcher must adopt the interpretivist approach in assessing the reality under investigation. This assessment is guided by the research objectives, which seek to explain a very particular phenomenon, i.e. assessing the benefits (or otherwise) of implementing EMS in the Industrial City (IC) in Jeddah. In adopting this interpretivist approach however, the researcher is mindful that "*no construction* [or interpretation] *is or can be incontrovertibly right,* [he] *must rely on persuasiveness and utility rather than proof in arguing* [his] *position*" (Guba & Lincoln, 1994, cited in Andrade, 2009 p43). Notwithstanding this justification, the data collected from this exercise are subjected to tests for validity and reliability in order to ensure that the interpretations of the data (be they derived from the questionnaires, documentation review or interviews) are sound (these will be described in more detail later).

This interpretive approach to the case in this research is informed by 'grounded theory', which is now arguably the most widely adopted methodology in qualitative, social science research. Developed in the 1960s by Glaser and Strauss, grounded theory is a systematic methodology arguing that qualitative research should involve gleaning knowledge from data in order to develop hypotheses; this is largely an inductive approach where concepts are formed from the knowledge that emerges from the data (Glaser and Strauss, 1967; Denzin and Lincoln, 2007; Andrade, 2009). This facilitates the generation of analytic interpretations, which evolve from the data, which may inform further research in the same case, i.e. the researcher may then fine-tune any developing theoretical analysis (Denzin and Lincoln, 2007; Andrade, 2009).

Finally, interpretivism is generally described as being inductive, i.e. relating a generalization to a particular, but this infers that deductive is of little use in case study research because in case studies, theories tend to be built, rather than tested. However, the picture may be more complex, as case study research can be a blend of both; indeed, a theory may be built from a proposition or hypothesis even though a further theory may then be developed, resulting in a mixture of induction and deduction (Denzin and Lincoln, 2007; Andrade, 2009).

2.3 Quantitative and Qualitative Research

Data that are discrete and collected specifically to be measured and statistically analysed form a key part of quantitative research. The philosophy of quantitative research is underpinned by objectivity, and is associated with enumeration, aggregation and causation; such a numerical approach is not suited to description or in-depth analysis, and must follow standard procedures, methods, forms of analysis and reporting of the results of the research undertaken (Gelo *et al.*, 2008; Östlund *et al.*, 2011).

Quantitative methods can be used for the comparison of sub-groups and can be used to verify which hypotheses are true; analyses supporting such verification are generally conducted through statistics. The method is based on meanings derived from numbers, and the results are numerical and standardised data (Bergman, 2008; Gelo *et al.*, 2008; Östlund *et al.*, 2011), thereby presenting a picture that is, as far as possible, free from bias.

Quantitative methods are likely to take forms that follow the general sequence:

1. Observe/present questionnaire/ask questions with fixed answers
2. Tabulate
3. Summarise data
4. Analyse data
5. Draw conclusions

(Bergman, 2008; Gelo *et al.*, 2008; Östlund *et al.*, 2011).

Although quantitative research has clear advantages (the results tend to provide a clear picture, and are largely bias-free), it has a significant limitation: the picture provided tends to be superficial and lacking in explanation (Gelo *et al.*, 2008).

Qualitative research has grown out of a wide range of intellectual traditions and disciplines, and therefore, there is no consensus on a definition. Qualitative methods offer insights and understandings on the part of participants, which cannot be obtained by quantitative methods. However, it is more than just non-numerical research; it aims to study the subject in its natural surroundings and to collect naturally occurring, real-world data. In other words, the essence of qualitative research is to capture life as it is lived. It describes in words, rather than numbers, the qualities of the subject through observation. Qualitative researchers argue that qualitative methods have much more flexibility than quantitative methods, and they believe that the best way to study a phenomenon is to be immersed in it

(Soklaridis, 2009; Östlund *et al.*, 2011); they also argue that this approach is the most efficacious means of generating explanations for the observed or investigated scenario.

Methods of qualitative research include structured and unstructured interviews (as well as semi-structured ones), group interviews, focus groups and documentation. Qualitative methods can highlight key themes or patterns emerging in the project, are used to comprehend and manage data, and are used to develop and test hypotheses (Gelo *et al.*, 2008; Curry *et al.*, 2009; Soklaridis, 2009).

There are, naturally, weaknesses with qualitative research. The results are less easily generalized than with quantitative methods (Gelo *et al.*, 2008), and there is an ever-present danger of bias (usually on the part of the researcher) (Novick, 2008).

2.4 Mixed Research Methods (Triangulation)

Research studies may be either quantitative or qualitative, although it is possible to use both approaches in the same research project. Triangulation is the term used for integrating more than one method of research; regardless of it being qualitative or quantitative. The term 'triangulation', in research methodology, refers to combining two or more methods in order to draw a wider picture of understanding the phenomenon under study, enabling the validation of the findings, helping in explaining diverging results and coping with limitations inherent in any one research method. Some writers have stated that research data derived from a multi-method methodology, through internal cross-checking procedures and because of the ensuing validation process, are more reliable than data derived from only one method (Abusabha and Woelfel, 2003; Holden and Lynch, 2004; Bryman, 2006; Baxter and Jack, 2008).

Mixed-method research is a rapidly growing area in research methodology today (Bergman, 2008). It aims to take the best of qualitative and quantitative methods and to combine them. However, many debates on mixed-method research design are based on methodological arguments that, upon closer inspection, are difficult, if not impossible, to sustain. This is due in part to the way in which, particularly from the early 1980s, qualitative research methods were explicitly associated with interpretivism, while quantitative methods continued to be used by positivists (Abusabha and Woelfel, 2003; Bergman, 2008). However, these positions are no longer deemed valid, and accordingly, triangulation is now adopted as an intermediate philosophical position (Holden and Lynch, 2004).

2.5 Research Design and Data Collection Techniques

Research design is concerned with facilitating data interpretation and generating meaning. It should reduce any ambiguity in interpreting the collated data. The research design should provide a structure to provide sufficient information in which to interpret the significance and meaning of observations and to help in choosing between alternative possible explanations of the phenomenon (De Vaus, 2001). The research design should provide a guide for the structure and content of the data to be collected and a template for analysing and comparing the data (De Vaus, 2001).

2.5.1 Case Study Research

A case study is "*an empirical investigation of a particular contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used*" (Yin, 2009 p18). The case is the situation that the researcher is interested in; it may contribute uniquely to our knowledge of individuals, a group, or of organisational social, and political phenomena (Robson, 2002; Brown, 2008; Yin, 2009).

A case study approach is widely used, in particular, in many social sciences and life sciences disciplines (Verschuren, 2003; Hartley, 2004; Barkley, 2006; Baxter and Jack, 2008; Tight, 2010). It is an ideal and common strategy if in-depth investigation is needed (Tellis, 1997; Dubé and Paré, 2003; Hartley, 2004), and if the case associates with a location, such as a community or organization (Tight, 2010).

Yin (2009) argues that case study research is an appropriate methodology in three particular circumstances: when the researcher seeks to address 'how' and 'why' questions, when the researcher has little or no control over the phenomenon under investigation, and when the researcher wishes to examine a phenomenon in its real-life context. He also states that case study research usually adopts an empirical approach, seeking to describe and explain how a particular phenomenon of interest fits into some wider context. This makes it particularly well suited to the investigation of social phenomena, where there may be a great many variables, data sources and propositions, most of which could be qualitative in essence (Yin, 2009).

In a case study, social scientists attempt to examine contemporary real-life situations and provide the basis for the application of ideas and extension of methods. It provides a delineated boundary for various phenomena and a structural process within which any appropriate method can be applied. Because of its flexibility and rigour, a case study allows researchers to develop theory, evaluate programmes and develop interventions, in carefully planned and crafted studies of real-life situations, issues and problems of individuals or organizations (Luck *et al.*, 2006; Baxter and Jack, 2008).

Given a great deal of flexibility and individual variation for a case study strategy, it can be used with any philosophical perspective and paves the way for researchers to embrace 'methodological openness and paradigmatic freedom' (Dubé and Paré, 2003; Verschuren, 2003; Brown, 2008).

Flyvbjerg (2006) stated, "*good social science research is problem driven and not methodology driven*" (p242). A case study approach, in general, combines qualitative data collection methods (Brown, 2008; Yin, 2009), such as interviews, documentation, and observations, which may mean that the phenomena are limited to being detectable in secondary data sources. In situations that add depth to the analysis, quantitative data collection, such as questionnaires and time series, can also be included (Dubé and Paré, 2003; Verschuren, 2003; Barkley, 2006; Flyvbjerg, 2006). It thus becomes easy to understand that triangulation is now a strongly recommended strategy within case study research methods (Tellis, 1997; Dubé and Paré, 2003; Verschuren, 2003; Baxter and Jack, 2008).

2.5.2 Types of Case Study

Both Robert Yin and Robert Stake, who have wide experience in case study research, have determined various types of case study. Yin (2003) identifies case studies as explanatory: for doing causal investigations to explain the presumed complex causal links in real-life interventions; exploratory: used to explore situations that have no clear evaluated interventions; or descriptive: used to describe occurred phenomenon and its real-life context. Yin also categorises these types of cases into a single case study and multiple-case studies (Tellis, 1997; Verschuren, 2003; Baxter and Jack, 2008). On the other hand, Stake (1995) states that a case study may be intrinsic: when the case itself is of the researcher's interest; instrumental: when the case is used to achieve more than what is observed; or collective: where multiple cases are studied (Tellis, 1997; Verschuren, 2003; Baxter and Jack, 2008).

Yin (2003) and Stake (2005) share the same classification of main case study designs (single/multiple case), whereas Yin distinguishes between them by adding holistic/embedded. Yin's distinction depends on whether the focus is on an overall study of the case or selected units within it (Luck *et al.*, 2006; Baxter and Jack, 2008; Yin, 2009; Tight, 2010). "*The similarities or differences in the chosen cases are not of as much importance as the understanding of the shared phenomena of interest that can be discovered through the cases. Hence, single vs. multiple case study is not a definitional distinction for paradigmatic preference, as researchers can apply both single and multiple case studies qualitatively and/or quantitatively*" (Luck *et al.*, 2006 p106).

Although widely used, the case study approach has a few key drawbacks; it may be the case that the phenomenon under investigation is unique, and therefore almost impossible to generalize. On the other hand, it may be so commonplace that any findings do not add to the existing body of knowledge. Also, it may not be possible to repeat the research, should any be required for verification purposes. There is also the danger of bias; the researcher may bring with him his own baggage of experience and beliefs, skewing his focus toward areas that are of particular interest to him and away from areas that may be pertinent to the research aims (Flyvbjerg, 2006).

2.6 This Research

This research focuses on an Industrial City (IC) in Jeddah in KSA as the case study. The current scope of environmental management systems (EMSs), including barriers and opportunities for EMS implementation, for the delivery of environmental benefits to this IC are explored and investigated. A questionnaire and interviews are prepared in order to address the objectives of the study as well as to collect data more widely (allowing the researcher to gain a deeper understanding of the real-world context of this study), although the first objective is addressed through a combination of questionnaire and documentation review. The levels of industrial activity, be they manufacturing or otherwise, are assessed, and the key internal and external drivers for EMS (according to the local situation) are identified.

From the fieldtrip conducted in February 2012 (more in the Fieldtrip section below), the researcher identified the precise number of organizations that were to participate in the questionnaire and interview phases in this study. These were selected based on activity type and on the numbers of businesses in the various development phases of the Industrial City (IC).

There is very little literature on sample sizes relating to the context of this study but it is generally accepted that the sample size must be sufficiently large to satisfy the research objectives (but not so large as to waste resources) (Lenth, 2001). The study was initially designed to be applied on 30% of the total number of industrial plants but during the fieldtrip, this was slightly increased to 183 out of 573 organizations in the IC in Jeddah (an embedded single case study); this represents some 32% of the total. This sample size is '*big enough*' (Ibid, p. 187), and covers about a third of the population of the case study. The number of plants and organizations participating in the questionnaire survey is not the most important factor, rather it is that those selected for inclusion in the study are representative of the whole population (Krosnick, 1999; Lenth, 2001), and this was ensured through the equation described below. Only through investigating a truly representative sample may the research be generalized to other similar scenarios. To support any generalization of the findings, it is also important that the response rate be high; this may pose problems, as it is generally recognized that telephone surveys rarely achieve response rates above 60%, and even face-to-face surveys sometimes fall below 70% (Krosnick, 1999; Lenth, 2001).

In receiving 183 responses, the questionnaire was initially administered to a greater number because the researcher was cognisant of the fact that not all of the organizations approached would be willing or able to respond to the questionnaire; this is indeed their prerogative. Thus, it was incumbent upon the researcher to anticipate and mitigate for non-response and, accordingly, the questionnaire was administered in person to 205 organizations; to include all 573 would represent data overload (and, given the size of the sample, would add little to the findings) and would be inordinately time-consuming. The response rate was slightly higher than expected, at around 89%. Furthermore, the 183 participating organizations are drawn equitably from the five development phases described in section 1.7. This means that the number of questionnaires administered to each phase was proportionate to the size of that phase; as detailed in Chapter 1, Phases 3, 4 and 5 are considerably larger than Phases 1 and 2, and so the questionnaires were distributed accordingly. This stratification of the population reflects the development phases of the IC and is in concert with the PME's administration of it.

Furthermore, two key factors need to be taken into consideration with respect to the participating sample: the size of the organization and the type of activity. Each phase contains organizations of varying size (in terms of employees, turnover or surface area) and type of activity; this latter will be considered shortly. However, the first key criterion is size; the EU now defines SME (Small and Medium-sized Enterprises) accordingly: a small enterprise is one with fewer than 50 employees and a medium one has fewer than 250 (those with fewer than 10 are termed 'micro'). Enterprises with over 250 employees can be described as large, but the KSA is not a fully industrialized country and has proportionately fewer large enterprises than the EU (Merdah and Sadi, 2011). According to the Saudi Arabian General Investment Authority (SAGIA) study that was conducted by the Department of Industrial Development, and which was reported in Merdah and Sadi (2011), the industrial classification of SMEs in the KSA is based on the following employee factors:

- Micro-sized enterprises: employ fewer than 25
- Small-sized enterprises: employ 25 - 59
- Medium-sized enterprises: employ 60 - 99
- Large-sized enterprises: employ more than 100

(Otsuki, 2002; Merdah and Sadi, 2011).

The scale above indicates that organization sizes in the KSA are generally smaller than those in the EU; however, this research is applied in the KSA and therefore the scale above is adopted in this analysis of the IC in Jeddah.

As with the questionnaire distribution across the development phases (being of varying sizes) within the IC, the questionnaires are administered equitably with respect to size, ensuring that no particular size is disproportionately represented. However, should a particular size category not be represented by an organization in any given phase, this will not affect the validity of the findings because the size categories are intended to facilitate the interviews only, rather than to represent any particular phase.

The second key criterion is type of activity; it is important that a varied mix of enterprises be represented, as each type has its own particular implications for the environment and this in turn has ramifications for the manner in which any EMS is implemented. For the purposes of this research and to facilitate sampling, a number of types of activity have been identified, but it is not the number that is important, rather that they should fairly represent all the business activities of the IC. As stated in Table 1.2, the business activities in this IC have been categorized by PME (2014) into: metals and heavy machinery, chemicals (incl. petrochemicals) and medicines, wood and furniture, textiles and clothing, paper and printing, food, and building materials and glass (PME, 2014). These seven categories reflect the business activities of the whole of the IC; one or more of these categories may not be represented in a particular development phase but, as with the size criterion above, this will not affect the overall findings of this study.

This categorization of the activities in the IC is important in the context of this research because each one has its own very particular processes, resulting in a distinct agglomeration of waste products and emissions, for example, the food category may indeed produce much waste but the vast bulk of it tends to be non-toxic and biodegradable, whereas the emissions and liquid wastes of the chemicals industry can be both highly toxic and persistent. Accordingly, each of the categories is expected by this researcher to implement its EMS to meet its own needs and to satisfy its own unique set of environmental protection criteria.

However, as previously mentioned, this research combines empirical data collection methods; a survey of documentation is conducted (at the PME) and interviews are also used in order to collect qualitative data (to support the quantitative questionnaire data and for the purposes of triangulation). The interview data are collected from environmental managers (or their equivalents) in a number of organizations (detailed below). In addition to these interviews, the researcher conducts a series of interviews with persons from public bodies outside the IC (as detailed further below).

The organizations selected for interview must fairly represent the 183 organizations surveyed, i.e. the same key criteria pertaining to type of activity and size (as described above), taking into account the five development phases, are applied. Accordingly, each of the activity categories are assigned two interviews, one for relatively smaller organizations and one for relatively larger ones (as deemed appropriate). This means that the number of interviews is 14, and the researcher has allocated the two interviews for each category according to size. Thus, the activity and size criteria are addressed but in order to include consideration of the five phases, the interviews are spread equitably with no two interviews (of one activity category) being conducted in one phase, although should this have been necessary, it would not have affected the interview findings relating to EMS. This researcher could have adopted a number of other systems for allocating the interviews, some of which could have been, arguably, more statistically consistent but this research is interpretivist in nature, and the key aspect is that the widest possible view be taken; a system employing a percentage approach would have to ignore the smallest categories (see Table 1.2).

Thus, through considering the above, the researcher determined the exact number of organizations (according to activity) to be involved in the questionnaire survey, and the number of industrial plants to be included in each of the five Phases of the IC. In this latter determination, the researcher considered, for example, the number of metallurgical organizations that would be needed in total as well as the number from each phase. Table 1.2 presents the total number of organizations across all the Phases in the IC, being 573, and it states that the total number of metallurgical organizations is 173. As the questionnaire is to be applied on about 30% (172 out of 573) of the total number of industrial plants, and as it is to be administered equitably across the Phases and types of activity in the IC in Jeddah, this percentage can therefore be used to identify the numbers of plants from each activity and from each phase to be included in the administration of the questionnaire. Accordingly, in this example, the numbers of metallurgical organizations needed for questionnaire in Phase 1 is calculated as follows (figures for use in the subsequent tables and analyses will be rounded):

573 ⇨172

173 ⇨ ??

173 x 172 ÷ 573 = 51.9 (the total number of metallurgical organizations needed)

Thus, the number of metallurgical organizations needed from only Phase 1 is:

173 ⇨ 3

51.92 ⇨ ??

3 x 51.92 ÷ 173 = 0.9 (total number of metallurgical organizations from Phase 1)

From such equations, the precise numbers of industrial plants needed from each phase (according to activity) were determined; they are presented in Table 2.1:

Table 2.1: Number, location and type of activity for the organizations of this research in the IC

	Phase/ Industrial activity	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Frequency	Percent
1	Metals	1	5	14	15	18	53	30
2	Chemicals	5	5	13	17	15	55	30
3	Wood and furniture	1	1	1	3	3	9	5
4	Textiles and clothing	1	1	1	3	5	11	6
5	Paper and printing	1	1	2	5	3	12	6
6	Food	3	3	8	9	8	31	17
7	Building materials and glass	-	1	6	2	3	12	6
	Frequency	12	17	45	54	55	183	
	Percent	6	9	25	30	30		

Thus, the questionnaires are administered (in person) to the environmental managers (or their equivalents) of 205 organizations, with an 89% response rate (183 plants in this IC in Jeddah). On the other hand, the interviews are conducted with environmental managers (or their equivalents) in only those industrial plants that have agreed to participate (14), and with other persons from the various relevant governmental departments and private bodies who have particular specializations or scientific expertise, representing a further 12 interviews. These include representatives from:

- the Presidency of Meteorology and Environment (PME), which is the body responsible for environmental licensing and enforcement, and for maintaining up-to-date records on which organizations have registered for EMS accreditation, which are in the process thereof, and which have been warned/fined for failings in their EMS commitments;
- the Saudi Industrial Property Authority (Modon), which is responsible for the design, establishment and development of the IC.
- the Ministry of Commerce and Industry, which is the national body responsible for implementing polices pertaining to industrial development;
- the Jeddah Municipality, which is responsible for waste management, and has a great deal of relevant information on how waste is managed in the IC;
- the Jeddah Chamber of Commerce and Industry (one private body), which promotes modern management techniques and is aware of the problems facing companies that wish to modernize;
- the Environmental Sciences department at King Abdul Aziz University (KAU)

as well as the Centre of Excellence for Environmental Studies (the other private body) at the same university because the lecturers and researchers at these institutions have a wealth of experience and academic expertise in all matters pertaining to environmental protection;

- organizations providing EMS consultancy and accreditation services that have a wealth of experience of implementing EMS standards in the KSA and the wider Middle East region and can offer insight especially regarding the challenges of EMS adoption.

Thus, the researcher conducts 12 interviews outside the IC in addition to the 14 inside, as mentioned above (see Figure 2.1).

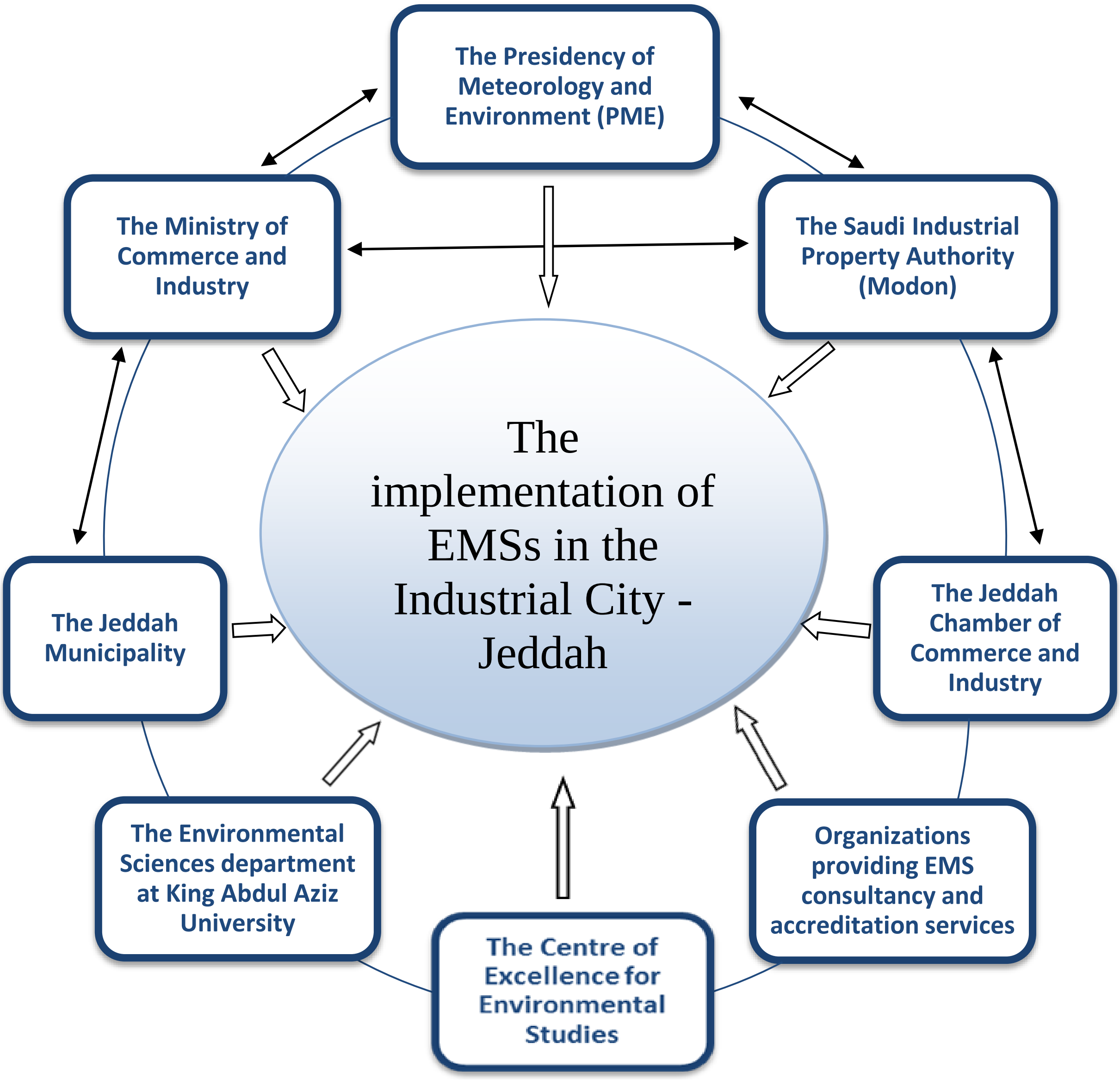


Figure 2.1: Relevant governmental departments (and private bodies).

Thus, the questionnaire and the two sets of interviews are conducted in an attempt to gain valuable insights and to draw a clear picture regarding the barriers and opportunities toward the delivery of environmental benefits from EMS implementation in the IC in Jeddah in its real-life context.

In order to conduct a critical investigation into the barriers and opportunities for EMS implementation for the delivery of environmental benefits to the IC in Jeddah, KSA, a number of objectives have been set:

- Determine the current scope of EMSs in the various industrial plants.
- Assess the current level of the PME's awareness raising and control efforts.
- Identify the obstacles facing the implementation of EMSs.
- Identify the possible environmental benefits to be derived from implementing EMSs.

Table 2.2 presents the methods that are applied to collect the data in order to achieve these objectives.

Table 2.2: Data collection methods

	The objectives	Collection method	Analysis method
1	Determine the current scope of EMSs in the various industrial plants.	Questionnaire – Interview – Documentation	Explanatory/descriptive pattern-matching SPSS - MaxQDA
2	Assess the current level of the PME's awareness raising and control efforts.	Questionnaire – Interview – Documentation	Explanatory/descriptive pattern-matching SPSS - MaxQDA
3	Identify the obstacles facing the implementation of EMSs.	Questionnaire – Interview	Explanatory/descriptive pattern-matching SPSS - MaxQDA
4	Identify the possible environmental benefits to be derived from implementing EMSs.	Questionnaire – Interview	Explanatory/descriptive pattern-matching SPSS - MaxQDA

2.6.1 Questionnaire

The starting point for conducting such an investigation should be to determine the current scope and level of EMS implementation in all those industrial plants that are participating in the survey. This will help to reflect the measurement and scope of EMS implementation in the whole IC (see Section 2.6). A questionnaire is considered the most appropriate method for measuring and evaluating such parameters, as it is highly effective at obtaining discrete data; it is one of the most commonly used research methods in the social sciences. The questionnaire's function is measurement (Oppenheim, 2000; Wilkinson and Birmingham, 2003; Rattray and Jones, 2007) and, although the data collected are essentially quantitative, the questionnaire method can be used to measure knowledge, attitudes, emotion, cognition, intention or behaviour (Rattray and Jones, 2007); these data can then be subjected to statistical analyses.

The questionnaire method has been widely used in many social science studies, and particularly in those related to environmental issues in the industrial sector, in various countries around the world. By way of example, rather than exhaustive coverage: investigation of EMS implementation in the Lebanese industrial sector, taking the food industry as a case example (Massoud *et al.*, 2010a); collection of information on environmental practices and performance on the part of manufacturing facilities in Japan and selected OECD countries (Arimura *et al.*, 2008); assessment of compliance and performance of environmental regulations in the main industrial area in Turkey (Yasamis, 2007); a survey of environmental management system initiatives in industries along the Atlantic coast of Cameroon (Alemagi *et al.*, 2006); environmental management system awareness in an investigation of the top 50 contractors in Egypt (Sakr *et al.*, 2010); investigating the implementation status of ISO14001 and its impact on enterprises in China (Zeng *et al.*, 2005); and an empirical study asking why firms engage in environmental management in China (Zhang *et al.*, 2008).

Vast quantities of data can be gathered from a large number of respondents by well-designed questionnaires. Questionnaires are an inexpensive research tool; very little training is needed to develop them, and they can be analysed easily once completed. A well-designed questionnaire can gather information on both the overall performance of the case study as well as information on specific components of the case study. In other words, it delivers useful and accurate information or data, derived from the respondents, to the researcher. The questions should always be clear and understandable to all (Wilkinson and

Birmingham, 2003; Cucerzan, 2008).

In a questionnaire's design, the concern and purpose of every single question should be clear; this is critical. A questionnaire that is written without a clear goal and objectives may overlook important issues and waste participants' time by asking superfluous questions (Wilkinson and Birmingham, 2003; Cucerzan, 2008). Apart from being wholly pertinent to the objectives, the questionnaire should also be as brief as possible, as there is the danger of 'question fatigue' on the part of the respondent. As a general rule, the ideal questionnaire length would allow completion in no more than about twenty minutes (Wilkinson and Birmingham, 2003).

As mentioned above, the questionnaires are submitted in person to environmental managers (or their equivalents) in 205 plants in this IC in Jeddah. In this research, the questionnaire is designed using closed questions, and written in two languages: English and Arabic. The questionnaire is initially written in English (to facilitate feedback in the UK and for ethical approval) and then translated into Arabic as this is the first language in KSA; the respondents are offered both and they may choose which one they prefer.

A questionnaire is usually a multi-stage process, and each step needs to be designed carefully because the final results are only as good as the weakest link in the questionnaire process (Wilkinson and Birmingham, 2003; Cucerzan, 2008). In this research, the questionnaire is divided into two parts, preceded by a definition of EMS:

• Part I: General information (pertaining to demographics, statistical description of the organization as well as certain details relating to its EMS).

• Part II: Collection of technical information, entitled:

A. The characteristics and efficiency of the EMS in your organization in the IC.
B. The obstacles facing the implementation of EMSs, and the PME's awareness and control efforts.
C. The possible environmental benefits to be derived from implementing EMSs.

Part II represents the main body of the questionnaire (it comprises three pages, whereas Part I is only a single page), and is drawn from the strengths and weaknesses identified in the literature review. Furthermore, each of the three aspects reflects the objectives detailed in Table 2.2, in so far as the sections in Part II include all the aspects addressed in the objectives, although they do not precisely reflect the formulation of the four objectives, rather, they are modified for the purposes of the questionnaire (see Appendix B).

For the purposes of triangulation, the first objective is achieved through a combination of questionnaire and a documentary survey, although supported by the interview questions. The documentary survey is only conducted at the PME, as it is the body that has all the relevant documents pertaining to the status of EMS implementation in the IC. The questionnaire method is the only practicable one for high survey populations (Alemagi *et al.*, 2006). The questionnaire's purpose is measurement and evaluation (Oppenheim, 2000; Wilkinson and Birmingham, 2003; Rattray and Jones, 2007), and the questions included pertain to the current status and scope of EMS implementation in each of the respondent organizations. As illustrated in Table 2.2 above, the questionnaire is also used to achieve the other three objectives of this study, which are combined with interviews rather than documentation, and these three are:

- Assess the current level of the PME's awareness raising and control efforts.
- Identify the obstacles facing the implementation of EMSs.
- Identify the possible environmental benefits to be derived from implementing EMSs.

Questionnaire-based methods, however, are not the method of choice where the focus is on elucidating motivations or perceptions and where little is known about a subject or topic area. In such an instance, the integration of qualitative methods, such as interviews, with quantitative ones may be more appropriate (White *et al.*, 2005; Rattray and Jones, 2007). In this respect, interviews are combined with questionnaires to collect in-depth information pertaining to these objectives, in order to gain a full understanding of these objectives and to draw relevant conclusions at the end.

2.6.2 Interviews

An interview is "*a conversation with a purpose*" and is a flexible and adaptable way of identifying specific data (Robson, 2002 p228), and considered as one of the most important sources of case study information (Yin, 2009). Interviews are most often conducted face-to-face but they may be conducted over the telephone (Wilkinson and Birmingham, 2003). The key benefit of this technique over the questionnaire is that in an interview, the interviewer can respond to the answers given, and explore them in greater depth. The interviewer may also uncover an aspect that he or she had not considered hitherto, and may then investigate a new and relevant line of enquiry. In an interview, the interviewer can gain a much deeper insight into the perspectives and motives of the interviewee; this is generally not possible through a questionnaire (Robson, 2002; Wilkinson and Birmingham, 2003; Yin, 2009). A great deal of human interaction is through body language, and a skilled interviewer can garner a great deal of significance from the responses. It has also been argued that interviewees tend to be honest in their responses and often feel more able to discuss sensitive issues, although this depends on the level of rapport that the interviewer can build with the interviewee (Robson, 2002; Wilkinson and Birmingham, 2003). Thus, the interviewer should develop an atmosphere of cordiality and confidentiality with the interviewee, through comforting signals or acceptance cues. These will facilitate the interview, stimulating an uninhibited flow of information (Wilkinson and Birmingham, 2003).

Interviews are, by their very nature, not rigid instruments but they are usually adopted in one of three different forms: the unstructured interview, the semi-structured interview, and the structured interview. The first is often adopted when the interviewer has little knowledge of the phenomenon being investigated, and is seeking to learn from the interviewee. In the structured form, the interviewer is largely seeking clarification vis-à-vis the phenomenon, and attends the interview armed with a set of pre-determined questions. Perhaps the most common method adopted, however, is the semi-structured form, as this allows the interviewer some flexibility in framing the questions and in responding to the answers whilst maintaining a focus on the issues at hand. Thus, semi-structured interviews are less rigid than the structured form but more rigid than the unstructured, facilitating a focused, conversational, two-way communication, where the interviewer can learn as well as clarify. In this form, not all of the questions need to be designed and phrased beforehand (Robson, 2002; Wilkinson and Birmingham, 2003). There is a further form of interview: the group interview. By employing both the individual and group forms, the researcher may capitalize on the strengths of both (Wilkinson and Birmingham, 2003); however, the group form is not suited to this study context.

Interviewers usually couch their questions in an open, rather than a closed, form, as these tend to deliver data of considerable depth; closed (Yes/No) questions are better suited to questionnaires. However, care must be taken in ensuring that the questions are not leading. Thus, the questions in the interviews to be conducted by this researcher will be couched in terms of ‘How’, ‘Why’ and ‘Could you explain...’, etc., rather than ‘Do you...’. This distinction between open and closed questions in the social sciences reflects the difference between qualitative and quantitative methods (Robson, 2002; Wilkinson and Birmingham, 2003; Leech and Onwuegbuzie, 2007). The former are aimed at reaching insights in order to clarify or comprehend the phenomenon, and the interviewer extracts information from a particular source; this means, however, that the data derived often cannot be generalized (Robson, 2002; Yin, 2009). Quantitative methods, on the other hand are usually formalized and structured, making them better suited to questionnaires, where certain issues are addressed and a range of possible answers are predefined. Quantitative data lend themselves to generalization and comparison, whereas qualitative data lend themselves to comprehending phenomena (Wilkinson and Birmingham, 2003).

Interviews are widely used in social science studies in general and in case study research methods in particular (Yin, 2009). There are a lot of studies that have conducted interviews, and particularly combined them successfully with questionnaires in order to obtain an in-depth understanding related to environmental issues in the industrial sector (Zeng *et al.*, 2005; Alemagi *et al.*, 2006; Yasamis, 2007; Zhang *et al.*, 2008; Massoud *et al.*, 2010a; Sakr *et al.*, 2010).

Notwithstanding the efficacy of employing the interview method, it has certain drawbacks, which are described below, but chief among these is that it can be time-consuming, and this has implications for determining the size of the sample. No researcher can interview all the stakeholders in the case, and therefore a selection must be made; this must be taken with care as the sample must be fairly representative of the population (Robson, 2002; Wilkinson and Birmingham, 2003; Bryman, 2012). As described in Section 2.6, this researcher has selected 14 organizations for interview, each of which represents an industrial activity (present in each of the IC's development phases) and an organizational size (small, medium or large, depending on the number of employees), according to the sampling criteria described above. This will afford the researcher the opportunity, with the support of the other two instruments, to generalize the interview findings to the whole population, allowing the researcher to identify the views of all of the organizations within Jeddah's IC, although the researcher is cognisant of the fact that each interview is characterized by very particular parameters that are not replicated in the other interviews. Nevertheless, each interview does represent an activity category, whereas, for the second set of interviews, the researcher is less concerned with the concept of representativeness, as the interviewees are policy makers, enforcers or experts in the field of EMS, rather than members of companies implementing an EMS; they may indeed represent obstacles as well as facilitators.

Accordingly, face-to-face semi-structured interviews are used to obtain in-depth data relating to each environmental manager's experience of working with EMS (and environmental management in general). A second set of interviews is employed to gain valuable insights from government personnel and private bodies regarding the opportunities and barriers to EMS implementation for the delivery of environmental benefits to the IC. This second set is also conducted to gather relevant information from those members of staff who have particular specializations or scientific expertise (as detailed in Section 2.6).

The importance of the aforementioned actors cannot be overlooked in this research. Firstly, the personnel at the aforementioned government departments (and some private bodies) and the KAU have a wealth of experience and a role to play as far as industrial pollution and protection of the environment in KSA is concerned. Secondly, the KAU is the only institution in KSA that offers environmental science programmes. Therefore, researchers and staff members of the Department of Environmental Sciences at this university should be directly involved in research pertaining to environmental protection, and most specifically industrial sustainability. It should be noted however that their powers are extremely limited; they may only offer advice but it is this advice that could significantly deepen this researcher's understanding of the issues involved. Thirdly, organizations providing EMS consultancy and accreditation services (who have a wealth of experience in implementing EMS standards in the KSA and the wider Middle East region) can offer insights, especially regarding the challenges to EMS adoption. Fourthly, the environmental managers of industries within the IC in Jeddah are to a large extent responsible for general environmental management. Indeed, they are responsible for the implementation and maintenance of EMSs within their organizations, which in turn, directly affects the local environment. These managers have an important role in how EMSs are created, what they encompass, which issues are given priority, and the rate of progress. From this perspective, environmental managers at the corporate level are best suited to answer questions focused on the implementation and effects of EMSs.

During the interviews, the researcher will manually note down the responses of the interviewees; the possibility of taking sound recordings was considered but in the experience of the researcher, most interviewees in KSA prefer not to be recorded. Nevertheless, each interviewee will be politely asked for permission to record the session, although a positive response will not be assumed. "*Using recording devices is a matter of personal preference*" (Yin, 2009 p109); in the event, of all the 24 interviews, 18 were recorded. Following each interview session, the field notes or recordings will be collated and prepared for analysis; this will be done in Arabic as interviewees usually prefer to respond in their mother tongue, and the transcriptions will be offered to the interviewees so that they may satisfy themselves that their (or their organization's) confidentiality has not been compromised. All the most relevant sections will then be translated into English for the purposes of this thesis.

As alluded to above, although the interview technique can deliver substantial quantities of highly relevant data, it does suffer from a number of drawbacks. Interviews usually involve logistics; the researcher may have to conduct the interviews at a time and place of convenience to the interviewee. These may be changed at short notice and so the researcher must build flexibility into his/her plan. During the interview, the researcher must be at pains to ensure that the interviewee is comfortable and that an element of rapport has been established, otherwise the interviewee may merely say what he feels the interviewer wants to hear in order to expedite the session as quickly as possible. Furthermore, having conducted an interview, the responses must be transcribed and coded or collated, which is again a time-consuming process (Robson, 2002; Wilkinson and Birmingham, 2003).

The interview session may fail if the interviewer fails to plan appropriately, to develop rapport, asks vague or insensitive questions, repeats questions (in different forms), fails to listen closely, fails to probe and expand on any unanticipated issues, and fails to fully comprehend the answers. Thus, before embarking on this venture, the researcher ensured that he was well versed in the semi-structured interview technique, practicing beforehand and including it in the pilot study; failure to do so could have resulted in diminishing the value of the research in the eyes of the interviewee, compromising the value of the data derived (Ibid).

2.6.2.1 Overview of the interview content

In qualitative research, the data to be analysed are unlike the data in quantitative research, in which the researcher assesses, measures and then analyses discrete data; rather, in qualitative research, the focus is on data from which meaning must be inferred, abstracted, described and collated in a manner that allows a picture to emerge, one that reveals the thoughts, opinions and motivations of the actors or events under investigation (Soklaridis, 2009; Hennink *et al.*, 2010; Östlund *et al.*, 2011; Bryman, 2012). Thus, this research approach is particular efficacious for more fully comprehending the actions of the individuals engaged in the event under investigation, through the eyes of those individuals (Yin, 2009; Bryman, 2012).

As qualitative research is a methodology that focuses on investigating the thoughts and opinions of the subjects at hand, it is generally considered wise to restrict the remit of the research to only a limited number of hypotheses and to a restricted research paradigm (Ibid). In satisfying these criteria, researchers generally adopt the interview technique (Soklaridis, 2009; Östlund *et al.*, 2011; Bryman, 2012). Therefore, in order to achieve this research's objectives, face-to-face semi-structured interviews were designed and applied.

The semi-structured interview is flexible, although the interviewer has an interview guide (a list of questions or specific topics to be covered); compliance with the original wording or order of the questions is less important and can change. In addition, any further topics mentioned by the interviewee can be addressed and explored (Yin, 2009; Bryman, 2012). Accordingly, although the interviewees were asked specific questions, they were free to expand on their answers and the interviewer was then also free to put fresh questions to the interviewee. To facilitate this, the questions, as described in the methodology chapter, were carefully designed so as not to lead the interviewee in terms of supporting or disagreeing with any particular EMS approach or model (Yin, 2009). Furthermore, the interview questions addressed certain issues and points that had not been directly covered in the questionnaire, such as environmental standards, dealing with waste, how to avoid legal sanctions, and pressure from the public.

The interview guide as recommended by Braun and Clarke (2006) and Yin (2009) used for the semi-structured interviews covered 24 main questions, which represent the topics of the four objectives of this research:

- Determine the current scope of EMSs in the various industrial plants:
  - How would you assess the environmental situation and the contribution of the industrial sector to the environment in KSA?
  - Do you think that implementing EMSs is necessary in the industrial sector in KSA? Why?
  - Where do you think private Saudi organizations are in comparison with organizations in the developed world with reference to the implementation of environmental management? Why do you think so?
  - How would you describe the environmental situation in your organization? And in the IC in general?
  - From your experience, to what extent have EMSs been implemented in your organization? And in the Industrial City in general?
  - In your organization, what are the criteria or standards for controlling and assessing its environmental performance?
  - How does your organization monitor its compliance with environmental requirements?
  - Could you explain the EMS processes that your organization applies (policymaking, planning, implementing, checking, reviewing)? Why?
  - Does your organization promote the re-use/recycling/reduce of waste? How?

- Assess the current level of the PME's awareness raising and control efforts:
  - How do you assess the PME's efforts, as the primary body responsible for environmental protection affairs, in addressing environmental concerns in KSA?
  - Are there any particular strengths or weaknesses in their environmental efforts in: awareness, information, training, enforcement, monitoring and control? Why?
  - From your experience, what does the PME need to do in terms of its current environmental protection efforts?

- Identify the obstacles facing the implementation of EMSs:
  - In your opinion, are there any problems or obstacles that prevent implementing EMS in your organization?

- What are the major obstacles? And how do you overcome them?
- Could you explain the challenges facing your organization in implementing EMS?

➢ For those organizations that do not have an EMS:

- Why you do not have any EMS in your organization?
- How do you avoid legal sanctions, for example, forfeiture of operating permits and financial fines and penalties that hamper business activities?

➢ For the organizations providing EMS consultancy and accreditation services:

- From your experience, are there any problems or obstacles that prevent implementing EMS in the KSA and the wider Middle East region?

• Identify the possible environmental benefits to be derived from implementing EMSs:

➢ For those organizations that have EMS:

- Do you think that regulatory pressures (legal requirements) are the main reason for implementing environmental initiatives in your organization? What about public pressures (customers, community, supply chain) or other reasons?
- Could you explain the reasons behind implementing EMS in your organization?
- What do you think are the incentives that encourage your organization to adopt EMS?
- Have you noted any environmental, economic or other benefits resulting from the usage of EMS in your organization?
- How do you manage the process?
- What were the hurdles?
- Were all staff engaged in the process?
- Did you use consultants in EMS adoption process?

As mentioned above, two sets of interview data were collected; the interview guide changed slightly according to the group of interviewees. For example, participants from organizations were asked about the implementation of EMS in their organizations, while the other group were asked about the implementation of EMS in IC in general (see Appendix C).

2.6.3 Documentation

The third tool employed in this research is a survey of documentation. There is a variety of sources for documentation but they can be broadly categorized as personal (diaries and letters) organizational/institutional (in-house publications, records and confidential data) and public (journals, newspaper articles and government institution archives). These may be subjected to content analysis, whereby the data therein are categorized in order to identify the core elements, allowing the researcher to build a richer picture of the area under investigation. Several issues arise in relation to documentation, and they chiefly revolve around confidentiality. Documents can be highly sensitive and be of significant commercial value, and so the researcher must be cognisant of their potential value, refraining from the photocopying of any sensitive data (Curry *et al.*, 2009). In this research, the documentary survey is conducted mainly at the PME offices but Modon is also contacted as it holds data pertaining to the analysis of waste-testing and sewerage-checking, and is responsible for the development and maintenance of industrial cities in KSA. All the most essential and relevant data found within these documents were collated and later used as evidential references and support for the finding of the qualitative analysis in the discussion chapter (and in certain aspects for the background analysis).

2.7 Methodology Refinement (undertaken during the research design process)

2.7.1 Pilot Study

When designing an interview or a questionnaire it is easy to overlook mistakes and ambiguities in question layout and construction. No research instrument is completely perfect. The researcher can begin to identify and correct imperfections (before it is too late) by piloting, or testing out, the questions with a select few people in order to establish their clarity (Wilkinson and Birmingham, 2003).

Piloting will assist the researcher to refine his/her data collection plans with respect to both the data content and the procedures to be followed (Robson, 2002; Yin, 2009). Usually, mistakes are quickly highlighted through piloting, and can be rectified relatively easily. In the same way, ambiguous questions can be restated or redeveloped. Whilst conducting the pilot study, the researcher can determine the length of time it takes to complete the questionnaire; this should not exceed 20 minutes but if it does so, then the researcher has the opportunity to modify or omit questions. Feedback may also inform the researcher of poorly worded questions, and these may then be rephrased (Robson, 2002; Wilkinson and Birmingham, 2003; Yin, 2009).

Although crafting interview questions is important, many researchers overlook the importance of piloting them; only through piloting can the researcher ensure that the questions follow a natural sequence, building a consistent body of knowledge, and that the session is of a suitable length (it is important that the schedule of the interviewee not be interrupted). Piloting affords the opportunity to restructure certain questions or phrases so that they support and develop answers, rather than obfuscate the issue at hand (ambiguity must be avoided at all costs) (Wilkinson and Birmingham, 2003).

Consequently, the pilot study (involving both questionnaire and interview) was first administered on some Saudi students undertaking postgraduate research in the UK and then on some colleagues and students at KAU (all of whom are currently engaged in this field); this was done particularly in order to ensure that the exact meanings of the questions had been captured in the English-to-Arabic translation. This sample was asked to comment and provide feedback in order to make the final versions of the questionnaire and interview questions as easy as possible to comprehend. A small sample of 5 organizations in the IC (otherwise not included in the survey) were then approached by the researcher to test both the questionnaire and interview questions; each environmental manager was from a different organizational category in the IC, in order to test the research instruments in a real-life context. Furthermore, the pilot study sample was conducted to allow ‘fresh eyes’ to comment on the suitability and clarity of the instruments. Through the above considerations and processes, the researcher satisfied himself that the instruments are tailored to addressing the research hypothesis, although the questionnaire was modified in order to avoid leading questions and any questions that contained repetition (in particular, Part II was reduced from four to three sections). Subsequently, the modifications were presented to the researcher’s supervisors who approved the revised version.

2.7.2 Field Trip

In order to gain access to the case study (IC in Jeddah, KSA) under investigation, and to conduct the research in the desired manner, a number of steps had to be taken. The main steps began before the researcher arrived in Jeddah, KSA. All materials needed to conduct the investigation and the proposed methodologies to be used were presented to the researcher's supervisors. Accordingly, the researcher obtained a letter from his supervisors explaining the importance of the study; this greatly facilitated matters in the KSA, and encouraged all those invited to respond positively. Also, all the procedures intended for this study were presented for approval before the UEA Ethics Committee (see Appendixes A & E). Finally, those approvals were forwarded to the sponsor's representatives here in the UK, as they released the funds to initiate the fieldtrip.

The researcher went to KSA at the beginning of February 2012. As a first step and to start the data collection process in the IC in Jeddah, the researcher had to obtain legal permission and approval from the relevant government departments. Accordingly, about two weeks were spent seeking letters of permission from the PhD research sponsor (King Abdulaziz University (KAU)), the Presidency of Meteorology and Environment (PME), which is the body responsible for environmental licensing and enforcement (and for maintaining up-to-date records on which organizations have registered for PME environmental licence, which are in the process thereof, and which have been warned/fined for failings in their PME licence commitments), and the Saudi Industrial Property Authority (Modon), which is responsible for the design, establishment, management and development of industrial areas and cities in KSA (see Appendix A). The letter of permission from the PME's Environmental Department was signed by the incumbent Head at that time, although he has since been relieved of his post (in 2013) (Alriyadh, 2013).

Following this, the researcher piloted the research instruments (questionnaire and interview) as mentioned above. Therefore, he started collecting data from the end of February, 2012. The total number of organizations included in this research was relatively demanding, given the timeframe. After trying a few different methods, for example, sending the questionnaire by email (if they have one but most organizations in Jeddah do not have a website in which to find an email address), drop and collect, and sending by Fax, the researcher found that the best way to conduct his survey was by submitting the questionnaire in person and staying with the respondent until he finished answering it; in this manner, the researcher managed to visit 3 to 5 organizations per day.

On the other hand, the interviews were conducted with the environmental managers (or their equivalents) in only those industrial plants that had agreed to participate (14), and with other persons from the various relevant government departments (and some private bodies) who have particular specializations or scientific expertise.

Finally, the researcher conducted the documentation survey after finishing the questionnaires and interviews. The documentation survey was conducted mainly at the PME and the Modon. Accordingly, the researcher completed his fieldwork at the end of June 2012.

2.8 Data Analysis

Efficacious analysis of the results collated from the data gathering exercise is a critical aspect of any research and it is important that the researcher develops a strategy to guide him through the various possible techniques (Robson, 2002; Leech and Onwuegbuzie, 2007; Yin, 2009). There are, generally speaking, two analytic strategies: relying on theoretical propositions, and developing a case description. In the first, the analysis is guided by a set of the theoretical propositions that informed the approach to the study. In this, focus is maintained on particular aspects, and data that are deemed to be irrelevant to the propositions are discarded. In the second, a framework is developed for organizing all the descriptive data that is pertinent to the phenomenon under investigation (Leech and Onwuegbuzie, 2007; Yin, 2009).

Regardless of the strategy applied, there are a few key techniques used in data analysis: pattern matching, explanation-building, and time-series analysis. Pattern matching (explanatory/descriptive) involves comparing empirically garnered patterns with predicted ones; the expected patterns may be delivered, alternative patterns may emerge (necessitating alternative hypotheses and explanations), or similar patterns may be realized, revealing a number of key variables inherent within the phenomenon. In explanation-building, the researcher seeks to identify causal links in order to explain the phenomenon. This may involve a series of iterations, where statements are refined following sequential investigations into a series of similar cases (it is possible that the researcher will experience an element of 'drift' away from the initial investigation). In time-series analysis, the researcher investigates changes over time; this may begin with a hypothesis that is then tested over a certain period. This technique is particularly useful for examining trends which is beyond the remit of this research. Each of these may involve embedded designs, where there are many units of analysis within one case, and where the researcher is seeking to identify patterns. Regardless of the technique employed, an analysis should incorporate all the relevant data and address the research problem (Leech and Onwuegbuzie, 2007; Yin, 2009).

This research is broadly a case study, exploring barriers, opportunities and benefits, and so the analytical strategy is ‘developing a case description’. The appropriate technique in this case would be ‘explanation-building’ but as this is an embedded study, with multiple units, there is also an element of ‘pattern-matching’. Notwithstanding the importance of fully comprehending the appropriate strategy and techniques, all social science data needs to be analysed, and this can be a time-consuming process (Leech and Onwuegbuzie, 2007; Yin, 2009). However, various computer-based tools are available, and of particular interest in this regard are the Statistical Package for the Social Sciences (SPSS) and the MaxQDA v.11 software; these are computer software packages. SPSS has been widely used by the research community in order to analyse quantitative data (Miller and Acton, 2009), and MaxQDA v.11 is recommended by Wilkinson and Birmingham, (2003); Leech and Onwuegbuzie, (2007) and Yin, (2009) to assist with the analysis of qualitative data.

In order to facilitate the process of analysing the data, the data collected from all the various sources has to be coded. These codes may be numerical or otherwise; in this study, the quantitative data (questionnaires) are numerically coded but the qualitative data (interviews and significant findings from the documents) are ascribed values that have particular meanings. It is important that through the coding process, the researcher keeps an open mind, and remains as objective as possible, allowing the coding scheme to emerge from the data, rather than from the perspectives of the researcher. Coding is particularly useful in analysing complex multi-category systems, and there are various off-the-shelf systems that could be adapted to this research, however, in order for the coding system in this research to accurately reflect the objectives, and depending on how the fieldwork progresses, this researcher will develop a unique one. The coding process in this research will entail several stages; there will be an initial analysis phase whereby, as the data are being collected, regardless of source, they will be ascribed certain codes (Robson, 2002; Charmaz, 2006; Andrade, 2009). These will reflect certain basic criteria, such as data source and some of the key characteristics of that source. At a slightly higher level of abstraction, additional codes will reflect certain qualitative elements, reflecting individual experiences with EMS (Andrade, 2009). As the process of collation proceeds, patterns may then emerge from the data, and these may then be further categorized through coding. At this stage, the presence of outliers may become apparent, and they will be dealt with as deemed necessary, although this will depend on a case-by-case assessment of each. Through asking questions relating to the research objectives, through recognizing patterns in the answers to these, and through further refining the data (through outlier deletion and aggregation or clustering), a handful of themes, propositions or hypotheses may then emerge; this may entail modifying the codes (Charmaz, 2006; Andrade, 2009). At various stages in the above process, the aforementioned tools (SPSS and MaxQDA) will assist the researcher in data collation and in identifying emergent themes, and thus they will assist the researcher in ascribing meaning to an otherwise unstructured mass of data, and in more fully comprehending the context in which the responses to the questionnaires and interviews were given.

2.8.1 Analysis of the Quantitative Data

This section focuses on the quantitative data derived from the questionnaire and is divided into two main parts. The first section presents the descriptive statistics, drawing on the first part of the questionnaire, and the subsequent section presents the inferential statistics, through which the researcher directly addresses the objectives of the study; this second category focuses on the main body of the questionnaire.

Descriptive statistics describe the data in question. Through particular techniques, the raw data are transformed into an understandable form by summarizing, categorizing and rearranging, and through graphical representations and other forms of analysis in order to simplify and clarify the research data (Scale, 2004; Pallant, 2010). Typically, the first part of such analysis describes the respondents and the second describes the organization. Descriptive statistics thus enable the researcher to assess the data in a clearly organized manner. Furthermore, descriptive analysis is a tool for explaining the associations that connect one variable to another, and this also assists in reducing large amounts of information into a more understandable form.

Inferential statistics allow the researcher to draw inferences (on the basis of the data collected and collated) related to the research hypotheses. They determine whether any anticipated patterns described in the hypotheses are actually apparent within the data (Scale, 2004; Pallant, 2010). Inferential statistics encompass both parametric and non-parametric tests of significance, i.e. the Pearson’s Chi square for identifying associations and determining attitudes. Cronbach’s Alpha analysis is used to provide indications pertaining to the reliability of the measurement scales.

2.8.1.1 Preparing the Data for Analysis

Once all data have been collected, the researcher must prepare them for analysis. Organizing the data correctly and appropriately can save a great deal of time and can prevent errors. Accordingly, several processes must be undertaken after completing the questionnaires in order to prepare the data for analysis and to achieve the research objectives. These processes chiefly encompass coding and data entry, although data entry includes several sub-processes: editing, verifying and cleansing the data (Scale, 2004; Pallant, 2010); these steps are discussed below in detail.

Coding: this represents a transition from the questionnaire to the program (SPSS) and can be defined as the process of assigning numerical equivalents to each response for each question in the study. In other words, coding is the process by which responses are classified into meaningful categories; the main rule of coding is that the numbers assigned must make intuitive meaning and be easily inserted into the computer (Scale, 2004; Andrade, 2009). It is the step that succeeds collecting the data, and that precedes entering the data into a computer prior to analysis. It should be noted that coding is also applied on qualitative data, wherein descriptive data are assigned numerical values; this is addressed in the subsequent section.

According to the concept of SPSS (Statistical Package for the Social Sciences), a respondent who answers a questionnaire is called a ‘case’, each question in the questionnaire is a ‘variable’, and the answer to a question (variable) is called a ‘value’ (Pallant, 2010).

The process of coding the data requires a great deal of attention on the part of the researcher, in particular when assigning a number to each variable and value in the study. The variables in this research start with “Part I: General Information” from the questionnaire which include questions such as position/title, age, educational level, etc., and are ascribed symbols from g1 to g13. Part II contains three subsections: “A”, which is on the efficiency of the EMS, is ascribed symbols from e14 to e21, “B”, which is on obstacles to implementing EMS, is ascribed symbols o1 to o10, and “C”, which is on the benefits of EMS, is ascribed symbols b1 to b13 (see Appendix B).

The values to all these variables are given numbers that reflect the range of possible responses in the questionnaire, and accordingly the numbers 1 – 13 are employed; these are categorized according to the responses to each aspect explored and do not constitute a scale. More specifically, the responses to the statements g1 to g13 elicited ‘yes’, ‘no’ or ‘don’t know' responses, and these were ascribed 1, 2 and 3, respectively, whereas the statements o1 to o10 and b1 to b13, which are on the ranking of the obstacles and benefits to implementing EMS, are ascribed a number from 1 - 10 and from 1 - 13, respectively.

The variables pertaining to the efficiency of the EMS (e14 to e21) are measured on a 5-point Likert scale; this expressed the responses of the respondents to each statement in terms of 'Strongly agree', 'Agree', 'Neutral', 'Disagree', 'Strongly disagree'. These responses are ascribed a code number according to the level of agreement. Consequently, 1 means that the respondent strongly disagrees with the statement, 2 that s/he disagrees, 3 that s/he has no particular feeling on the matter, 4 that s/he agrees and 5 means that the respondent strongly agrees with the statement (Scale, 2004; Pallant, 2010).

Data entry: once the codebook has been constructed, the data need to be transferred into a form that can then be entered into SPSS in order to facilitate data analysis. Firstly, each questionnaire was given a serial number, checked for omissions and errors, and then entered in accordance with the parameters mentioned above (case, variable and value). This entails the following three steps:

- **Editing data:** the purpose of editing the data is for quality control (Kanel and Gastel, 2008). Some of the respondents may not have answered certain questions, whilst others may have written marginal comments to the side instead of checking a box, and still others may have checked multiple categories when the instructions were to select only one answer (Redline *et al.*, 2005). Thus, the need to edit the data is to ensure completeness, consistency and readability of the data, and this should be done where necessary.
- **Verification:** the result obtained from data analysis can only be as good as the raw data entered. Therefore, data verification is required to enhance the quality of the data entry (Redline *et al.*, 2005). In this respect, the researcher followed a careful data entry procedure, with a double-check system for ensuring that the data from each questionnaire had been entered correctly. This step guarantees that there were no omissions in the data entry that could possibly result in misleading findings.

Cleansing the data: cleansing or filtering the data is the proofreading of the data, and its purpose is to identify and correct errors and inconsistent codes (Scale, 2004; DiLalla and Dollinger, 2006; Pallant, 2010). The data were checked twice before the analysis began; the first check was to ensure whether the coded answers were within the range of responses, and the second was to look for dependent relationships, i.e. when an answer to a particular question is determined by another answer. Both of these methods of data cleansing were applied in this study.

2.8.2 Analysis of the Qualitative Data

Having collected the interview data, the transcription tasks need to be accomplished. The nature of transcribing interview data necessitates at the very least assessing the data and drawing some preliminary findings. In practice, it entails collating and coding, and in this case the process revealed previously unconsidered issues, interesting points, puzzling information and critical incidents, all of which were coded accordingly. Generally, researchers should consider their transcription strategy with care, as the ensuing coding can significantly affect the clarity of the findings (Hennink *et al.*, 2010; Bryman, 2012).

Watling and James (2007 p352) stated, "*Whether they realise it or not, all qualitative researchers will have to analyse parts of the data while they are designing the project; when they are conducting their desk-based research; when they are doing their fieldwork; while they are storing, and when they are writing up their report*".

Thus, this transcription stage represents the preliminary stage of interpretation. In order to prepare qualitative data for analysis, (Watling and James, 2007; Denscombe, 2010) made the following general suggestions:

- Back-up copies of all original materials;
- Gather and organise all data in a compatible format;
- Collect data to which the investigator can add, at a later stage, alongside his/her notes and comments.
- Label every single item of 'raw data' with a serial number for referencing.

Accordingly, and in line with Yin (2009), Hennink *et al*. (2010) and Bryman (2012), a system of qualitative coding will be applied to the interview data in order to facilitate analysis. This system entails the segmentation of the interview statements into separate sections, which will be ascribed particular terms that summarize their contents (Ibid). As this is a somewhat arduous task, it can be conducted in two phases, as recommended by Charmaz (2006), Andrade (2009) and Bryman (2012): "*initial coding and selective or focused coding*" (Bryman, 2012 p569). The initial coding entails ascribing to each line or phrase a letter and a number, and the focused coding then entails adding further letters and numbers as deemed appropriate in order to synthesize, integrate and organize the data (Leech and Onwuegbuzie, 2007; Andrade, 2009; Hennink *et al.*, 2010; Bryman, 2012). In practice, this meant describing the data initially in terms of the interview set and the interviewee, and then during the focused coding, the initial codes were affixed with numbers and letters to reflect aspects such as organization size, phase, activity and whether or not they were implementing an EMS or whether or not that had the PME licence or ISO14001 accreditation.

In order to perform the coding, the NVivo v.8 software was initially selected, as it has a good reputation in the field and can greatly assist the ensuing data analysis phase. It helps the researcher to: code the interview segments quickly; write, store and view memos; and retrieve the coded data as needed; it also assists in making graphical representations of the data codes, displaying the links between them (Leech and Onwuegbuzie, 2007; Bryman, 2012). However, it was soon found that this program does not support right-to-left script, and thus, NVivo v.8 could not be used for the Arabic text in which much of the interview data had been transcribed.

Following research into this matter, the MaxQDA program was suggested; it is the updated version of the respected WinMAX12 program, which has much the same functionality as NVivo in that it can be used to refine, elaborate, add or delete codes and sub-codes (Kronenwetter *et al.*, 2005), and it presents the codes clearly on-screen in four separate windows (http://www.leeds.ac.uk/educol/documents/165945.htm).

The initial coding when being entered in MaxQDA followed a line-by-line procedure, as recommended by Charmaz (2006), Andrade (2009) and Bryman (2012), in which each sentence in the semi-structured interviews was ascribed a separate code. Thus, through the program, it was possible to visualize the data and to identify connections; it was also possible to differentiate between positive and negative responses. In the initial coding, the researcher was careful to ensure that the codes closely reflected the statements and that no theoretical direction was introduced, as stressed by (Charmaz, Andrade and Bryman). In addition, the codes were designed to be flexible and were occasionally adapted to fit new circumstances as they arose in order to ensure that the codes fairly represent the meanings of the interviewees (Charmaz, 2006; Bryman, 2012).

It should be noted that the language of the interviews (and therefore the terms used by the interviewees to describe matters relating to EMS) were conducted in Arabic.

Subsequently, the transcription and coding processes (undertaken by the researcher) were also conducted in Arabic; once the coding process had been completed, the categories and all the key data were translated into English. Lopez *et al.* (2008) and Marshall and Rossman (2010) suggested this as a possible approach which the researcher adopted as practical in view of the time constraints on the project. It meant, of course, that the researcher functioned as the interpreter of all the Arabic terms used by the interviewees. Bryman (2012) suggested using memos in which ideas and illustrations might be stored. During the interview process, memos were kept of the perspectives of the interviewees as well as any links they may have with the initial codes and categories, which greatly assisted in establishing the initial coding process following transcription. These memos also assisted the researcher in remembering the code definitions and why a particular code had been assigned to a particular datum.

Extrapolating from the recommendations of Charmaz (2006), the researcher considered the following issues whilst conducting the initial coding:

- How well qualified the interviewee was and how knowledgeable he was of the issues involved (in particular, for the first set of interviews).
- The overall opinion of the importance of EMS to the interviewee or to the organization.
- The stance of the interviewee to specific issues or factors as they were raised by the researcher.

Charmaz (2006) also emphasized the importance of keeping the codes open, short and precise, and staying close to the data and resisting making inferences; he also stated that the codes must facilitate data comparison (although this is to be conducted at a later stage), and that the researcher must be able to move quickly through the data. In establishing the final list of codes for the initial stage, being mindful of all the above issues, and following the advice of Kvale and Brinkmann (2009), the researcher sought to reveal initial patterns, themes and clusters in order to gain an overview of 'what goes with what'. This assisted in improving the collation and integration of the many and diverse pieces of data that have been collected from all the interviews.

As alluded to above, the bridge between initial and focused coding entails the consideration of 'themes'. Thematic analysis is the identification and assessment of patterns as they emerge or become apparent within data. This process serves to describe the dataset in terms of distinguishing certain elements from others whilst maintaining the detail. Thematic analysis is sometimes regarded as the process of drawing inferences from the data, or even of interpreting various aspects of them in light of the research questions; although it is widely used, there is no settled view as to what it is and what it entails (unlike for example, narrative analysis or grounded theory) (Braun and Clarke, 2006; Bryman, 2012). In this case, the researcher sought to exploit the emergence of themes merely to inform the subsequent stage of focused coding, i.e. this did not involve content analysis.

Having completed the initial coding, the researcher should then conduct the focused coding. This will entail a further examination and synthesis of the data through using the most significant and/or frequent initial codes to further assess the emergent themes, thereby determining the adequacy of the initial codes. This will allow the researcher to decide which of all the initial codes can be most fruitfully used for categorizing the data in a more holistic yet particular manner, i.e. one that is robustly consistent (Braun and Clarke, 2006; Charmaz, 2006; Andrade, 2009; Bryman, 2012). Kvale and Brinkmann (2009) state that this process also entails contrasting and comparing the themes within the data; this is a pervasive tactic that serves to deepen the researcher's comprehension of the themes. Differentiating the themes (through extending the codes) is then possible, and this entails the partitioning of certain variables as well as subsuming others (again, reflected in the codes). This process involves taking a broad range of poorly focused themes and creates a final list of codes that describe a coherent set of highly focused patterns; as such, this is akin to certain quantitative techniques in that it can be used to detail the relationships among the variables.

In generating categories and codes, Braun and Clarke (2006); and Marshall and Rossman (2010) also emphasized the importance of determining and exploiting patterns and themes from interviews. In this research, these patterns were initially determined for the first set of interviews through the demographic information and whether the organizations had an EMS, ISO14001 or the PME environmental licence. The group of stakeholders in the second set of interviews assisted in supporting or clarifying those patterns, which helped deepen the researcher's understanding of the issues involved, thereby facilitating the focused coding; indeed, this second set also served to some extent as a reference point for the interviews as these stakeholders were in possession of, and had knowledge of, documentary evidence describing certain aspects of reality in the field. MaxQDA also greatly facilitated the focused coding through clarifying the patterns in the interviews and exposing interrelations among the codes (Kronenwetter *et al.*, 2005; Bryman, 2012).

Kvale and Brinkmann (2009) stated that comparing the data during focused coding enables the researcher to identify variations in the data and in their patterns; this was aided through further use of the aforementioned memos, through comparing data with data, data with codes, codes of data with other codes, and codes with broad categories (Charmaz, 2006). Therefore, this researcher compared the categories and their patterns in terms of activity and size. In so doing, the researcher was able to reveal the relationships between the level of application of EMS and all the other variables. This is a process of summarizing the key findings (Marshall and Rossman, 2010), and systematically assembling a set of coherent, comprehensible and consistently coded data, that accurately reflect both sets of interviews. All of the above stages represent the building of a logical chain of evidence that is robust and that can be easily referenced, allowing for conceptual/theoretical coherence and consistency.

2.9 Validity and Reliability

Validity is intended to be a measure of how truthful the results are and whether or not they reflect the purposes of the study (Joppe, 2000). According to Joppe (2000), reliability can be defined as: "*The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability, and, if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable*" (p. 1).

In any empirical research, and case study research is one form of such research, consideration must be given to construct validity, internal validity, external validity, and reliability (Yin, 2009). The most common source of criticism in case study research is related to construct validity due to the potential subjectivity of the investigator. To achieve construct validity, the researcher is required to use the correct operational measures for the concepts being studied (Alemagi *et al.*, 2006; Yin, 2009). According to Yin, it could be obtained in three ways: using multiple sources of evidence, establishing a chain of evidence while collecting data, and using the composition strategy of having a draft case study report reviewed by key informants (Tellis, 1997; Alemagi *et al.*, 2006; Andrade, 2009; Yin, 2009). In this research, construct validity is achieved through employing three very different data sources (interview, questionnaire and documentation); the latter two serve to balance any possible subjectivity on the part of the researcher as they represent an objective chain of evidence against which the interviews can be assessed.

Internal validity refers to situations in which certain conditions are shown to lead to other conditions, i.e. that certain elements within the study domain have directly causal relationships; this necessitates the use of multiple pieces of evidence from multiple sources, where the researcher seeks to establish a chain of evidence forwards and backwards. This could be obtained by doing pattern-matching, explanation-building and/or time-series analyses in the stage of data collection. Internal validity is especially important in causal (explanatory) cases (Alemagi *et al.*, 2006; Andrade, 2009; Yin, 2009). In this research, however, internal validity is not considered as this study is a snapshot of the situation with respect to EMS, rather than an assessment over time.

External validity can be obtained from theoretical relationships, and from these generalizations can be made. This is usually a problem of inference in case studies, and can be dealt with using pattern-matching. In case studies, the objective is not to obtain statistical generalisations, but analytical generalisations, in which the investigator is seeking to generalise a particular set of results to some broader theory (Tellis, 1997; Alemagi *et al.*, 2006; Andrade, 2009). In this investigation, external validity will be satisfied if this research supports the established view that EMS is good for business, the environment and for employees and society at large.

Reliability can be achieved in many ways in case study research. It is traditionally understood as the absence of random errors of measurement, and could be achieved by the stability, accuracy, and precision of measurement. Thus, the most important method is the development of the case study protocol. Exemplary case study design involves properly documenting the procedures used, and this researcher has rigorously followed established procedure in terms of data collation and storage in order to eliminate the possibility of data duplication and/or deletion. Furthermore, for the research to be deemed reliable, it would be expected that the same results can be delivered through repeating the research over and over again (Tellis, 1997; Alemagi *et al.*, 2006; Yin, 2009). However, in interpretative research, results are not the same as conclusions, and another researcher may derive different conclusions from the same data (he/she may bring some new perspective to the issue at hand); for reliability to hold, it is only necessary that different researchers using similar tools in the same context would deliver much the same raw data (Andrade, 2009).

2.10 Ethics

In all research endeavours, there are ethical considerations to take into account; Diener and Crandall (1978) detailed four areas of particular concern. The first is that the researcher must determine whether or not there is any potential for harm to the participants; this could take various forms, for example, physical harm whilst being observed or psychological harm through being subjected to intrusive questioning. Secondly, the researcher must also ensure that there is no lack of informed choice, i.e. the participants are aware that they are under no compulsion to acquiesce to the researcher's requests. Thirdly, they argue that the researcher must ensure privacy and confidentiality; the participant's personal details must not be made available to any other party without their prior consent. Finally, the researcher must be able to demonstrate transparency and be able to assure all parties that there are no ulterior motives (Diener and Crandall, 1978).

Thus, the researcher shall endeavour to respect the dignity, rights and welfare of all the participants. Taking the above into account, this researcher shall explain to the participants that their best interests, rather than the interests of the researcher will be served by their participating in this study, i.e. no harm will befall them. Secondly, this researcher shall inform the participants of their freedom to withdraw from the research at any time, without explanation, and that there will be no consequences ensuing from such an action. Thirdly, all the data derived from both instruments will be anonymized through a process of codification, so that no participant in whatever capacity (but in particular the interviewees) can be identified from the coded data; this ensured that triangulation was still possible without the participants being identified. Finally, all participants will be informed precisely of the purposes of this research, and the researcher shall explain that the data garnered from the participants will not be used for any other purposes. As a final measure, the researcher shall supply the participants with contact details so that they can raise any issue of concern or merely ask for clarification. All these issues are reflected in the form (Declaration of Informed Consent by Questionnaire and Interview Participants) that the researcher has designed to protect the participants' rights; a copy will be supplied along with each questionnaire and one will be given to each interviewee to sign prior to the interview session (see Appendix D).

Thus, before engaging in the fieldwork, the researcher sought guidance from his supervisors, permission from the UEA Ethics Committee (see Appendix E), and funding and approval from his sponsors (the KAU, through the Saudi Arabian Cultural Bureau).

Chapter 3:

Findings based on the Quantitative Data

3

3.1 Introduction

This chapter presents the results of the quantitative data analysis in order to achieve the objectives of the study which were stated in Chapter 1.

This chapter focuses on the quantitative data derived from the questionnaire. The results derived from the qualitative data (interview survey and documents data analysis) are presented in the following chapter (Chapter 4), and all quantitative and qualitative findings will be combined and discussed in Chapter 5.

3.2 Descriptive Data Analysis

This analysis describes the distribution of each variable based on frequency, percentage, crosstabs and weighted means for the total sample of 183 organizations in the Industrial City (IC) of Jeddah.

The total number of valid questionnaires is N = 183. The questionnaire was segmented in such a manner as to address all the research objectives, and divided into two parts, preceded by a definition of EMS (See Appendix B):

- Part I: General information (pertaining to demographics, statistical description of the organization as well as certain details relating to its applied EMS).

- Part II: Collection of technical information; three parts entitled:
  A. The characteristics and efficiency of the EMS in your organization in the IC. This page of the questionnaire comprises 8 questions (nos. 14 – 21), which are measured on a 5-point Likert scale.

B. The obstacles facing the implementation of EMSs, and the PME's awareness and control efforts.

C. The possible environmental benefits to be derived from implementing EMSs. Sections B and C are separated onto two pages; the first page asks the respondents to rank a list of obstacles, phrased as 10 statements, which the respondent is asked to rank on a scale of 1 to 10 according to perceived importance. The second page asks the respondent to rank a list of benefits, phrased as 13 statements, which the respondent is asked to rank from 1 to 13 according to perceived importance.

This research aims to conduct a critical investigation into the barriers and opportunities for EMS implementation for the delivery of environmental benefits to the Industrial City in Jeddah, KSA. In order to achieve these aims, the questionnaire comprises a number of themes, which reflect the four objectives below as well as one general theme for demographics:

- Determine the current scope of EMSs in the various industrial plants.
- Assess the current level of the PME's awareness raising and control efforts.
- Identify the obstacles facing the implementation of EMSs.
- Identify the possible environmental benefits to be derived from implementing EMSs.

Table 3.1 illustrates these themes and their related questionnaire statements. Some of the questions are of dual significance; in Part I, Questions 10-13 are for general information but they also address the current scope of EMS, and so Part I is divided across two themes. Likewise, in Part II Section B: Questions 2, 3, 6 and 10, the statements are considered as obstacles to the implementation of EMS but they also serve as indicators for assessing the PME's awareness and control efforts. Accordingly, Section B is divided into two themes, reflecting two objectives. Although Part I is divided into two sub-themes (one for the respondents and another for their organization), because of the dual significance scenario previously mentioned, Part I ultimately is divided across three sub-themes.

Table 3.1: Themes for questionnaire statements

No.	Themes		Statements
1	General information	General information of questionnaire's respondents	Part I: 1, 2, 3, 4, 5
		General information of organizations	Part I: 6, 7, 8, 9
2	Current scope of EMS	General information of organization's EMS attitude	Part I: 10, 11, 12, 13
		Characteristics and efficiency of the EMS in organizations	Part II Section A: 14, 15, 16, 17, 18, 19, 20, 21
3	PME awareness raising and control efforts		Part II Section B: 2, 3, 6, 10
4	Obstacles to the implementation of EMSs		All sections of B: 1-10
5	Possible environmental benefits from implementing EMSs		All sections of C: 1-13

3.2.1 Descriptive Statistics for Part I

General information about questionnaire respondents

<u>Ques. 2 - Position/title of questionnaire respondents:</u>

Figure 3.1 describes the "position/title of questionnaire respondent", which illustrates percentage data pertaining to all the respondents; these participants were nominated by the company owner or general manager, who was generally able to identify an individual with knowledge or responsibility for environmental affairs. From the figure, it is apparent that most of the respondents held managerial positions; for example, 25.1% were Production Managers, 20.9% were Factory Managers, and 19.7% were Manager/Manager of Staff Affairs. These high percentages for senior managerial positions indicate that environmental concerns are related to key administration departments, at least within this sample. Nearly half of the sample (Factory manager, Technical manager, Manager of staff affairs and Vice manager) is likely to have some responsibility for environmental issues as well as their other administrative duties.

It was intended that the questionnaires be administered (in person) to environmental managers (or their equivalents), but many of this study's organizations (94%) do not have environmental managers specifically responsible for environmental issues and affairs. The percentage of respondents that have a position with explicit responsibility for environmental concerns is very low (6%); this is discussed further in Chapter 5.

Consequently, the owners/managers of each of these organizations, who were contacted in order to seek permission to conduct this survey, completed the questionnaire themselves or nominated those with responsibility for (or the most knowledge on) environmental issues to answer the questions.

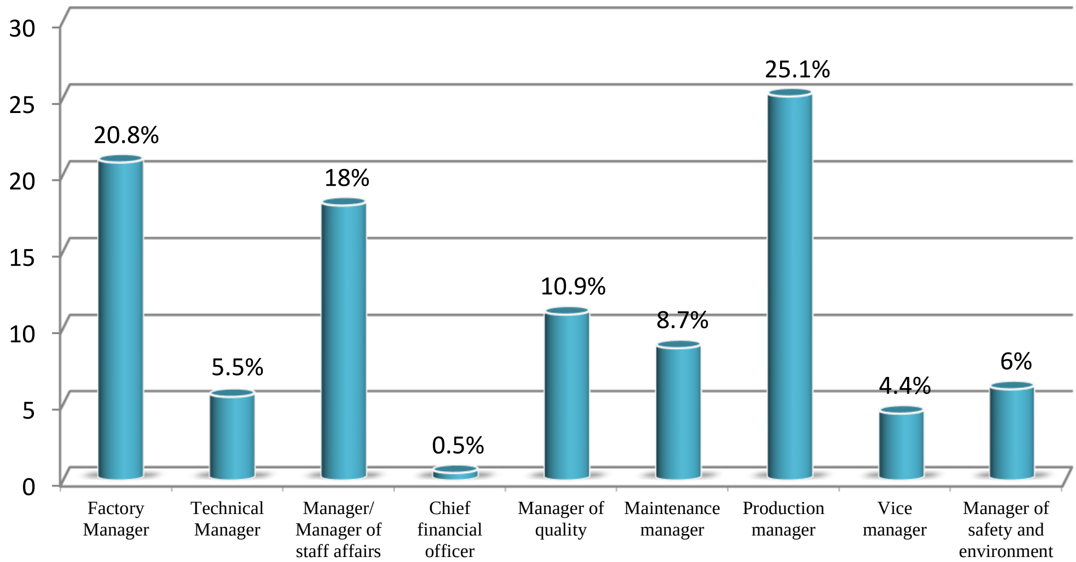


Figure 3.1: Position/title of questionnaire respondents

All organizations that have environmental managers specifically responsible for environmental issues and affairs (Manager of safety and environment) (11 organizations out of 183) are accredited to ISO14001. Of the 30 organizations that have an EMS, 37% (11 out of 30) have an environmental manager. Of those that have the PME environmental licence (6 out of 32) about 18% have an environmental manager, whereas 55% of the total organizations that are accredited to ISO14001 (11 out of 20) have an environmental manager (see Table 3.2).

Table 3.2: Relationship between position/title of questionnaire respondent and Ques. 10, 12 and 13

	Frequency	Percent	Do you have an (EMS)		Is your site accredited to ISO14001		Does your site have PME environmental licence		
			Yes	No	Yes	No	Yes	No	Don't know
Factory Manager	38	20.8%	5	33	4	34	2	35	1
Technical Manager	10	5.5%	0	10	0	10	0	8	2
Manager/ Manager of staff affairs	33	18.0%	4	29	1	32	7	25	1
Chief financial officer	1	.5%	1	0	1	0	1	0	0
Manager of quality	20	10.9%	3	17	0	20	8	11	1
Maintenance manager	16	8.7%	3	13	1	15	1	13	2
Production manager	46	25.1%	3	43	2	44	6	38	2
Vice manager	8	4.4%	0	8	0	8	1	7	0
Manager of safety and environment	11	6.0%	11	0	11	0	6	5	0
Total	183	100.0	30	153	20	162	32	142	9

Ques. 3 - The age of the questionnaire respondent:

The ages of the questionnaire respondents across the sample are shown in Figure 3.2. The structure of the age distribution categories in the questionnaire (18 – 26, 27 – 35, 36 – 44, 45 – 53, > 53) was taken from the last census in KSA, which was conducted in 2010 (Centre of Statistics and Information, 2014). It is clear that almost 99.5% of the questionnaire respondents are over the age of 25, from which it may be inferred that they have a certain level of experience in their respective fields, but not necessarily in environmental affairs.

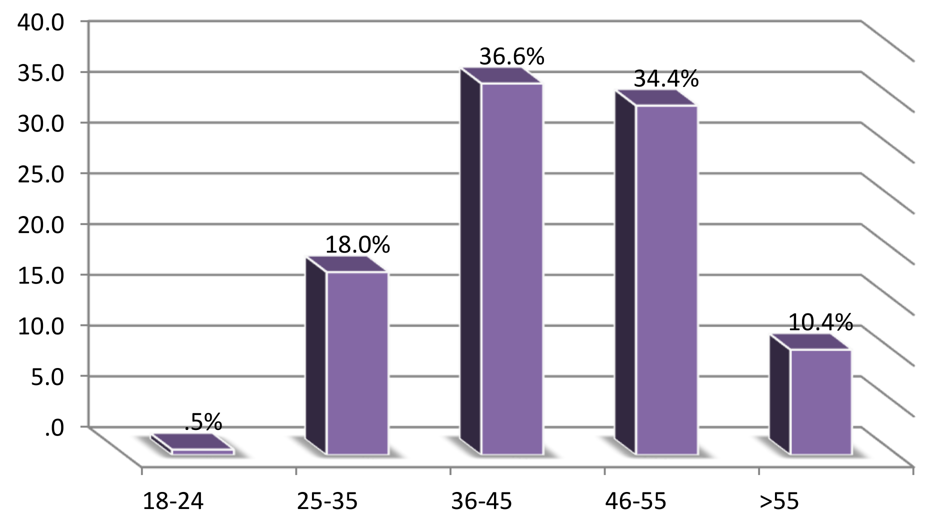


Figure 3.2: The ages of the questionnaire respondents

<u>Ques. 4 - The highest education level & Ques. 5 - Education background/specialism:</u>

96.2% of the questionnaire respondents are qualified graduates or postgraduates, and 65.1% are qualified in scientific subjects (engineering and chemistry); management qualifications represent 31.1% (see Table 3.3).

Table 3.3: Highest education level of questionnaire respondent & education background/specialism of questionnaire respondent.

Highest education level of questionnaire respondent	**Frequency**	**Percent**
High school	4	2.2
Graduate	161	88.0
Postgraduate	15	8.2
Other (Secondary school/Technical college diploma, etc.)	3	1.6
Education background/specialism	**Frequency**	**Percent**
Engineering	105	57.4
Management	57	31.1
Chemistry	14	7.7
Business	3	1.6
Arts	4	2.2

3.2.2 Descriptive Statistics for Part I

General information about the organizations

The number, location and type of activity for the organizations that participated in this research are shown in Table 2.1 from the previous chapter (Methodology).

<u>Ques. 6 - Location & Ques. 7 - Type of activity</u>

Table 2.1 and Figure 3.3 show that Phases 3, 4 and 5 are larger than Phases 1 and 2 in terms of size and number of organizations. Also, the lowest numbers of industrial activities are Wood and furniture, Paper and printing and Building materials and glass, whereas, Metals and Chemicals and plastics are the highest in terms of number. Furthermore, these two are sectors particularly prevalent in Phases 4 and 5 within the IC. It is pertinent to mention at this juncture that the Chemicals and plastics category was classified by the PME, who consider the activities undertaken by the firms in this sector to differ markedly from those of the oil industry, i.e., although this sector is dependent on the oil sector, its commercial activities bear no relation to it.

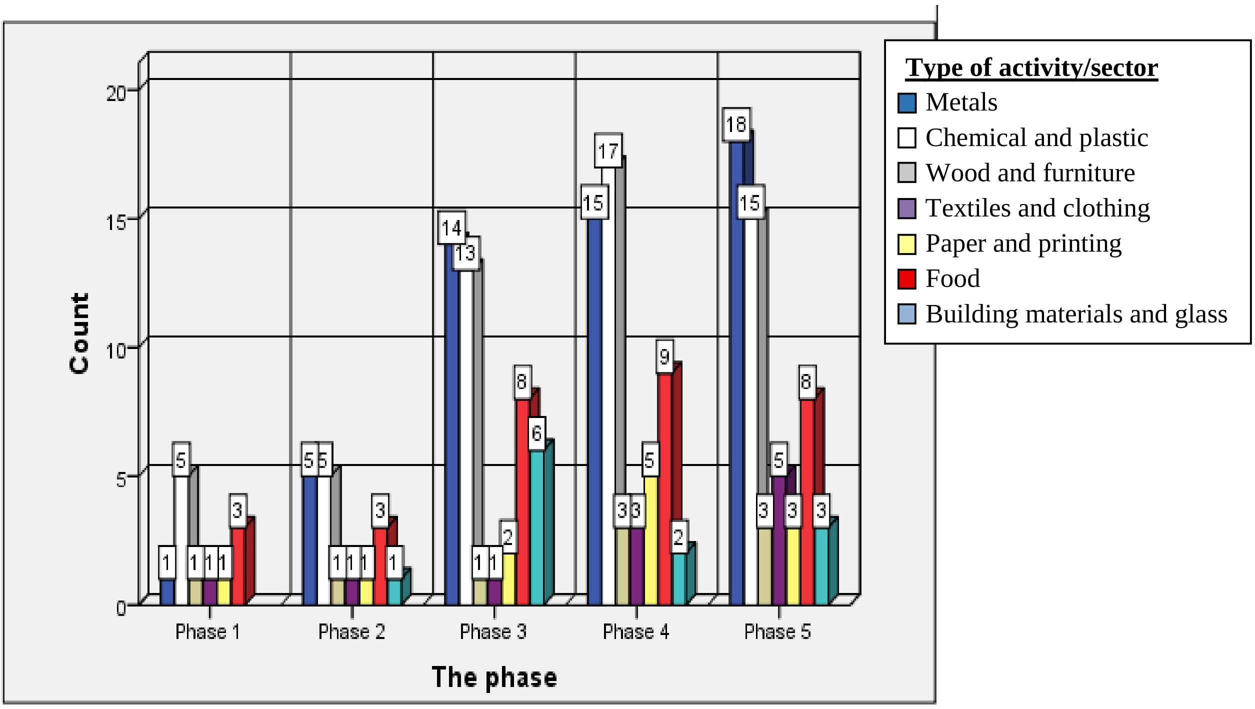


Figure 3.3: Relationship between numbers of organizations (with respect to type of activity/sector) and location in the IC (the Phase)

Ques. 8 - Organization Size

The size was assessed depending on the number of employees, as stated in the Methodology chapter. The industrial classification of SMEs in KSA is based on the following employee factors:

- Micro-sized enterprises: employ fewer than 25
- Small-sized enterprises: employ 25 - 59
- Medium-sized enterprises: employ 60 - 99
- Large-sized enterprises: employ more than 99

(Otsuki, 2002; Merdah and Sadi, 2011).

The number of Small and Medium-sized organizations combined (50.9%) is comparable with the Large-sized ones (47.0%) as illustrated by Figure 3.4.

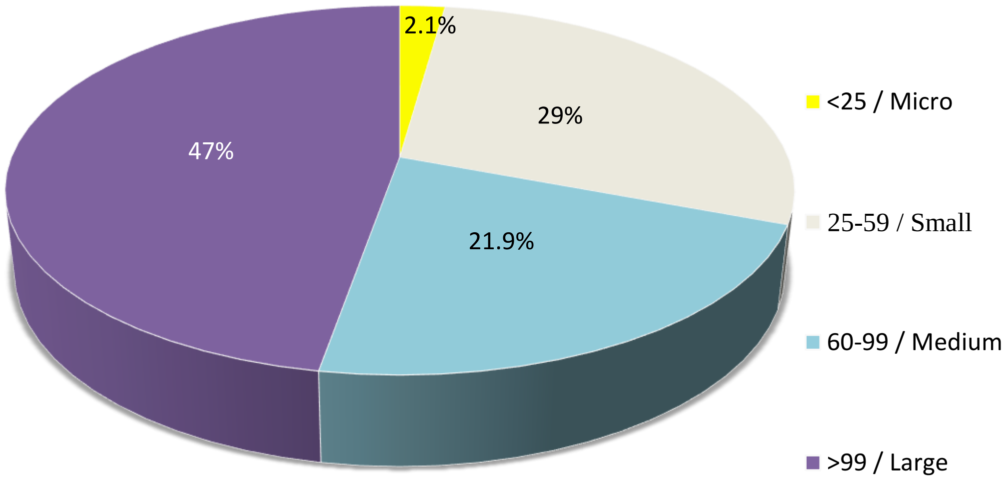


Figure 3.4: Organization Size

Ques. 9 - Establishment date in the IC

There was a rapid increase in the number of industrial businesses in the 2000s (by about 42%); in the previous decade the rate of growth had been 27%. This is illustrated in Figure 3.5. This increase coincided with the establishment of the 'General Environmental Regulations and Rules for Implementation in the Kingdom of Saudi Arabia', which came into force in 2001. Since then, the PME has been the primary body responsible for environmental protection affairs and for the enforcement of the environmental regulations in coordination with the appropriate agencies at the national level (PME, 2006b). The Saudi environmental law has obliged the owners of new and existing projects who request loans from lending agencies for establishing, modifying or expanding their projects, to submit an environmental licence that demonstrates compliance with these environmental regulations, standards, criteria and guidelines. According to Article 15 of the General Environmental Regulations, "*Projects existing at the time of the issuance of the General Environmental Law shall be given a maximum term of five years as a grace period before enforcement*" (PME, 2006b p20).

This grace period ended on 15th of October 2006, and therefore all organizations should now have obtained an environmental licence; this is particularly the case with those that were established after 2001 (when the licence became mandatory), which means that at least 35% of this research's organizations (35% representing all the organizations established since 2002) should have the PME environmental licence. This point shall be the central focus when assessing the PME's environmental awareness-raising efforts as well as its efforts in terms of monitoring and controlling pollution levels.

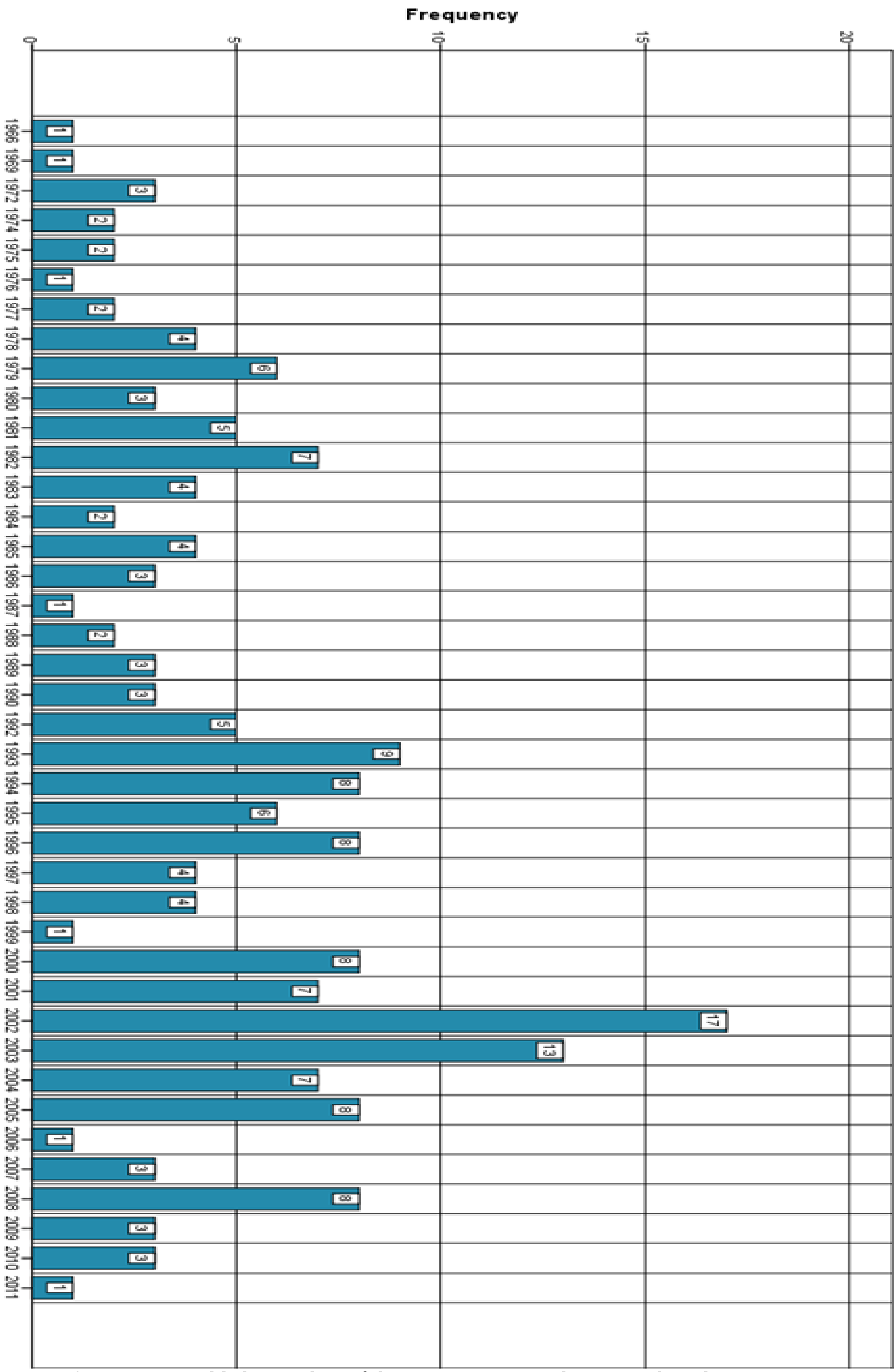


Figure 3.5: Establishment date of the organizations in this research in the IC

Ques. 10 - Do you have an environmental management system (EMS) at this site?
Ques. 12 - Is your site in the Industrial City accredited to ISO14001?
Ques. 13 - Does your site in the Industrial City have the PME environmental licence?

As many as 153 (83.6%) organizations do not have an EMS, and 9 (4.9%) organizations have an EMS but are not accredited to ISO14001; 20 (10.9%) organizations have an EMS accredited to ISO14001. This relationship is shown in tabular form in Table 3.4.

On the one hand, 18 (9.8%) of the organizations have both the PME environmental licence and an EMS, whereas 14 (7.7%) have the PME environmental licence but do not have an EMS. This means that PME-licenced organizations do not necessarily have an EMS; it is axiomatic that all ISO14001-accredited ones have an EMS.

On the other hand, from Table 3.5, the number of organizations that have neither ISO14001 accreditation nor the PME licence amounts to 135 (73.8%), which is quite a high percentage. Furthermore, not all ISO14001-accredited organizations have the PME environmental licence, even though it would be an easy matter to obtain (this will be discussed in Chapter 5).

Table 3.4: Relationship between Ques. 10 (Do you have an EMS?) and Questions 12 and 13

		Do you have an EMS? (Ques. 10)				**Total**	
		Yes		**No**			
Is your site accredited to ISO14001? (Ques. 12)	Yes	20	10.9%	0	0%	20	10.9%
	No	9	4.9%	153	83.6%	162	88.6%
	Don't know	1	0.5%	0	0%	1	.5%
Total		30	16.4%	153	83.6%	183	
Does your site have the PME environmental licence? (Ques. 13)	Yes	18	9.8%	14	7.7%	32	17.5%
	No	9	4.9%	133	72.7%	142	77.6%
	Don't know	3	1.6%	6	3.2%	9	4.9%
Total		30	16.4%	153	83.6%	183	

Table 3.5: Relationship between Ques. 12 (Is your site accredited to ISO14001?) and Ques. 13 (Does your site have the PME environmental licence?)

		Is your site accredited to ISO14001? (Ques. 12)						**Total**	
		Yes		**No**		**Don't know**			
Does your site have PME environmental licence? (Ques. 13)	Yes	11	6.0%	20	11%	1	0.5%	32	17.5%
	No	7*	3.8%	135	73.8%	0	0%	142	77.6%
	Don't know	2	1.1%	7	3.8%	0	0%	9	4.9%
Total		20	10.9%	162	88.5%	1	0.5%	183	

* Some firms have ISO14001 but do not have the PME licence; this is discussed in Ch. 5

3.3 Inferential Data Analysis

The analysis in this section is directly related to the research objectives; several statistical tests were used in order to achieve each objective.

3.3.1 Inferential Data Analysis Techniques

Inferential analysis encompasses both parametric and non-parametric tests of significance, i.e. Pearson's Chi Square is used for assessing associations and determining the respondents' attitudes. Cronbach's Alpha analysis is used to provide indications of the reliability of the measurement scales.

Pearson's Chi-square for association is a non-parametric statistical test for determining the significance of any relationship between categorical variables. It is used here to determine the significance of any relationship between the demographic variables and all the other categories in order to assist in clarifying the characteristics and level of efficiency of the EMS in the various participant organizations in the IC, and to assist in assessing the current level of the PME's awareness and control efforts (Kelly *et al.*, 2008; Al-Bostangi, 2009; Pallant, 2010; Bryman, 2012; Centre of Statistics and Information, 2014).

The Likert scale is also used here to identify the attitudes of the respondents' answers. The Likert scale was adopted because it affords more opportunity to the respondents, from whom the researcher was seeking opinions and attitudes; many of them felt a little uncomfortable in having to answer Yes/No directly to the questions, as they felt that some of them required a more nuanced response, rather than a binary one. In this questionnaire, the efficiency variables (i.e. statements e14 to e21, following the coding described in section 2.8.1) were taken as weights to reflect the respondent's opinions; the weights are as follows:

Table 3.6: Agreement level weights

Weight	Agreement level
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

As these variables are considered to have ordinal weights, the median for all respondents may be computed for each variable (and for the whole factor) and is used to reflect the respondent's opinions (attitudes).

Statistical significance (*p*-value): the statistical significance of a result is an estimated measure of the degree to which it is 'true' (in the sense of 'representative of the population'). More technically, the value of *p* represents a decreasing index of the reliability of a result. The higher the *p*-value, the less we can believe that the observed relationship between the variables in the sample is a reliable indicator of the relationships between the respective variables within the population.

Specifically, the *p*-value represents the likelihood of the observed result as being valid, that is, as 'statistically representative of the population', rather than the observed result merely being a fortuitous finding that coincides with the population. In many sciences, results that yield $p \leq .05$ are considered 'borderline statistically significant'. Results that are significant at the $p \leq .01$ level are commonly considered 'statistically significant', and the $p \leq .005$ or $p \leq .001$ levels are often called 'highly significant' (Kelly *et al.*, 2008; Al-Bostangi, 2009; Pallant, 2010; Centre of Statistics and Information, 2014).

Reliability Analysis Reliability analysis allows the researcher to study the properties of a measurement scale and the items of which it is comprised. The reliability analysis procedure calculates a number of commonly used measures of scale reliability, and also provides information about the relationships between the individual items within the scale.

Alpha (Cronbach's) is a model of internal consistency, based on the average inter-item correlation. Its value ranges from 0 to 1. The extent to which the value of Cronbach's Alpha approaches 1, reflects the reliability of the data in terms of representing the entire population from which the sample was drawn (Ibid).

For this study's data, and in particular for the questions in Part II Section A, the result for Cronbach's Alpha is found to be 0.920. This value is sufficiently high to have confidence in the reliability of the data as well as in the results.

3.3.2 Inferential data analysis according to this study's objectives

The analysis here is sub-divided in accordance with the four objectives detailed above.

3.3.2.1 Determine the current scope of EMS in the various industrial plants

There are two sub-themes in the statements designed to elicit answers as shown in Table 3.1 (Themes for questionnaire statements). These sub-themes are:

- ❖ General information about the organization's EMS attitude (Part I: Ques. 10 - 13):

10. Do you have an environmental management system (EMS) at this site?
11. When did your organization initiate an environmental management system (EMS)?
12. Is your site in the Industrial City accredited to ISO14001?
13. Does your site in the Industrial City have the PME environmental licence?

These questions were addressed under the descriptive analysis section above, but their relationships with the demographic data need to be tested in order to identify the characteristics and level of efficiency of the respective EMSs in the IC.

❖ Characteristics and efficiency of the EMS in the organizations (Part II Section A: Ques. 14 - 21):

14. Our organization has its own environmental policy.
15. Within our budget, there is a special item for environmental affairs in the organization.
16. The environmental responsibilities and authorities within our organization are fixed and clear.
17. There is an environmental record in our organization.
18. Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.
19. In the organization specific environmentally focused training programmes are established for employees whose work may have deleterious impacts on the environment.
20. The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.
21. There is an effective system within the organization to enforce the application of the organization's instructions concerned with environmental affairs.

This group of statements is aimed at assessing the characteristics, efficiency and current scope of the EMSs in the IC in Jeddah, in terms of: setting appropriate environmental objectives (policymaking); identifying programmes, targets and legal/other requirements (planning); conducting these programmes to achieve the environmental goals (implementing); monitoring, measuring and evaluating compliance (checking); verifying and reviewing environmental policies (reviewing). From the extensive analysis of the literature in Chapter 1, there is a consensus that full EMSs consist of these five procedures: policymaking, planning, implementing, checking, verifying and reviewing environmental policies.

To achieve this first objective, five statistical analyses are undertaken. These are, firstly, determining the organizations' attitudes toward EMS, secondly, identifying the relationships between the organizations' demographic variables and general information relating to the organizations' EMS attitudes, thirdly, identifying the relationships between the demographic variables and the characteristics and efficiency of the EMSs in the organizations, fourthly, identifying the relationships among the questions pertaining to the general information about the organizations' EMS attitudes, and finally, identifying the relationships between the general information about the organizations' EMS attitude and the characteristics and efficiency of the EMSs in the organizations.

i) Determining the organizations' attitudes toward characteristics and efficiency of the EMS (Statements 14-21)

Identifying the organizations' attitudes from the answers to these questions should help to investigate the characteristics, efficiency and current scope of the EMSs in the IC.

From the respondents' opinions, as expressed on the Likert scale and as shown on Table 3.7, two key findings emerged:

a) Two statements out of eight (representing 25%) indicate a 'Neutral' opinion (neither agree nor disagree). These statements are:

15. Within our budget, there is a special item for environmental affairs in the organization.
18. Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.

b) Six statements out of eight (representing 75%) indicate an attitude of 'Disagree'. These statements (arranged in an order relating to the questionnaire) are:

14. Our organization has its own environmental policy.
16. The environmental responsibilities and authorities within our organization are fixed and clear.
17. There is an environmental record in our organization.
19. Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment.
20. The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.
21. There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs.

Thus, the overall results pertaining to the organizations' attitudes to these eight statements vary. It was anticipated that all eight would result in either 'Agree' or 'Disagree', rather than 'Neutral'. However, it should be noted that the respondents who were 'Neutral' may have been unable to say whether or not their organization has a well-defined environmental management system; this may have been due to lack of knowledge but there remains the possibility that they were unwilling to disclose poor practice.

Table 3.7: The organizations' attitudes toward characteristics and efficiency of the EMS (Statements 14-21)

	Strongly disagree 1		**Disagree 2**		**Neutral 3**		**Agree 4**		**Strongly agree 5**		**Median**	**Attitude**
	F*	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**		
Our organization has its own environmental policy.	14	7.7	117	63.9	19	10.4	14	7.7	19	10.4	2	Disagree
Within our budget, there is a special item for environmental affairs in the organization.	5	2.7	65	35.5	48	26.2	48	26.2	17	9.3	3	Neutral
The environmental responsibilities and authorities within our organization are fixed and clear.	9	4.9	85	46.4	34	18.6	40	21.9	15	8.2	2	Disagree
There is an environmental record in our organization.	13	7.1	121	66.1	13	7.1	18	9.8	18	9.8	2	Disagree
Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.	6	3.3	55	30.1	49	26.8	53	29.0	20	10.9	3	Neutral
Specific environmentally focused training programmes are established for employees in the organization whose work may have	57	31.1	92	50.3	15	8.2	11	6.0	8	4.4	2	Disagree

deleterious impacts on the environment.												
The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.	53	29.0	86	47.0	14	7.7	14	7.7	16	8.7	2	Disagree
There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs.	55	30.1	74	40.4	16	8.7	17	9.3	21	11.5	2	Disagree

* **F** = Frequency

ii) Identifying the relationships between the organizations' demographic variables (Ques. 6-9) and general information relating to the organizations' EMS attitudes (Ques. 10, 12 & 13)

This section pertains to an analysis of the first objective and focuses on the relationships and effects of the organizations' demographic information (such as the 'type of activity', 'location', 'size' and 'establishment date' questions (Ques. 6, 7, 8 & 9)) on the general information of the organization's EMS attitude questions (nos. 10, 12 & 13). This analysis aims to better comprehend the characteristics and level of efficiency of the EMSs in the IC; the quantitative and qualitative findings are collated and discussed in Chapter 5.

Questions 10, 12 & 13 are:

10. Do you have an environmental management system (EMS) at this site?
12. Is your site in the Industrial City accredited to ISO14001?
13. Does your site in the Industrial City have the PME environmental licence?

In these 12 tests (see Appendix F), significant relationships only are shown here and the level of significance in the relationships is highlighted. The Chi-square test identifies whether there is a significant relationship between these variables; Table 3.8 shows the significant relationships and the Chi-square test results.

Table 3.8: Chi-square test results between Ques. 10, 12 & 13 and Ques. 6, 7, 8 & 9

	Do you have an (EMS)?	Is your site accredited to ISO14001?	Does your site have the PME environmental licence?
Type of activity/sector	$p < 0.01$	-	-
The Phase	-	-	$p < 0.001$
Number of employees (size)	$p < 0.001$	$p < 0.01$	$p < 0.05$
Establishment date	-	-	$p < 0.05$

- **Type of activity/sector**

Type of activity has a highly significant relationship with having an EMS in the organization (Ques. 10), whereas it does not have this relationship with having ISO14001 certification and the PME environmental licence (Ques. 12 & 13). A significant relationship is clear for Food, Chemicals and plastics, Metals and Building materials and glass. The respondents in these organizations answered 'Yes', slightly more often than those in other activities that mostly answered 'No' (when compared in terms of total numbers) to having an EMS. The following figure illustrates the results:

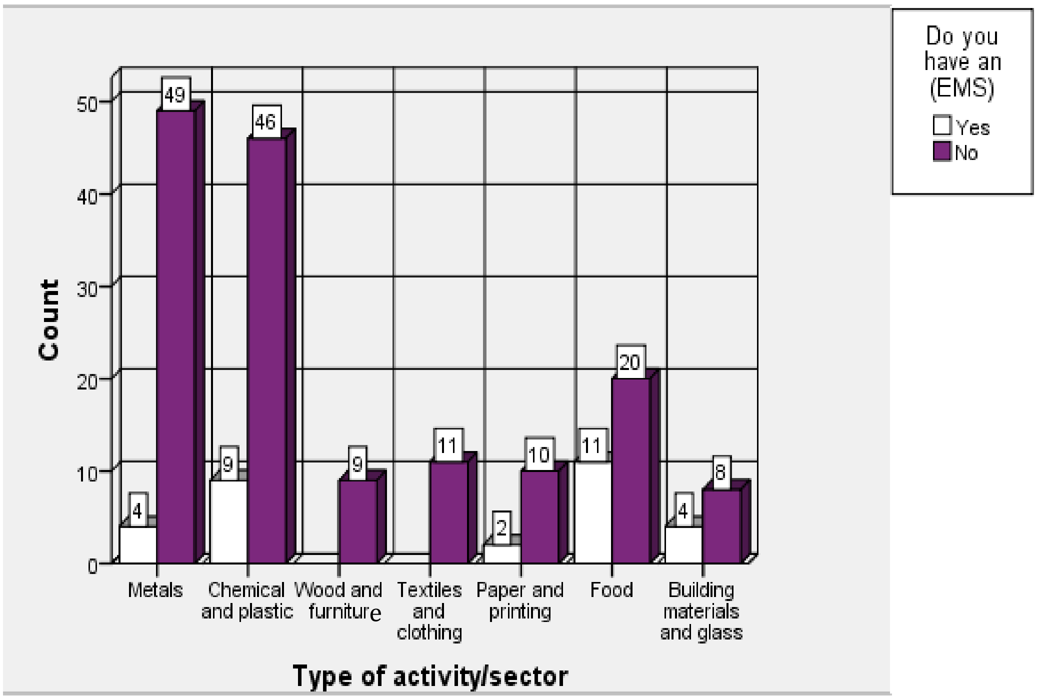


Figure 3.6: Numerical relationship between type of activity/sector and Ques. 10 (Do you have an EMS?)

Although these activities do not have any significant relationship with having ISO14001 certification or the PME environmental licence, Food and Chemicals and plastics activities have a higher number of organizations that have ISO14001 and a PME licence. These activities resulted in slightly higher numbers of ‘Yes’ answers in relation to having an EMS but these levels are still very low.

These findings confirm that some organizations have environmental management initiatives (30), some have ISO14001 accreditation (20) and some have the PME licence (32). However, this does not mean that these EMS initiatives adequately control their activities because having the PME licence or ISO accreditation is not a guarantee that emissions are being controlled; indeed, the current level of uptake by organizations (regardless of sector) is low, and therefore it would not be safe to draw definitive conclusions at this stage, except to say that the levels of EMS implementation are generally low, and that the PME is consistently failing to promote/enforce its own licence.

- **Organization’s location (relating to the Phase)**

There is no relationship between the location of an organization in the IC and the implementation of EMS. In fact, there is only one significant relationship for this variable: between the organizations’ location and having the PME environmental licence (Ques. 13). Figure 3.7 shows that the ‘Yes’ answers are very low in number (when compared in terms of their corresponding ‘No’ answers) in all Phases; however, these ‘Yes’ answers are relatively much higher for Phase 3 (followed by Phase 1) than those of Phases 2, 4 and 5. Despite compliance with the PME licence being low in general, Phase 1 has proportionally higher levels of compliance with the PME licence (5 out of 12); this is followed by Phase 3.

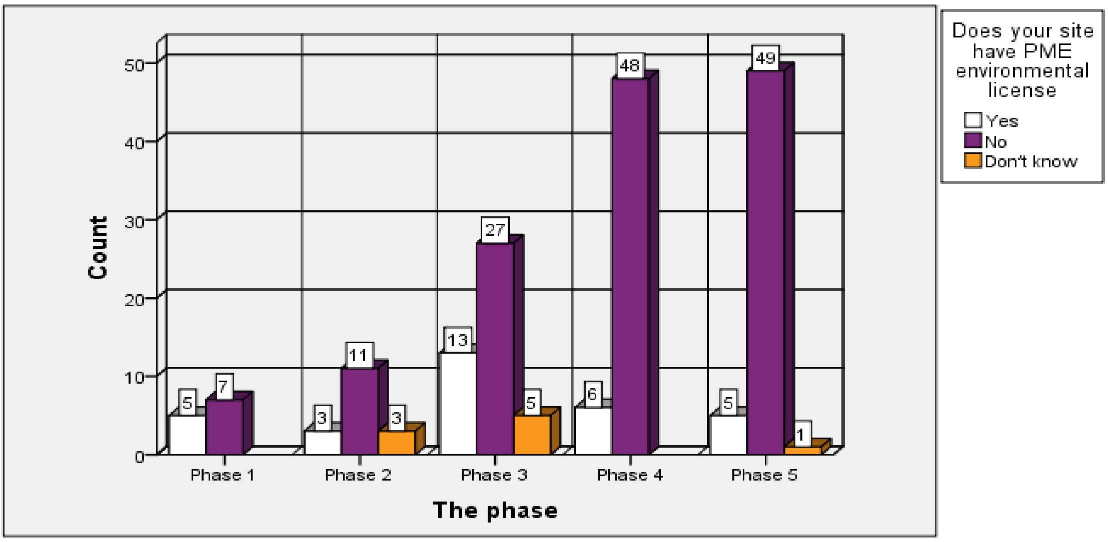


Figure 3.7: Numerical relationship between Phase and Ques. 13 (Does your site have the PME environmental licence?)

- **Organization size (number of employees)**

The size of the organization has a significant relationship with all these questions (Ques. 10, 12 and 13). Table 3.9 shows that the numbers answering 'Yes' to all three questions (10, 12 and 13) are low, when compared in terms of the total number of answers for all sizes.

It is evident that large organizations (number of employees > 99) more often have an EMS, ISO14001 certification and the PME environmental licence than the others. Large organizations, in general, are more concerned about their image and have '*greater societal visibility*' (Darnall *et al.*, 2010) as they tend to have larger markets.

Table 3.9: Relationship between number of employees and Ques. 10, 12 & 13

		Do you have an EMS?			**Total**
		Yes	**No**		
Number of employees	< 25 / Micro	1	3		4
	25-59 / Small	1	52		53
	60-99 / Medium	1	39		40
	> 99 / Large	27	59		86
Total		30	153		183
		Is your site accredited to ISO14001?			**Total**
		Yes	**No**	**Don't know**	
Number of employees	< 25 / Micro	0	4	0	4
	25-59 / Small	0	53	0	53
	60-99 / Medium	1	39	0	40
	> 99 / Large	19	67	1	86
Total		20	162	1	183
		Does your site have the PME environmental licence?			**Total**
		Yes	**No**	**Don't know**	
Number of employees	< 25 / Micro	1	3	0	4
	25-59 / Small	4	47	2	53
	60-99 / Medium	3	34	3	40
	> 99 / Large	24	58	4	86
Total		32	142	9	183

- **Establishment date at the site**

Establishment date at the site in the IC only had a significant relationship with having the PME environmental licence. According to Figure 3.8, the number of organizations successfully applying for the PME environmental licence relative to the number of newly established organizations fell markedly after 2002. This result is contrary to the intentions of the Saudi environmental law, and therefore, this relationship shall be discussed in detail when addressing the PME's environmental awareness-raising and control efforts.

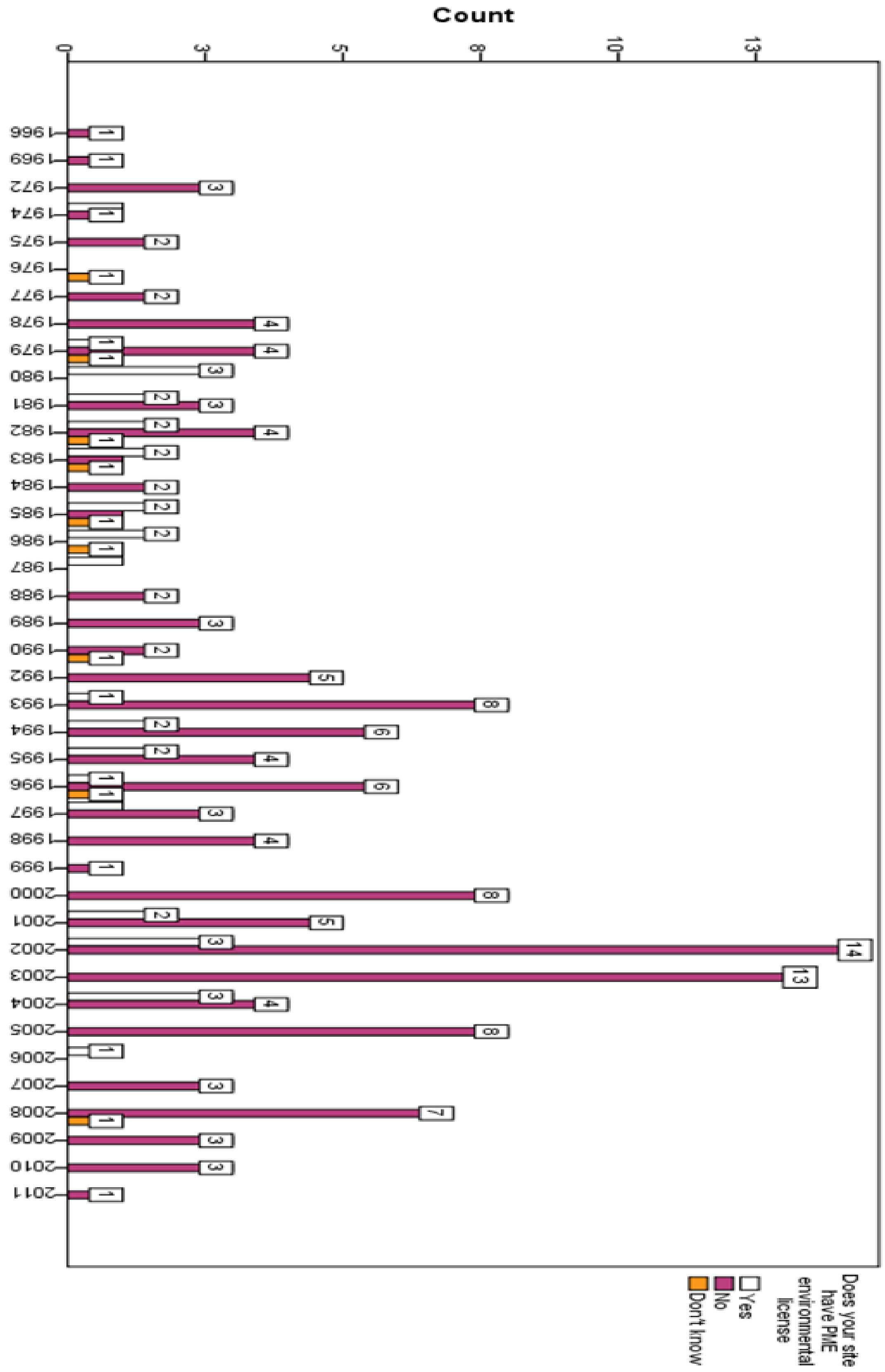


Figure 3.8: Numerical relationship between establishment date and Ques. 13 (Does your site have the PME environmental licence?)

iii) Identifying the relationships between the demographic variables (Ques. 6-9) and the characteristics and efficiency of the EMSs in the organizations (Ques. 14 – 21).

This analysis focuses on the relationship with and the effects of the demographic information of the organizations (such as the 'type of activity', 'location', 'size' and 'establishment date' questions (nos. 6, 7, 8 & 9)) on the characteristics and efficiency of the EMS in the organizations (Ques. 14 – 21). This analysis aims to better comprehend the characteristics and efficiency of the EMSs in the IC.

❖ Characteristics and efficiency of the EMS in organizations (14 – 21):

14. Our organization has its own environmental policy.
15. Within our budget, there is a special item for environmental affairs in the organization.
16. The environmental responsibilities and authorities within our organization are fixed and clear.
17. There is an environmental record in our organization.
18. Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.
19. In the organization specific environmentally focused training programmes are established for employees whose work may have deleterious impacts on the environment.
20. The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.
21. There is an effective system within the organization to enforce the application of the organization's instructions concerned with environmental affairs.

Given that as many as 32 relationship tests have been made here, only the significant relationships are shown in this section; all of these tests can be found in detail in the Appendix section.

The significant relationships were found amongst the following variables:

Table 3.10: Chi-square test results between Ques. 6, 7, 8 & 9 and Statements 14-21

	Type of activity /sector	**The Phase**	**Number of employees (size)**	**Establishment date**
Our organization has its own environmental policy	-	-	$p < 0.001$	-
Within our budget, there is a special item for environmental affairs in the organization	-	-	-	-
The environmental responsibilities and authorities within our organization are fixed and clear	-	-	$p < 0.001$	-
There is an environmental record in our organization	-	$p < 0.005$	$p < 0.05$	-
Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities	-	-	$p < 0.01$	-
In the organization specific environmentally focused training programmes are established for employees whose work may have deleterious impacts on the environment	-	$p < 0.001$	$p < 0.001$	-
The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness	$p < 0.05$	-	$p < 0.001$	-
There is an effective system within the organization to enforce the application of the organization's instructions concerned with environmental affairs	-	-	$p < 0.001$	-

- **Type of activity/sector**

Type of activity has a significant relationship only with Question 20 (The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness).

The 'Disagree' answers are higher than the 'Agree' ones for all industrial sectors as illustrated in Figure 3.9. This is also the case for 'Strongly disagree' and 'Strongly agree', except in the Food sector, in which the number of strongly opposing responses was approximately equal. This confirms the finding that significant numbers of the industries across the Phases do not periodically assess their EMS or check whether they are meeting their environmental targets.

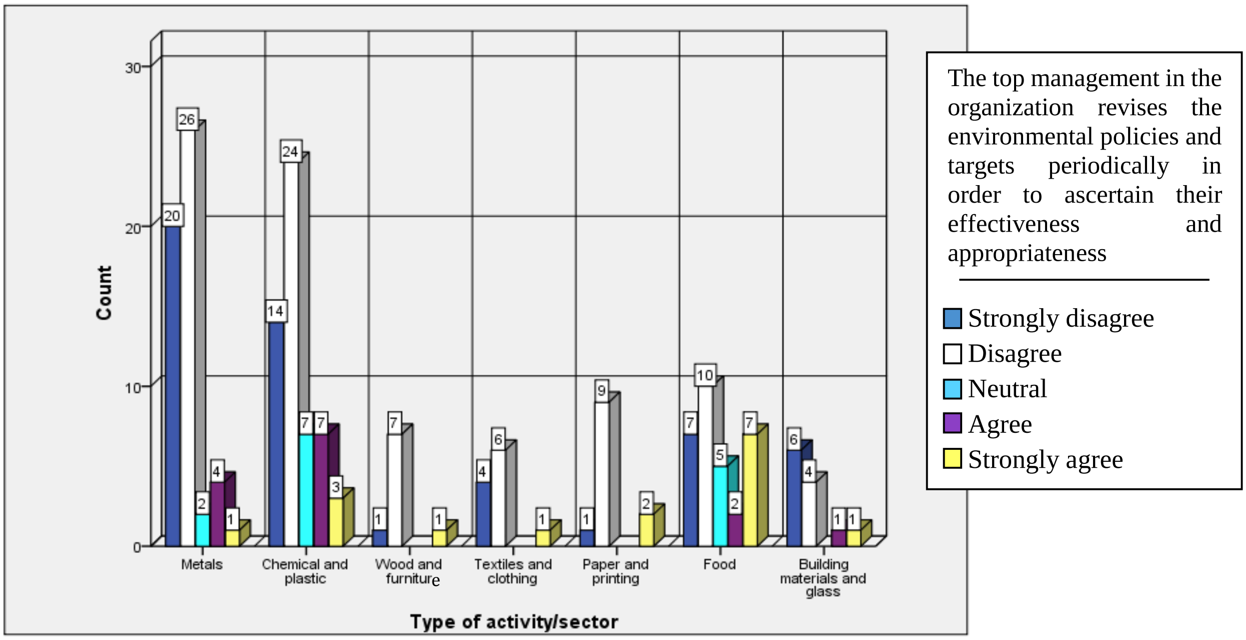


Figure 3.9: Numerical relationship between type of activity/sector and Ques. 20 (The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness)

- **Organizations' location (the Phase)**

Two significant relationships were found here (with statement nos. 17 and 19). From Figure 3.10, the 'Disagree' responses to Statement 17 (There is an environmental record in our organization) are very high (121 for all Phases) when compared with the other responses. In addition, the 'Strongly agree' responses to Statement 17 are high for Phase 3; this phase has a quite high number of Food 18% (8 of 45), Chemicals and plastics 29% (13 of 45) and Metals 31% (14 of 45) sectors. These are the sectors stated on Page 119 and shown in Figures 3.3 and 3.6 to have answered 'Yes' more often to question about EMS initiatives.

From Figure 3.11 'Strongly disagree' and 'Disagree' both have very high responses to Statement 19. This means that this statement (Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment) recorded more negative responses than Statement 17. However, Phase 4 recorded relatively higher scores for 'Strongly agree' due to hosting the second high percentages of Food, Chemicals and plastics and Metals sectors, 17%, 31.5% and 28% respectively (Ibid).

The following figures illustrates the results:

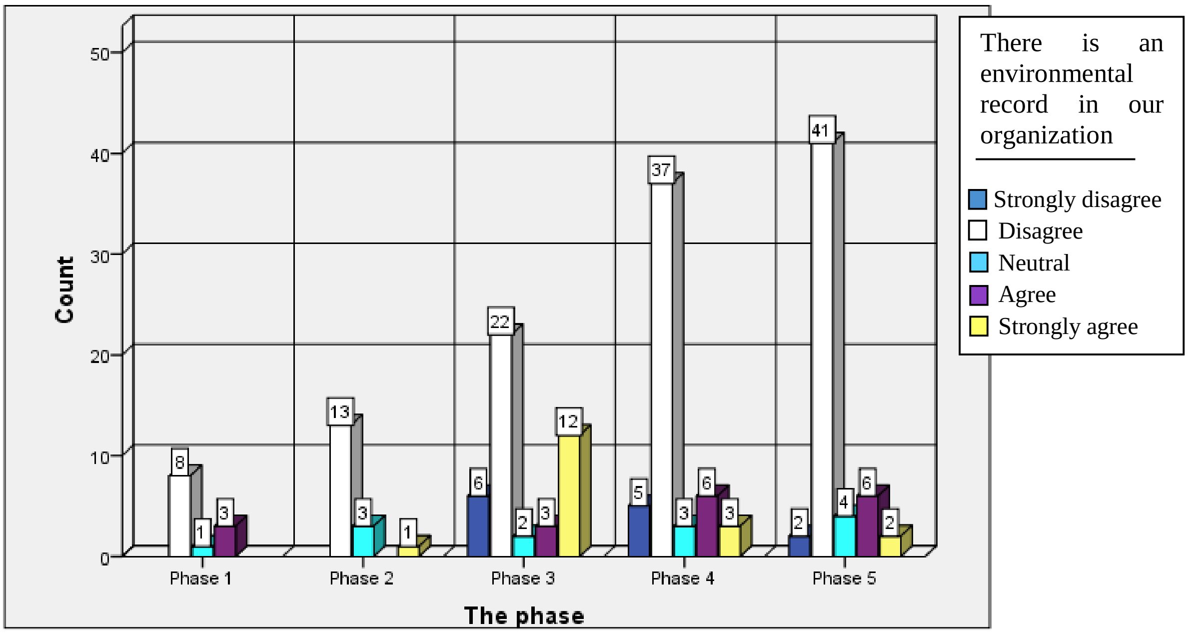


Figure 3.10: Numerical relationship between the Phase and Ques. 17 (There is an environmental record in our organization)

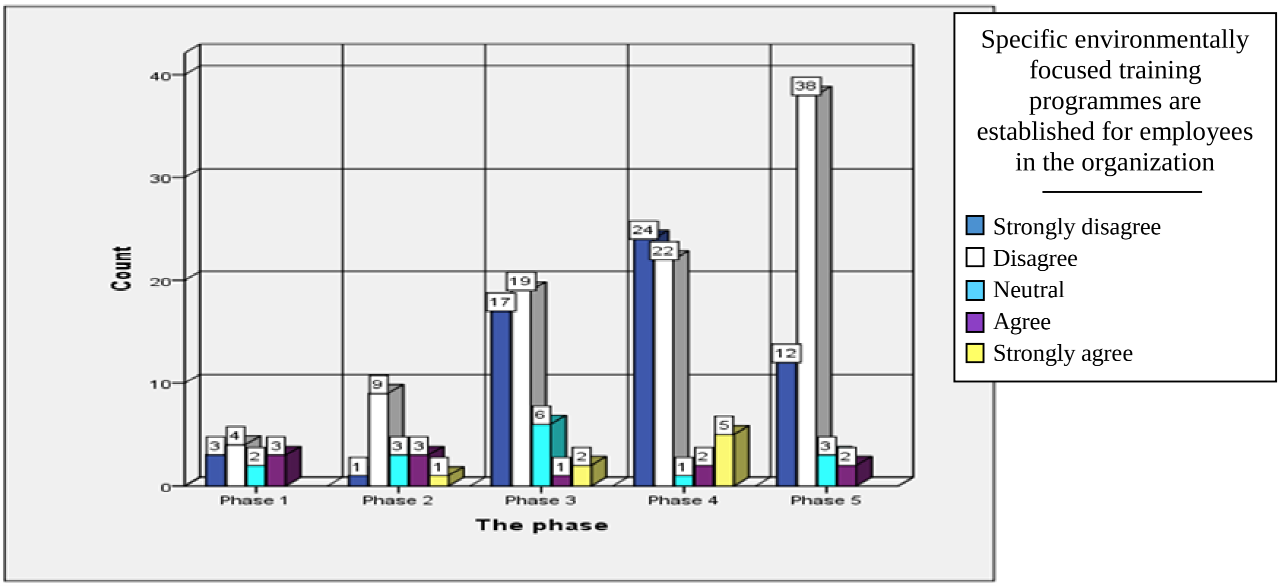


Figure 3.11: Numerical relationship between the Phase and Ques. 19 (Specific environmentally focused training programmes are established for employees in the organization)

- **Organizations' size (number of employees)**

This demographic variable has highly significant relationships with all the statements in this section except statement number (15).

In general and as shown in Table 3.11, the 'Strongly disagree' and 'Disagree' answers to all statements (14-21) are higher in number than the 'Strongly agree' and 'Agree' ones, for all organization sizes except for the large ones; the numbers of 'Strongly agree' and 'Agree' answers are high for some statements in the large organizations (relative to the other sizes). For example, to statements 16 and 18, the numbers of 'Strongly agree' and 'Agree' answers in the large organizations actually exceeded the numbers of 'Strongly disagree' and 'Disagree' answers. This is supported by the finding earlier that very few organizations reported having an EMS, ISO14001 certification or the PME environmental licence in general (Ques. 10, 12 & 13 in Tables 3.4 and 3.5), except for the large organizations, which have higher numbers for answering 'Yes' to these three questions (relative to the other sizes); this may be for the reasons mentioned above, pertaining to their greater market awareness.

Thus, large organizations are more likely to have environmental initiatives than small and medium-sized organizations (SMEs) and micro-organizations in the IC in Jeddah, although these initiatives do not necessarily take the full form of EMSs.

Table 3.11: Relationships between Organization size and Statements 14-21

		Our organization has its own environmental policy					Total
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Number of employees	< 25 / Micro	0	2	2	0	0	4
	25-59 / Small	9	40	1	1	2	53
	60-99 / Medium	2	31	5	1	1	40
	> 99 / Large	3	44	11	12	16	86
Total		14	117	19	14	19	183
		The environmental responsibilities and authorities within our organization are fixed and clear					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Number of employees	< 25 / Micro	0	2	1	1	0	4
	25-59 / Small	4	38	5	6	0	53
	60-99 / Medium	1	24	8	6	1	40
	> 99 / Large	4	21	20	27	14	86
Total		9	85	34	40	15	183
		There is an environmental record in our organization					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Number of employees	< 25 / Micro	0	2	1	1	0	4
	25-59 / Small	6	42	2	0	3	53
	60-99 / Medium	2	30	1	5	2	40

	> 99 / Large	5	47	9	12	13	86
Total		13	121	13	18	18	183
		Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Number of employees	< 25 / Micro	0	1	0	3	0	4
	25-59 / Small	4	22	18	9	0	53
	60-99 / Medium	1	13	10	14	2	40
	> 99 / Large	1	19	21	27	18	86
Total		6	55	49	53	20	183
		Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Number of employees	< 25 / Micro	0	3	0	1	0	4
	25-59 / Small	29	22	1	0	1	53
	60-99 / Medium	13	24	0	3	0	40
	> 99 / Large	15	43	14	7	7	86
Total		57	92	15	11	8	183
		The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	

	< 25 / Micro	1	2	1	0	0	4
	25-59 / Small	27	22	3	0	1	53
	60-99 / Medium	10	24	3	3	0	40
Number of employees	> 99 / Large	15	38	7	11	15	86
Total		53	86	14	14	16	183

		There is an effective system within the organization to enforce the application of the organization's instructions concerned with environmental affairs					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
	< 25 / Micro	0	2	1	1	0	4
	25-59 / Small	29	17	3	2	2	53
	60-99 / Medium	12	21	2	4	1	40
Number of employees	> 99 / Large	14	34	10	10	18	86
Total		55	74	16	17	21	183

iv) Identifying the relationships among the questions pertaining to the general information on the organizations' EMS attitudes (Ques. 10, 12 & 13)

In order to support the descriptive analysis relating to these three questions in Section 3.2.1 (and in order to avoid repeating the tables), this section of the analysis now investigates the statistical relationships between Questions 10, 12 and 13:

- General information on organization's EMS attitude (10, 12 & 13):
  10. Do you have an environmental management system (EMS) at this site?
  12. Is your site in the Industrial City accredited to ISO14001?
  13. Does your site in the Industrial City have PME environmental licence?

The corresponding value for Chi-Square = *p*-value < 0.001 in all of these tests. This means that there are highly significant relationships between these three questions. These relationships are discussed in detail on page 111 (see Tables 3.4 & 3.5).

v) Identifying the relationships between the general information on the organizations' EMS attitudes (Ques. 10, 12 & 13) and the characteristics and efficiency of the EMSs in the organizations (Ques. 14 – 21)

This section of the analysis investigates the relationship between:

- General information of organization's EMS attitude (10,12,13):
  10. Do you have an environmental management system (EMS) at this site?
  12. Is your site in the Industrial City accredited to ISO14001?
  13. Does your site in the Industrial City have the PME environmental licence?

And

- Characteristics and efficiency of the EMS in organizations (14 – 21):
  14. Our organization has its own environmental policy.
  15. Within our budget there is a special allocation for environmental affairs in the organization.
  16. The environmental responsibilities and authorities within our organization are fixed and clear.
  17. There is an environmental record in our organization.
  18. Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.

19. In the organization specific environmentally focused training programmes are established for employees whose work may have deleterious impacts on the environment.
20. The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.
21. There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs.

The corresponding *p*-value for Chi-Square is $p < 0.001$ in all of these 24 tests (see Appendix F). This means that there is a highly significant relationship between these two groups of questions. However, this does not mean that positive responses to the questions in the first group result in 'Yes' responses to all the statements in the second group; there are anomalies in the responses, and these are addressed below.

In general, Table 3.12 shows that in this section the 'Disagree' answers are higher in number with respect to all the 'characteristics and efficiency of the EMS' statements (14 – 21) for all three questions (10, 12 and 13). This is to be expected for those organizations that do not have any EMS; however, for those that do, this reflects the fact that the general characteristics and level of the implementation of the EMSs in the organizations in the IC are low, although those with accredited EMS may have higher standards in implementing full EMS.

Furthermore, this low level in terms of implementing EMSs in the IC is clearly observed even among organizations that have some form of EMS, ISO14001 accreditation and the PME environmental licence. Such organizations, for example, do not generally have their own environmental policy (7 of these have an EMS, 2 have ISO14001 and 12 have the PME environmental licence), or revise their environmental targets periodically (8 with an EMS, 2 with ISO14001 and 14 with the PME environmental licence).

The number of respondents who answered 'Agree' to statements 15, 16 and 18 (i.e.:

15. Within our budget there is a special item for environmental affairs in the organization,
16. The environmental responsibilities and authorities within our organization are fixed and clear, and
18. Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities)

was quite high among the ‘No’ answers to Questions 10, 12 and 13. This emphasizes the fact that that there are some environmental management practices even among those organizations not having an EMS, ISO14001 or the PME licence. However, these practices may be inferior to established ones and therefore may be weak, limited and not integrated.

To Statements 14 and 17, i.e.:

14. Our organization has its own environmental policy, and

17. There is an environmental record in our organization,

the number of ‘Disagree’ responses was very high, with a large margin between these and the other responses; they reached 117 (Statement 14) and 121 (Statement 17), respectively for all three questions (Ques. 10, 12 & 13). This means that implementing even the basic aspects of an EMS is poor.

To Statements 19, 20 and 21, i.e.:

19. Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment,

20. The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness, and

21. There is an effective system within the organization to enforce the application of the organization’s instructions concerned with environmental affairs,

both the ‘Strongly disagree’ and ‘Disagree’ responses resulted in high values, with a large margin between these and the other responses, for all three questions. Consequently, this indicates that environmental concerns, awareness and compliance are very low among the organizations in the IC; indeed, even those with the PME licence gave significant numbers of ‘Strongly disagree’ and ‘Disagree’ responses for these three statements.

- Our organization has its own environmental policy.

It is shown in Table 3.12 below that the majority of responses to this question is ‘Disagree’ (117) for all three questions, even in some of the organizations that have an EMS and the PME environmental licence; more than a third (12 out of 32) of the organizations that do have the PME environmental licence gave responses as being ‘Strongly disagree’ and ‘Disagree’ (2 and 10, respectively). Nevertheless, having an EMS is not a prerequisite to being awarded a PME licence.

In organizations that are accredited to ISO14001, the responses pertaining to having an environmental policy are mostly for ‘Agree’ and ‘Strongly agree’ (18 out of 20); this is unsurprising as this accreditation is itself an EMS. It would seem a simple matter merely to state Yes/No to this question, but many managers, as alluded to during the interviews, were less concerned with specific accreditations and were more concerned with whether or not their EMS was successfully delivering the required results. Thus, although the Likert responses may seem to be introducing a level of uncertainty, they are in fact delivering more nuanced responses. The 2 opposing responses may reflect poor knowledge of the requirements for ISO14001 on the part of those respondents.

- Within our budget there is a special item for environmental affairs in the organization.

It is noted from Table 3.12 that (for all three questions) ‘Disagree’ has the highest number of responses to this statement (65). Furthermore, the ‘Agree’ responses are quite high (48), even among organizations that do not have an EMS, ISO14001 or the PME environmental licence; the ‘Neutral’ responses also scored 48 (through totals).

Interestingly, some organizations have an EMS and the PME environmental licence, yet their responses to this important question vis-à-vis implementing an EMS were ‘Disagree’ (3 and 5, respectively). This may have been because these organizations had fully integrated their environmental affairs into all aspects of their industrial activities, and accordingly felt no need for a ‘special item’; this was alluded to by a small number of interviewees. On the other hand, this may reflect poor knowledge on the part of these respondents (who were nominated to answer these questions).

- The environmental responsibilities and authorities within our organization are fixed and clear.

Table 3.12 illustrates that for all three questions ‘Disagree’ scored high numbers of responses (85) to this statement. Furthermore, the ‘Agree’ and ‘Strongly agree’ responses in total are quite high, particularly among organizations that do not have an EMS (29), ISO14001 (34) and the PME environmental licence (25); also, the ‘Neutral’ responses are 32, 34 and 28, respectively.

- There is an environmental record in our organization.

From Table 3.12, it is clear that the ‘Disagree’ responses to this statement, which is a basic and fundamental step in environmental management initiatives, are very high in number (121) for all three questions. Furthermore, the ‘Disagree’ and ‘Strongly disagree’ answers (in total) are high among organizations that have an EMS (6) and the PME environmental licence (8), whereas, one ‘Disagree’ answer belongs to organizations that are accredited to ISO14001. It is possible that these negative responses are influenced by the respondents’ interpretation of the meaning or practical application of ‘environmental record’.

- Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.

According to Table 3.12, for all three questions the ‘Disagree’ and ‘Agree’ answers (in total) are almost equal (55 and 53, respectively). The ‘Strongly disagree’ and ‘Disagree’ responses are fewer than the ‘Strongly agree’ and ‘Agree’ ones (61 and 73, respectively when totalled).

Indeed, this statement (Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities) reflects the organizations’ level of environmental concern and awareness, and therefore the high number of negative responses is important; however, the high number of ‘Neutral’ responses (49) indicates that, although many organizations do not have an EMS, the employees nevertheless take steps to mitigate any adverse effects. As described earlier, these responses were given by senior managers; one must take their word at face value, although it may of course be the case that some of them have a hidden agenda. This is why the questions, although clearly related to each other, are couched quite differently and are so numerous, i.e., the overall responses should overcome any incidence of subjective bias on the part of individual managers.

From Table 3.12, there are four ‘Disagree’ responses belonging to organizations that are accredited to ISO14001 (1) and that have the PME environmental licence (3).

- In the organization specific environmentally focused training programmes are established for employees whose work may have deleterious impacts on the environment.

It is shown in Table 3.12 that ‘Disagree’ has high numbers of responses to this statement (92), followed by ‘Strongly disagree’ (57), for all three questions.

The ‘Strongly disagree’ and ‘Disagree’ answers to this statement were selected in total 10 times by organizations that have an EMS (total 30), and 16 times by those with the PME environmental licence (total 32), whereas, the ‘Disagree’ answer (only) was selected 4 times by organizations that are accredited to ISO14001 (total 20).

- The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.

This statement is similar to the previous one in terms of the ‘Strongly disagree’ and ‘Disagree’ responses, which again are very high when compared with the other responses. From Table 3.12, for all three questions, the ‘Disagree’ responses are highest to this statement (86), followed by ‘Strongly disagree’ (53).

Furthermore, the ‘Strongly disagree’ and ‘Disagree’ responses of organizations that have an EMS, that are accredited to ISO14001 and that have the PME environmental licence are (in total) 8 out of 30, 2 out of 20 and 14 out of 32, respectively.

- There is an effective system within the organization to enforce the application of the organization’s instructions concerned with environmental affairs.

According to Table 3.12, the ‘Disagree’ responses to this statement are highest (74), followed by ‘Strongly disagree’ (55); the ‘Strongly agree’ responses are third (21) for all three questions.

Finally, as with Statements 15, 16 and 17, the ‘Strongly agree’ and ‘Agree’ responses to this statement among the organizations that do not have an EMS, ISO14001 or the PME environmental licence are slightly higher than for the other statements (for all three questions).

Table 3.12: Relationships between Questions 10, 12 and 13 and Statements 14 – 21

		Our organization has its own environmental policy					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Do you have an EMS?	Yes	2	5	1	8	14	30
	No	12	112	18	6	5	153
Total		14	117	19	14	19	183
Is your site accredited to ISO14001?	Yes	1	1	0	6	12	20
	No	13	116	19	7	7	162
	Don't know	0	0	0	1	0	1
Total		14	117	19	14	19	183
Does your site have the PME environmental licence?	Yes	2	10	5	6	9	32
	No	12	101	13	7	9	142
	Don't know	0	6	1	1	1	9
Total		14	117	19	14	19	183
		Within our budget there is a special item for environmental affairs in the organization					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Do you have an EMS?	Yes	0	3	5	13	9	30
	No	5	62	43	35	8	153
Total		5	65	48	48	17	183
Is your site accredited to ISO14001?	Yes	0	0	2	9	9	20
	No	5	64	46	39	8	162
	Don't know	0	1	0	0	0	1
Total		5	65	48	48	17	183
Does your site have the PME environmental licence?	Yes	0	5	7	10	10	32
	No	5	59	38	35	5	142
	Don't know	0	1	3	3	2	9
Total		5	65	48	48	17	183
		The environmental responsibilities and authorities within our organization are fixed and clear					**Total**

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Do you have an EMS?	Yes	1	1	2	14	12	30
	No	8	84	32	26	3	153
Total		9	85	34	40	15	183
Is your site accredited to ISO14001?	Yes	0	0	0	8	12	20
	No	9	85	34	31	3	162
	Don't know	0	0	0	1	0	1
Total		9	85	34	40	15	183
Does your site have the PME environmental licence	Yes	1	0	5	19	7	32
	No	8	81	28	19	6	142
	Don't know	0	4	1	2	2	9
Total		9	85	34	40	15	183
		There is an environmental record in our organization					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Do you have an EMS?	Yes	1	5	4	9	11	30
	No	12	116	9	9	7	153
Total		13	121	13	18	18	183
Is your site accredited to ISO14001?	Yes	0	1	3	5	11	20
	No	13	119	10	13	7	162
	Don't know	0	1	0	0	0	1
Total		13	121	13	18	18	183
Does your site have the PME environmental licence?	Yes	1	7	2	11	11	32
	No	12	110	9	5	6	142
	Don't know	0	4	2	2	1	9
Total		13	121	13	18	18	183
		Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	

Do you have an EMS?	Yes	1	1	1	13	14	30
	No	5	54	48	40	6	153
Total		6	55	49	53	20	183
Is your site accredited to ISO14001?	Yes	0	1	0	6	13	20
	No	6	54	49	46	7	162
	Don't know	0	0	0	1	0	1
Total		6	55	49	53	20	183
Does your site have the PME environmental licence?	Yes	0	3	0	18	11	32
	No	6	49	48	32	7	142
	Don't know	0	3	1	3	2	9
Total		6	55	49	53	20	183

		Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment					Total
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Do you have an EMS?	Yes	3	7	8	6	6	30
	No	54	85	7	5	2	153
Total		57	92	15	11	8	183
Is your site accredited to ISO14001?	Yes	0	4	6	4	6	20
	No	57	88	8	7	2	162
	Don't know	0	0	1	0	0	1
Total		57	92	15	11	8	183
Does your site have the PME environmental licence?	Yes	5	11	7	5	4	32
	No	50	77	6	5	4	142
	Don't know	2	4	2	1	0	9
Total		57	92	15	11	8	183

		The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness					Total
		Strongly	**Disagree**	**Neutral**	**Agree**	**Strongly**	

		disagree				agree	
Do you have an EMS?	Yes	4	4	3	6	13	30
	No	49	82	11	8	3	153
Total		53	86	14	14	16	183
Is your site accredited to ISO14001?	Yes	1	1	1	6	11	20
	No	52	85	12	8	5	162
	Don't know	0	0	1	0	0	1
Total		53	86	14	14	16	183
Does your site have the PME environmental licence?	Yes	3	11	5	3	10	32
	No	48	72	7	9	6	142
	Don't know	2	3	2	2	0	9
Total		53	86	14	14	16	183
		There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs					**Total**
		Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Do you have an EMS?	Yes	1	4	4	6	15	30
	No	54	70	12	11	6	153
Total		55	74	16	17	21	183
Is your site accredited to ISO14001?	Yes	1	1	1	4	13	20
	No	54	73	14	13	8	162
	Don't know	0	0	1	0	0	1
Total		55	74	16	17	21	183
Does your site have the PME environmental licence?	Yes	1	5	5	10	11	32
	No	52	65	9	6	10	142
	Don't know	2	4	2	1	0	9
Total		55	74	16	17	21	183

3.3.2.2 Assess the current level of the PME's awareness raising and control efforts

From the following analytical steps, the PME's awareness and control efforts can be measured and assessed quantitatively. This shall be achieved through two steps: firstly, identifying the relationships between the organizations' establishment date and their having the PME environmental licence, and secondly, exploiting the dual significance questions to assist in identifying the PME's current level of awareness and control efforts.

i) Organizations' establishment date and having the PME environmental licence

As previously mentioned, since instituting the General Environmental Regulations and Rules for Implementation in the Kingdom of Saudi Arabia in 2001, the PME has been the primary body responsible for environmental protection affairs and for the enforcement of the environmental regulations in coordination with the appropriate agencies at the national level (PME, 2006b). Saudi environmental law has obliged the owners of new and existing projects who request loans from lending agencies for establishing, modifying or expanding their projects, to submit an environmental licence that demonstrates compliance with these environmental regulations, standards, criteria and guidelines.

According to Article 15 of the General Environmental Regulations, "*Projects existing at the time of the issuance of the General Environmental law shall be given a maximum term of five years as a grace period before enforcement*" (PME, 2006b p20).

This grace period finished on 15th of October 2006, and therefore all organizations should now have obtained an environmental licence. This is particularly so for those that were established after 2001 (when the PME licence was introduced), which means that at least 35% of this research's organizations (i.e. those established between 2002 and 2011) should already have the PME environmental licence, and for those that were not required to have one when they were established (the 65% established before 2001), the grace period has been over for at least 5 years. In both cases, the PME requires the organization in question to submit itself to an EIA (as mentioned in Ch. 1); for new organizations, this is before they are allowed to commence operations, but for older ones, their lack of a PME licence only reflects the PME's lack of adequate enforcements efforts (this is discussed in Ch. 5).

Figures 3.5 and 3.8 show that a total of 64 organizations were established in the period 2002 – 2011 (representing 35%), but only 7 (10%) of them have been awarded the PME environmental licence; all of them should have the PME environmental licence by now.

ii) Dual significance questions

As mentioned above (see Table 3.1 and Appendix B), Section B of the questionnaire contains some dual significance questions (namely Ques. 2, 3, 6 and 10):

- There is difficult or poor access to environmental legislation and information.
- The customers' environmental concerns and awareness are very low.
- There is no adequate legal enforcement for the environmental laws in KSA.
- The maximum sanctions (e.g., closure) are rarely applied in cases of repeated violation of the environmental laws by industrial activities.

These statements, although considered as obstacles, are also used as indicators for assessing the PME's awareness and control efforts.

Table 3.13 shows that there is an agreement and concordance with respect to the listing of the obstacles facing the implementation of an EMS in the organizations in the IC. Consequently, Question 6 in Part II Section B of the questionnaire (*There is no adequate legal enforcement for the environmental laws in the KSA*) is rated as the most important obstacle facing the organizations in implementing an EMS in the IC in Jeddah. Also, Question 2 (*There is difficult or poor access to environmental legislation and information*) is rated in third place as a very important obstacle facing the implementation of an EMS in the IC.

Furthermore, Question 3 (*The customers' environmental concerns and awareness are very low*) is rated in sixth place of the 10 most important obstacles facing the implementation of an EMS in the IC, whereas Question 10 (*The maximum sanctions (e.g., closure) are rarely applied in cases of repeated violation of the environmental laws by industrial activities*) came in tenth place.

Thus, legal enforcement of the environmental laws in the KSA, access to environmental legislation and information, public environmental concerns and awareness as well as applying the maximum sanctions for violations are all insufficient. The PME is the primary body responsible for all these issues, as it is charged with disseminating information as well as enforcing the legislation, thereby ensuring maximum protection of the environment, and enhancing the level of environmental knowledge among employees.

Consequently, the PME's level of awareness raising and control efforts are clearly inadequate.

3.3.2.3 Identify the obstacles facing the implementation of EMSs.

Section B of the questionnaire (see Appendix B), which consists of 10 important obstacles facing the implementation of EMSs, as derived from the literature review, covers this aim.

This section asks each respondent to rank a list of obstacles, phrased as 10 statements, which the respondent must rank from 1 to 10 according to perceived importance. Thus, a form of cumulative percentage is used to reveal the relative importance of these according to the respondents' choices.

Cumulative percentage is generally defined as the sum of all previous frequencies up to the current point; it is another way of expressing frequency distribution, as it calculates the percentage of the cumulative frequency within each interval, much as relative frequency distribution calculates the percentage of frequency (Levin, 2006; Al-Bostangi, 2009; Welkowitz *et al.*, 2010).

Consequentially, cumulative percentage is calculated by dividing the cumulative frequency by the number of observations and multiplying by 100. The last value will always be equal to 100% (Ibid).

In this case, however, each figure given in the Cumulative Percent column is itself an aggregate or cumulative figure; for example, in Table 3.13 the statement given the highest degree of importance by most of the respondents was No. 6 (36.9% of the respondents selected this one as being of most importance to them), but the subsequent positions have been calculated through accumulating all the frequencies for the previous positions and then dividing by the population to generate a cumulative percentage. Statement No. 10 was deemed to be of least importance (by 100% of the respondents), and is accordingly allocated the final position (10, i.e. at the bottom).

Table 3.13 illustrates that statements 6, 1 and 2 have been ranked in places 1-3, respectively, as the most important obstacles facing the implementation of EMSs in the IC. As mentioned above, relative percentage is used as a tool to reveal the importance of these obstacles according to respondents' choices.

Statements 6, 1 and 2 are:

6. There is no adequate legal enforcement for the environmental laws in KSA.
1. The levels of environmental awareness and knowledge are very low on the part of the workers in our organization.
2. There is difficult or poor access to environmental legislation and information.

Statements 8, 7, 3 and 9 are:

8. There is no significant economic advantage in the local market when applying environmental conditions.7. EMS adoption is very costly.
3. The customers' environmental concerns and awareness are very low.
9. The environmental responsibilities are not well defined in our organization.

These statements came in places 4-7, respectively, which means that in terms of relative frequency (and in the eyes of the respondents) they are moderately important obstacles, whereas statements 4, 5 and 10 are considered to be of low importance as obstacles facing the implementation of EMSs in the IC (see Table 3.13).

Table 3.13: The ranking of the obstacles facing the implementation of EMSs, according to the respondents' selection

Statement number	The obstacles facing the implementation of EMSs	Cumulative percent*	Rank
6	There is no adequate legal enforcement for the environmental laws in KSA	39.9	1
1	The levels of environmental awareness and knowledge are very low on the part of the workers in our organization	32.8	2
2	There is difficult or poor access to environmental legislation and information	39.3	3
8	There is no significant economic advantage in the local market when applying environmental conditions	57.4	4
7	EMS adoption is very costly	51.9	5
3	The customers' environmental concerns and awareness are very low	55.2	6
9	The environmental responsibilities are not well defined in our organization	57.9	7
4	There is a lack of planning for environmental training for the employees in the organization	77	8
5	A competitive market is one of the major obstacles facing the implementation of an effective EMS in the organization	84.2	9
10	The maximum sanctions (e.g., closure) are rarely applied in cases of repeated violation of the environmental laws by industrial activities	100	10

* See definition above

3.3.2.4 Identify the possible environmental benefits to be derived from implementing EMSs

This objective is covered by Part II Section C of the questionnaire and is presented in Table 3.1 (see Appendix B). These 13 environmental benefits are stated in the literature review as being the most important environmental benefits to be gained from implementing an EMS.

This section asks each respondent to rank a list of benefits, phrased as 13 statements, which the respondent must rank from 1 to 13 according to perceived importance. Thus, cumulative percentage is again used to reveal the importance of these benefits according to respondents' choices (as stated above).

Table 3.14 shows that statements 1, 5, 12 and 3 have been ranked in places 1-4, respectively, as the most important environmental benefits to be derived from implementing an EMS in the IC. However, it should again be noted that not all of the respondents are fully cognisant of all the aspects, requirements or benefits of EMSs.

Statements 1, 5, 12 and 3 in Section C are:

1. EMSs improve the environmental capability and performance of organizations.
5. EMSs improve the operational safety of organizations.
12. EMSs assist in avoiding legal sanctions, for example, forfeiture of operating permits and financial fines and penalties that hamper business activities.
3. EMSs define environmental objectives and targets.

Consequently, statements 8, 6, 2, 11 and 13 were ranked as relatively less important environmental benefits (in places 5-9, respectively), and statements 4, 7, 10 and 9 are considered to be relatively of least importance (in places 10-13, respectively) (see Table 3.14).

Table 3.14: The ranking of the possible environmental benefits to be derived from implementing EMS, according to the respondents' selection

Statement number	Possible environmental benefits to be derived from implementing EMSs	Cumulative percent*	Rank
1	EMSs improve the environmental capability and performance of organizations	32.2	1
5	EMSs improve the operational safety of the organization	37.7	2
12	EMSs assist in avoiding legal sanctions, for example, forfeiture of operating permits and financial fines and penalties that hamper business activities	36.1	3
3	EMSs define environmental objectives and targets	44.3	4
8	Increasing environmental performance will enhance the image of the organization	48.1	5
6	EMSs raise the level of environmental awareness among the workers in the organization through training sessions	56.8	6
2	EMSs provide a harmonized system for managing an organization's environmental impacts	59	7
11	EMSs assist in incorporating environmental considerations when designing plans and executing industrial projects	63.4	8
13	EMSs assist in providing regular periodic reports about the extent of adherence to established environmental standards	61.7	9
4	EMSs involve regular and periodic measurements of the levels of environmental impact derived from the organization's activities	75.4	10
7	EMSs enhance employee participation in environmental management activities	77	11
10	EMSs can offer improvements in environmental performance and could possibly improve market competitiveness in the longer term	90.2	12
9	EMSs provide economic advantages for the organization in the local market	100	13

* See definition in previous section

3.4 Summary of the findings of the quantitative data analysis

This stage of the research's analysis (i.e. pertaining to the quantitative questionnaire data covering 183 organizations) has delivered a number of findings, and issues of particular interest (i.e. related to the four objectives) are highlighted below.

Almost 94% of the organizations do not have a dedicated environmental manager specifically responsible for addressing environmental issues and controlling emissions. Thus, in the majority of organizations, the owner/manager was contacted in order to seek permission to conduct this survey; approximately 45% completed the questionnaire themselves (others nominated the best suited of their senior staff, or the most knowledgeable of environmental issues to answer the questions). Large-sized organizations represent 47.0% of the study's sample, followed by Small-sized (29.0%) then Medium-sized (21.9%); there were very few Micro-sized organizations (2.1%).

Several statistical tests were used in order to achieve each of the four objectives in this research. Accordingly, the findings are summarised in terms of these objectives as follows:

- **Determine the current scope of EMSs in the various industrial plants**

The organizations that have an EMS represent 16% of the sample, that have ISO14001 accreditation represent 11% and that have the PME environmental licence represent 17%. Given the size of the sample (183 organizations), these findings are very low (relative to other developing as well as developed countries, as discussed in Chapter 5), although there is an indication in the data that, even though some organizations do not practice EMS as a recognized package, they do have certain environmental management practices and initiatives in place, which are related to their particular activity.

The overall results pertaining to the organizations' attitudes towards the characteristics and efficiency of EMSs are such that the organizations in this sample have no positive attitudes toward the first objective. This means that the organizations' attitudes towards the characteristics and efficiency of EMSs in general are largely negative. There were relationships between the demographic information and the statements relating to Objective 1, i.e. those relating to the general information on the organization's EMS attitudes and those relating to the characteristics and efficiency of the EMS in the organizations.

‘Type of activity/sector’ revealed that the food sector has a relatively high number of organizations with an EMS; this is an important finding, as poor practice in these organizations could have serious ramifications for human health, although the key driver in adopting an EMS strategy may be merely for public relations and preserving their image. In terms of an organization’s location (Phase), the data reveal that despite compliance with the PME licence and having an environmental record being low in general, Phase 3 tends to have more compliance with the PME environmental licence and having environmental records. Phases 4 and 5 have particularly low numbers in terms of compliance, and recorded low levels for having specific environmentally focused training programmes for employees.

Organization size is the only variable that has significant relationships with all of the statements relating to Objective 1. Although far too few organizations reported having an EMS, ISO14001 certification or the PME environmental licence in general, the large organizations in this sample delivered higher numbers for answering ‘Yes’ to this variable than the other sizes. Large organizations evidently more often have an EMS, ISO14001 certification and the PME environmental licence than the other sizes (large organizations tend to be more concerned about their image as they usually have larger markets) but their initiatives do not necessarily take the form of full EMS. In terms of their establishment date, the numbers of organizations that have the PME environmental licence rapidly decreased for those that were established after 2002. This result is contrary to what the Saudi environmental law had intended, and therefore this relationship shall be discussed in detail when addressing the PME’s awareness and control efforts.

In identifying the relationships between the general information of the organizations’ EMS attitudes and the characteristics and efficiency of their EMSs, the data reveal that the general characteristics and level of efficiency of the EMSs in the organizations in the IC, that is, their ability to comply with all five basic points of the EMS process (see Page 142), are low. Furthermore, this low level in terms of implementing EMSs in the IC is clearly observed even among organizations that have some form of EMS, ISO14001 accreditation or the PME environmental licence. Such organizations, for example, do not generally have their own environmental policy, keep environmental records or revise their environmental targets periodically, which might reflect poor knowledge on the part of those respondents in the organizations that are accredited to ISO14001. Furthermore, there are some environmental management practices even among those organizations not having an EMS, ISO14001 or the PME licence. However, these practices are likely to be inferior to established ones and therefore may be weak, limited and not integrated. In general, implementing even the basic aspects of EMSs is poor, and environmental concerns, awareness and compliance are very low among the organizations in the IC.

- **Assess the current level of the PME's awareness raising and control efforts**

Identifying the relationships between the organizations' establishment date and having the PME environmental licence revealed that many of the older organizations have exceeded the limit of the grace period offered by the General Environmental Regulations and Rules for Implementation in the Kingdom of Saudi Arabia (issued in 2001); this grace period finished on 15/10/2006. The relationship between the establishment date and the organization having the PME environmental licence shows that a total of 64 organizations were established in the period 2002 – 2011 (representing 35%), but only 7 (10%) of them have been awarded the PME environmental licence; all of them should have the PME environmental licence by now.

The dual significance questions in Part II Section B, although considered as obstacles, are also used here as indicators for assessing the PME's awareness and control efforts. This analysis finds that there is agreement and concordance with respect to the listing of these obstacles facing the implementation of EMSs in the organizations in the IC. The most important obstacle reported by the respondents is that the legal enforcement of the environmental laws there is not adequate. Also, the respondents asserted that the employees' environmental concerns and awareness are very low. Furthermore, they complained of difficult or poor access to environmental legislation and information. The PME is the primary body responsible for all these issues, as it is charged with disseminating information as well as enforcing the legislation, thereby ensuring maximum protection of the environment, and enhancing the level of environmental knowledge among employees.

Consequently, and from the findings of the two analysis steps above, the PME's level of awareness and control efforts is clearly inadequate. It should be noted that this conclusion has been drawn from the questionnaire data; the interviews, as described in the next chapter, support this conclusion, although this matter is left for discussion in Ch. 5.

- **Identify the obstacles facing the implementation of EMSs.**

Part II Section B, which consists of 10 important obstacles facing the implementation of EMSs, covers this aim; they are presented in Table 3.13. The respondents were again asked to rank them according to perceived level of importance. They were generally agreed that there is no adequate legal enforcement for the environmental laws in KSA. The second obstacle of most concern was that the levels of environmental awareness and knowledge are very low on the part of the workers, and this was followed by there being difficult or poor access to environmental legislation and information.

- **Identify the possible environmental benefits to be derived from implementing EMSs**

This objective is covered by Part II Section C, and the 13 environmental benefits (as presented in Table 3.14) are seen as the most important ones to be gained from implementing EMS. Each respondent was asked to rank these benefits from 1 to 13 according to perceived importance. According to them, the most important one is that EMSs improve the environmental capability and performance of organizations; this was followed by EMSs improve the operational safety of the organization. The third and fourth most important benefits were identified as being EMSs assist in avoiding legal sanctions, for example, forfeiture of operating permits and financial fines and penalties that hamper business activities, and EMSs define environmental objectives and targets, respectively.

To draw a wider picture of understanding the current scope of EMSs, including barriers and opportunities for EMSs implementation, for the delivery of environmental benefits to the IC in Jeddah, enable the validation of the findings, and to help in explaining diverging results and coping with limitations inherent in any one research method, the following chapter focuses on the qualitative data analysis (interviews and documentation).

The research data derived from a multi-method methodology, through internal cross-checking procedures and because of the ensuing validation process, are more reliable than data derived from only one method. Thus, the findings of this chapter will then be combined with those of Chapter 4 in the discussion Chapter (5) in order to assist in the drawing of conclusions.

Chapter 4:

Findings based on the Qualitative Data

4

4.1 Introduction

This chapter details the outcomes of the qualitative (interviews and documentation) data analysis; it is conducted in order to obtain a deeper understanding of this critical investigation into the barriers and opportunities for EMS implementation for the delivery of environmental benefits to the IC in Jeddah, KSA. The results are used to achieve this research's objectives through a multi-method research approach and the findings in this chapter will be used to clarify issues arising from the results of the quantitative data.

4.2 Information about the interviewees

As mentioned in Section 2.6.3, two sets of interview data were collected; one from the environmental managers (or equivalent) in those industrial plants that agreed to participate (14), and the other from persons working at the various relevant governmental departments (and some private bodies) who have particular specializations or scientific expertise. Thus, this second set represents a further 12 interviews outside the IC in addition to the 14 inside (see Figure 2.1). The first set, as mentioned in the coding section in Chapter 2, is prefixed with A (thus, A1 - A14), and the second set is prefixed with B (thus, B1 - B12).

Table 4.1 presents the first set of interviews which were conducted with environmental managers (or their equivalents) in the participating organizations. This information is derived from their answers to 'Part I' of the questionnaire which was on general information (pertaining to demographics, statistical descriptions of the organizations as well as certain details relating to the implementation of EMS; (see Appendix B). In this respect, the organization's owner/manager was contacted in order to seek permission to conduct the interview. Some of them (5 of 14) answered the interview questions themselves and the others nominated the best suited of their senior staff, or the most knowledgeable on environmental issues, to be the interviewees.

Table 4.1: First set of interviews (organizations)

Code	Organization's activity (sector)	Position/title of interviewee	Highest education level and background / specialism of interviewee	Organization's size (number of employees)*	Organization's location (the phase)	Organization's establishment date	Having (an EMS, ISO14001 or PME env. licence)
A1	Metals	Factory manager	Graduate / Arts	Small	4	2008	No
A2		Production manager	Graduate / Engineering	Large	5	1989	No
A3	Chemicals	Manager of quality, safety and environment	Graduate / Engineering	Large	3	1995	Yes for all
A4		Factory manager	Graduate / Management	Small	1	1996	No
A5	Wood and furniture	Vice-manager	Graduate / Management	Small	2	1997	No
A6		Technical manager	Graduate / Engineering	Medium	4	2000	No
A7	Textiles and clothing	Safety manager	Graduate / Engineering	Large	4	1989	No
A8		Factory manager	Graduate / Management	Small	1	1972	No
A9	Paper and printing	Safety and environment manager	Graduate / Engineering	Large	2	1982	Yes for all
A10		Technical manager	Graduate / Engineering	Small	5	2010	No
A11	Food	Quality manager	Graduate / Engineering	Large	3	2002	An EMS** only
A12		Manager / Manager of staff affairs	Graduate / Arts	Small	5	2007	No
A13	Building materials and glass	Factory manager	Graduate / Engineering	Large	3	1979	An EMS** and ISO14001
A14		Production manager	Graduate / Engineering	Large	5	1993	An EMS** and PME env. licence

* <25 Micro - 25-60 Small - 60-99 Medium - >99 Large
**EMS: the standards set by the organizations themselves, following environmental principles but not formally accredited.

Table 4.2 shows the second set of interviews which were conducted with persons from the various relevant governmental departments (and some private bodies) as well as their position. It should be noted that the head of each governmental department and private body was contacted and it was they who decided who would represent them and be best able to answer the interview questions.

Table 4.2: Second set of interviews

Code	Department	Position
B1	The Presidency of Meteorology and Environment (PME) (the Environmental Licences department)	Director of the Environmental Licences department
B2	The Saudi Industrial Property Authority (Modon)	Technical affairs official
B3	The Ministry of Commerce and Industry	Director of the Western Region
B4	The Jeddah Municipality	Manager of Environmental Health
B5	The Jeddah Chamber of Commerce and Industry	The Chief Secretary
B6	The Environmental Sciences department at KAU	Senior Director of the Environmental Management division
B7	The Centre of Excellence for Environmental Studies at KAU	Vice-president
B8	Organizations providing EMS consultancies and accreditation services	ISO14001 consultant
B9	Organizations providing EMS consultancies and accreditation services	ISO14001 consultant
B10	Organizations providing EMS consultancies and accreditation services	ISO14001 auditor
B11	The Presidency of Meteorology and Environment (PME) (Environmental inspection department)	Environmental inspector
B12	The Presidency of Meteorology and Environment (PME) (Environmental Inspection department)	Environmental inspector

4.3 Findings of the qualitative data analysis

The findings of the qualitative data presented below cover the interviews and documents through which the researcher directly addresses this research's objectives:

- Determine the current scope of EMSs in the various industrial plants.
- Assess the current level of the PME's awareness raising and control efforts.
- Identify the obstacles facing the implementation of EMSs.
- Identify the possible environmental benefits to be derived from implementing EMSs.

4.3.1 Determine the current scope of EMSs in various industrial plants

This aspect of the study in the first set of interviews includes patterns and categories determined according to demographic information (the size and type of activity) and whether the organizations had an EMS, ISO14001 or PME environmental licence (see Page 123) which would, with the help of a second set of interviews, indicate an understanding of the level of implementing EMS.

There are nine questions addressing environmental concerns in the industrial sector generally, and the extent of the implementation of EMS in the IC in Jeddah, gathered from the two sets of interviews (see section 2.6.2.1).

From all the respondents' answers to these questions, it is evident that there is dissatisfaction about the environmental situation in KSA. All the participants in both the first and second sets of interviews, when asked for an assessment of the environmental situation and contribution of the industrial sector to the environment in KSA, share the subjective opinion that the environmental situation has deteriorated (in their experience) and that the industrial sector has played a major role in this (see section 1.3.2). It is interesting to notice that the representatives of the most relevant government departments (B1 and B2), namely PME and Modon (the latter is the government authority responsible for developing Saudi industrial cities) in the second set of interviews, agreed that the environmental situation in KSA is unsatisfactory but have added the following comments: "*the official environmental concerns in the KSA just started a few years ago. We are just at the beginning*" (B1), and "*we (as a governmental department) have taken great strides in controlling the industrial pollution*" (B2). On the other hand (B6) added that: "*regarding the environmental concerns in the KSA, I will give it a percentage of 20%, and it needs to be integrated and promoted*".

When asked about the necessity of implementing EMSs in the industrial sector in KSA, all the participants replied positively. It should be remembered that some of these interviewees of the first set of interviews (A1, A2, A4, A6 & A7) had admitted they did not know what EMS meant at the time when they were given the questionnaire but this was then explained to them. They mostly shared the idea and answered with such words as:

"*Yes of course, it is very important to implement EMSs in the industrial sector*" (A2).

On the other hand, the answers were varied when they answered the question "Why?", and for example, they expressed ideas such as how to control industrial activities, imagine industry without control (A1, A2, A3, A6, A8, A9, A10, A11, B3, B4 & B7), it depends on the industrial activity (A12 & B5), to protect the environment and people's health (A4, A5, A7, A13, A14, B2 & B5) and it is an indispensable tool in industry which ensures continuous improvement (B1 & B6). Other tools are available, such as EIA; however, none is as comprehensive as EMS, as this tool covers all management and production processes under an umbrella of environmental protection.

However, the respondents have also reported concerns about being behind in implementing EMSs. When asked the question "Do you think that private Saudi organizations are lagging behind concerning the implementation of environmental management in comparison with organizations in the developed world? Why?" 19 out of 21 interviewees agreed that this was the case. This answer was almost unanimous, although, (B1) stated that "*not all our private organizations are lagging behind; there are good examples of organizations that are committed to environmental management processes, we are really proud of them*", and (A4) said: "*I do not know about organizations in the developed world to judge and compare Saudi organizations with*". Furthermore, (B6) stated that, when he answered this question: "*I cannot say to (sic) some non-integrated environmental practices in some organizations that are environmental management. For example, there is no organization in the Saudi private sector that publishes its environmental reports periodically*". Additionally, the reasons that are stated here to answer and explain (Why?) are slightly varied, for example, in the first set of interviews (with interviewees A1 - A14), they are: the absence of legal enforcement for environmental legislation and rules (A1, A3, A7, A9, A10, A12, A13 & A14) – the absence of legal monitoring (A3, A7, A9, A10, A12 & A14) – low environmental awareness among workers in the industrial sector (A2, A3, A5, A6, A7, A8, A9, A10, A11, A12 & A14) – high cost of environmental compliance (A5, A8, A12 & A13) - scarcity of sources of environmental information (A3, A5 & A8). The second set of interviewees (B1 - B12) summarised the reasons as: low environmental awareness among workers in the industrial sector and society – high cost of environmental compliance (B1, B2, B3, B4, B6 & B7, B11 & B12) – the absence of legal enforcement and monitoring (B2, B3, B4, B5, B6 & B7).

The organizations' representatives in this survey tried to introduce their organizations positively when asked the question "How would you describe the environmental situation in your organization and in the industrial city in general?" All the first set of interviewees were unanimous (whether they had an EMS, ISO14001 or PME licence, that is A3, A9, A11, A13 & A14, or the remainder, who did not) in the view that the environmental situation in their organizations was satisfactory. Nevertheless, there was variation regarding the way the IC environmental situation was described. Some (A2, A4, A6, A8 & A11) stated that environmental situation in the IC was acceptable whereas the others stated that it was unsatisfactory in general. Furthermore, one of them said: "*the environmental situation in the IC is chaos everywhere*" (A10), (A3) added "*I can estimate (from my observation) that the organizations that are concerned about environmental issues are between 2 – 3% of the total number of organizations in the IC*". (A7) said: "*the environmental situation (in general) in the IC is less than 10% of full implementation*", and (A9, A12 & A13) added comments that there are many environmental offences and abuses in the absence of environmental control and monitoring.

However, all but one of the organizations that have described the environmental situation in the IC as satisfactory are almost always those who do not have an EMS, ISO14001 and PME environmental licence (A11 being the exception, claiming to have an EMS only). This could be interpreted as an attempt to deny a true, negative picture of the environmental situation in the IC in order to hide their failure to apply any environmental management standards to control their activities, or alternatively, just insufficient knowledge of the situation. This suspicion is supported by the consensus of everyone in the second set of interviews, who confirmed that the environmental situation in the IC is unsatisfactory in general and "*not as hoped*" (B1).

The organizations were then questioned about their implementation of EMS. Nine of fourteen organizations in the first set of interviews admitted to not implementing any form of EMSs when they were asked "to what extent have EMSs been implemented in your organization and in the industrial city in general?" The organizations that claim they apply EMS, or have ISO14001 or PME environmental licences (A3, A9, A11, A13 & A14) (see Table 4.1) answered positively about implementing EMSs in their organizations. A3, A9 & A13 that have an EMS and ISO14001, and/or a PME environmental licence (see Table 4.1), confirmed that they do fully conform to EMSs under the ISO14001 standard. A11 & A14, however, said that they did their best to take steps or initiatives in order to control their activity in an environmentally acceptable way and to comply with national environmental legislation and rules.

This situation, whereby organizations claim to have an EMS but fail to follow all the five basic processes (see section 1.4.2), was confirmed when the interviewees were asked about the basic processes of EMS that were applied by the organizations in the IC, and the answers were varied. Eight out of fourteen organizations admitted that they do not apply any of the basic five processes, policy-making, planning, implementing, checking, and reviewing (A1, A2, A4, A5, A6, A8, A10 & A12), whereas three said that they applied two of these processes: planning and implementation (A7, A11 & A14). A7 was an exception because the interviewee did not claim the organization had an EMS and yet they carried out some of the EMS's processes.

However, all the basic processes were applied by the organizations that were accredited to ISO14001 (A3, A9 & A13). This was also confirmed by some of the second set of interviewees (B2, B5 & B6) who agreed the organizations that have ISO14001 follow all the processes of EMS but that the others follow some but not all of the five processes.

As well as obtaining answers to the interview questions, this research looked for documentary evidence about the environmental situation in the IC. Indicating the concern about the environment in the ICs in the KSA, Althamenah (a documentary TV programme on the official Saudi TV channel with a reputation for objectivity) reviewed the environmental impacts of industrial factories inside Saudi cities. This programme, which can be found on this link Althamenah TV Program (Alsharian, 2013), featured a dialogue among a group of officials drawn from industry and the government's environmental protection agencies. It was shown, in one episode, how the Kingdom's three main cities, Riyadh, Jeddah and Dammam, have expanded to include major industrial cities that were originally built just outside them. In the absence of environmental control and monitoring, either by legal enforcement or by industrial plants self-regulating (by conducting any form of environmental management of their industrial activities), the programme concluded that the consequent environmental impacts were quantifiable and even dangerous. The programme argued that these ICs are negatively influencing the air quality within these cities, and are polluting the coasts adjacent to Jeddah and Dammam, thereby directly affecting people's health.

It is worth mentioning that the activities of the five organizations that have an EMS, ISO14001 or PME environmental licence (A3, A9, A11, A13 & A14) belong to either the Chemicals, Food, Building materials and glass, or Paper and printing sectors, whereas A1, A2, A5, A6, A7, A8 & A10 attributed not implementing any form of EMSs to the fact that the environmental impacts of their activities are much less than those of other industries such as chemicals and metals. Indeed, they had already agreed that the environmental situation in the IC was unsatisfactory, but they threw the responsibility for this situation on the shoulders of other organizations concerned with activities which they perceived to cause more pollution.

With regard to implementing EMSs in the IC in general, ten of the fourteen interviewees, from their experiences and observations, answered negatively to the effect that they considered that there are no convincing EMSs being implemented in the IC (A9, A10 & A14), or that implementation of EMS is weak as there is little evidence of good EMS practice (A1, A2, A3, A5, A7, A8 & A12). However, it may be the case that many of the respondents were unaware of the evidence in favour of EMS implementation. One of the respondents (A13) declined to answer this aspect of the question, and two respondents (A4 & A6), whose organizations do not have any form of EMSs, and a third (A11) whose organization has an EMS, stated that the implementation of EMSs in the IC is acceptable in general.

Respondents to the second set of interviews all agreed that the implementation of EMSs in the IC has been unsatisfactory. B1, B6 and B7 reported that the implementation in the IC was belated and at a less-than-acceptable level. B6 added there were some environmental initiatives but he doubted whether they reached the full level of any EMS standards. He added that fines have not been issued for many of the breaches of the 2001 'General Environmental Regulations and Rules' administered by the PME, and that some problems had been covered up. On the advice of one of the respondents (A7), who was aware that emissions were taking place at weekends, the researcher visited the IC and saw that emissions were indeed taking place then when the PME was not available to monitor them. B5 considered that organizations in the IC took the view that discretion could be used in complying with environmental regulations.

Accordingly, all the answers given by the second set of interviewees and ten out of fourteen of the first set disagree with the positive answers given by A4, A6 and in particular A11 (which claims to have an EMS but has no formal certification). These three might have responded in the way they did because of poor knowledge of environmental issues and EMS, or because they are content with the current situation which reflects their lack of environmental awareness, as suggested by Gunningham (2007), Massoud *et al.*, (2010a) and Lam *et al.*, (2011).

Regarding the question of the criteria or standards that are applied by the organizations for controlling and assessing their environmental performance, ten organizations out of fourteen have not applied any standards to control their activities even though these standards are required under the ‘General Environmental Regulations and Rules for Implementation in the Kingdom of Saudi Arabia' (PME, 2006b) and therefore apply to all regardless of whether they have a formal EMS or not. These ten are the same organizations that answered the question about implementing EMS in their organizations negatively, plus A14 who has the PME environmental licence. Some of them explained, as before, that in their activities there was no need to set these standards due to the fact that they did not have negative environmental impacts (A5, A10 & A12). In addition, some said they did not know about the official standards (A1, A2, A4, A7 & A8) and they have not been asked about them (A6). A14 said “*Although we do not use these standards we have taken many environmental initiatives to control our activity and we think that our organization’s environmental impacts are satisfactory; we have not been fined or violated [sic]*”.

Three of the four remaining organizations use local and mandatory PME environmental standards to control their activities and are accredited to ISO14001 (A3, A9 & A13). A11, who claims his organization has an EMS, yet does not follow all the basic EMS steps and said that the environmental situation in the IC was acceptable, uses other standards such as: OSHA (the Occupational Health and Safety Administration) and NFPA (the National Fire Protection Association) standards but none of these are environmental standards.

One of the most important documents on the IC in Jeddah (PME’s Report No. NMEC-WQ (2006a)) reviewed for this research, showed that large amounts of hazardous and toxic chemical elements in the form of liquid effluent are being produced. An inspection programme was conducted in order to determine whether the environmental standards for liquid wastes in the industrial cities in Riyadh, Jeddah and Dammam had been exceeded. As discussed in Chapter 1, the results revealed unacceptably high levels of hazardous and toxic chemical elements, even some thousand times above the standards, with adverse consequences for the environment, health and economy in the KSA (PME, 2006a). Much of this liquid waste is channelled through the IC’s waste networks, which ultimately deposit the waste directly into the sea. For example, the level of approval for Chromium in liquid waste is 50 μg/Litre and in some organizations in the IC in Jeddah, the amount of Chromium reached 70.1 mg/Litre, 70000% above the approved limit (PME, 2006a p:43); this would have been discharged into the waters off Jeddah. The inspection programme did not include heavy industries such as petrochemical organizations (A3) and Metals (A1 & A2).

Furthermore, in a newspaper article entitled: ‘The contamination of Jeddah’s beach has exceeded global standards’ by Eshqy (2013), a former professor in the College of Marine Sciences at the University of King Abdulaziz in Jeddah (KAU), stated that contamination by sewage and liquid wastes produced by industrial activity has exceeded the global standard in the south beach of Jeddah (the part that is close to the IC). This article sounded an alarm about the impact of these pollutants on the marine environment on the shores of the city of Jeddah and on public health.

The existing standards, while not as comprehensive as they could be, would do much to safeguard the environment if they were used properly and fully enforced (Cohen, 1998; Tosun, 2012). The organizations (A3, A9 & A13) (all of them large-sized) are all accredited to ISO14001 and say they apply and use the PME’s environmental standards. These three have explicit responsibility for environmental concerns and employ environmental departments. It should be noted that while the interviews with A3 and A9 were conducted with the environmental managers, in the case of A13, the Factory Manager instead of the head of the environmental department gave the response. When asked “How does your organization monitor its compliance with environmental requirements?” one of the most significant questions of this survey, all three answered in detail. A3 said that, in addition to applying the ISO regulations, his organization had an Environmental Department and Quality Assurance Department, and that these have their managers, who consult with the PME on all matters relating to the environmental standards. A9 said that they have an environmental and a safety department, that regularly check their waste levels against the standards issued by the PME. A13 said that they have a laboratory and tested waste daily; the production manager has the responsibility for checking the waste streams against the PME’s standards. These three organizations, which have an EMS under ISO14001 in the IC in Jeddah, appear to implement EMS in full. Many authors (such as Melnyk *et al*., 2003; Gavronski *et al*., 2008; Nishitani, 2009; Heras-Saizarbitoria *et al*., 2011) argue that organizations that adopt a formal EMS, such as ISO14001, have better environmental credentials than organizations that do not possess an EMS certificate.

According to previous answers, organizations that claim they have an EMS or PME environmental licence (but do not have ISO14001) do not follow all the steps required and therefore their claim to adhere to an EMS and PME licence is questionable. A11 and A14 for example, claim to have EMS, A14 claiming a PME licence as well, but neither could provide evidence of compliance with any standards. Indeed, A14 added there was no need to monitor compliance because their activities did not have much impact on the environment.

Thus, the answers given by the interviewees varied but most could be said to be unsatisfactory from an environmental point of view. A1 & A12 also considered that no monitoring was necessary as their activities had no impact on the environment. A6 & A10 admitted that no monitoring was carried out. A2, A4, A5 & A7 answered the question about monitoring compliance by saying it was dealt with by someone in their organization: the Manager (A2), the Departmental Manager (A4 & A5), and the Maintenance Manager (A7).

Regarding the way these organizations promoted the reuse, recycling and reduction of waste, all the organizations answered positively, saying they now recycled their solid waste by selling it to contractors who resell to other organizations, who then use this waste in their activities or export it to other countries such as China or India. A14 added that these contractors may buy one tonne of Plastics solid waste from his company for 5,000 SR (£875) and export it to China, where the waste is then refabricated ready for export (as a new product) for as much as 25,000 SR (£4,375). It is noteworthy that in the KSA there are no restrictions on the export of wastes such as: plastics, cartons and paper, metals and scorched oils (and some petroleum products), after obtaining a permission from Ministry of Commerce and Industry (Ministry of Commerce and Industry, 2015). The respondents commented that in the past decade the disposal of this waste was very difficult but now it is easier and they can make money from it. Now they are looking for a similar way to benefit from their liquid waste (A2, A7, A12 & A14). It seems that there is a purely commercial motive behind such activities, rather than complying with any duty of care (which is a poorly specified and little used concept in KSA law) (Idowu and Caliyurt, 2014). Interestingly, the organizations that are accredited to ISO14001 (A3, A9 & A13) in addition to reducing their emissions, reuse and recycle their waste (solid and liquid) themselves and sell the remainder to the contractors. For example, A3 said:

> "*we reuse plastic and recycle the water that we have used in our production processes*".
>
> A9 said: "*in our organization we reuse and recycle the waste paper that results from production processes. In addition, we have a solar system which assists us to reduce our consumption of power in production processes and which provides light for our organization*".
>
> A13 said: "*we have machines for recycling and reuse our waste and reduce it*".

It is worth mentioning that there are other contractors who assist the organizations to dispose of their unwanted and dangerous liquid and solid waste for a fee. The organizations claimed that the number of these contractors is small and their services are very expensive (A2, A7, A8, A12, A13 & A14).

Supporting the claim that waste disposal facilities were inadequate, another document reviewed for this research was one published in the Al-Watan newspaper (considered the second most widely-read newspaper in the KSA) (Alzain, 2013). It was a statement given by the Director of the Chemical Safety department at the PME and acknowledged that 900,000 tonnes per year was the volume of solid and liquid hazardous and chemical wastes produced from all the industrial activities in the KSA. However, the ability to address these wastes currently did not exceed even 60,000 tonnes because only 6 specialized companies were presently approved to provide this kind of treatment within the Kingdom. The rest is merely sent to landfill but there is a scarcity of land and facilities dedicated to this, in addition to the lack of trained cadre and techniques for handling waste more generally. Alzain (2003) also indicated (and at the same time) warned of the threat from the growing quantities of hazardous and non-hazardous waste in Jeddah as a result of not changing the methods for dealing with it; he said that the increasing quantity of waste is affecting the existing infrastructure that is supposed to deal with it.

All organizations in the IC in Jeddah are requested to reduce the negative impacts of their wastes and emissions to the standards that are defined by the Saudi environmental laws. The issue of aerosol emissions is also serious but, according to the interviewees (A3 and A12), this is largely ignored by the PME; they do not monitor emissions because they do not have the requisite equipment or personnel. ISO14001 commits accredited organizations to reducing emissions but this is not specified in the same manner as for solid and liquid wastes. Nevertheless, B1 & B12 stated that it was the intention of the PME to install monitoring equipment in the IC in an attempt to control emissions in the future.

4.3.2 Assess the current level of the PME's awareness raising and control efforts

This theme was addressed by three main questions (see section 2.6.2.1) which were put to all the interviewees. All the first set of interviewees agreed that the PME's efforts in raising environmental awareness and controlling the environmental situation in the IC in Jeddah were very weak. Although they do not know the reasons for this weakness, they stressed that the PME should, as a first step, improve and raise the environmental awareness among society in general and workers in the industrial field, and inform them of local environmental rules and regulations that are to be applied. After this initial step, they can enforce these rules and regulations and fine the organizations that contravene them (A2, A7, A9, & A11). The PME have not provided, for example, awareness ads in the streets or in the media, such as newspapers and magazines, local TV channels or even inside the IC; not to mention the fact that they have not conducted environmental awareness sessions, training courses and lectures to increase awareness among the owners and employees of the industrial establishments (A4, A8 & A14). A1, A2, A4, A6 & A7 did not know what EMS meant when the researcher gave them the questionnaire. A2 and A7 thought that "environmental protection" meant wildlife conservation and looking after endangered animals, yet another example of the lack of understanding of environmental issues. A1, A2 & A10 stated that they had not even heard about the PME environmental rules and licence. It can therefore be said that the PME provides inadequate information and publicity about environmental legislation and rules.

This is in stark contrast to many developed nations where levels of environmental awareness are high. However, this has been the product of a number of public health disasters (such as the London smog of 1952) as well as of the efforts of charitable organizations (such as Friends of the Earth in the UK) and individuals (such as Rachel Carson's *Silent Spring* in the USA); politicians responded with legislation, which then stimulated the private sector into adopting and promoting environmental awareness. Thus, awareness-raising has had tangible results in terms of public awareness and an ongoing commitment to reducing harmful emissions (Clifford, 2012).

Regarding the PME's efforts in monitoring and control, six out of fourteen of the first set of interviewees stated that there are no efforts to control the environmental situation. They claimed they had never seen the PME's inspection teams (A1, A2, A7, A10, A12 & A13), while others said that there were some efforts at control but they were still very ineffective (A4, A5, A6, A8, A11 & A14) and two of them added that they had seen them just once in the last two years (A6 & A4). A3 & A9, both of which have an EMS, ISO14001 and PME licence, expressed their delight with the researcher's visit and said that they were compliant with local and international environmental legislation and rules and no one from any formal governmental department had come and asked them about this issue before. They realised that it was a very important issue and wanted to explain and share their experiences in implementing EMSs. In total, only three organizations hold ISO14001 accreditation, but all of them proclaimed that this had benefited them in the long run; the costs associated with the initial implementation had long been outweighed by the resultant cost benefits (discussed further in Section 4.3.4).

All the second set of interviews confirmed that there were shortcomings in the PME's environmental efforts in the areas of awareness, information, training, enforcement, monitoring and control. There is an apparent gap between the legal mandate of the PME and its ability to fulfil its duties. B1, B11 and B12 explained that there are 13 PME branches, with at least one PME office in each of the Kingdom's Provinces, including the Western Province where Jeddah is located; the PME branch in Jeddah is the primary one for the whole of KSA. They added that the Inspection Department in the PME was established at the beginning of 2010 (in all the PME's offices). This department in the Jeddah branch consists of about 20 employees, only 13 of whom are responsible for conducting inspection tasks across a wide range of industrial and commercial activities in the whole of the Western Province; the duties of the other 7 are related to administrative and financial auditing, reviewing for irregularities and sanctions, and collecting the financial penalties and fines that arise from all the PME offices in the Kingdom. Nevertheless, most of the employees are not qualified environmentally (i.e. they are not specialists in environmental subjects). They have only two cars, there are no measuring devices to monitor noise and air pollution levels, and liquid samples are tested by accredited private laboratories (B1, B11 & B12). Finally, there is no team working night shifts or over the weekend, and they only work from 8 am – 3 pm, 5 days per week, due to there being no overtime incentives. Nevertheless, they are responsible for monitoring all industrial activities in the western region of KSA (B1, B11 & B12). Interestingly, B6 introduced a very important issue, saying, "*it seems that the PME does not have a clear plan and programme to improve environmental awareness among society and employees in the industrial sector, or to enforce and apply local environmental legislation and rules*". This was born out by the documents that contain the numbers of organizations that obtained a PME licence from 2008 – 2011. These four Excel documents, one file for each year, showed that by 2011 only 86 out of 573 (15%) of the IC organizations had a PME licence (PME, 2011), whereas it was planned that by 2006, all the organizations should have this licence.

These points can be summarised into three, thus:

- Shortages of staff and qualified personnel (B1, B2, B3, B4, B5 & B6).

- Lack of facilities and equipment to carry out their work effectively ranging from having no laboratories to a shortage of measurement devices (B1, B2, B3, B6, B11 & B12). Too few fines are gathered to fund extra resources.
- Lack of cooperation between the relevant authorities such as: Modon, the Ministry of Commerce and Industry, the Jeddah Municipality and the universities and research centres (B1, B5, B7, B11 & B12).

When the first set of interviewees were asked "From your experience, what does the PME need to do to improve its environmental protection efforts?" all of them emphasised that the PME needs to focus on raising environmental awareness among the managers in industrial sectors by conducting environmental lectures, courses, sessions and training, and by publishing and distributing brochures and booklets on environmental awareness. A1, A3, A7, A12 and A14 also added that the PME needed to increase the numbers of inspection teams, the number of people in each team and also to ensure the members of these teams were better qualified to carry out the work. Organizations that have an EMS, ISO14001 and PME licence such as (A3 & A9) suggested a 'carrot and stick approach' by rewarding and stimulating committed organizations at a ceremony in front of everyone, honouring achievements in environmental protection to encourage those organizations which were less committed.

The second set of respondents also confirmed that the PME needs to increase its efforts in raising the level of environmental awareness among society and the workers in industrial sectors, and in monitoring and controlling the environmental situation in the IC in Jeddah. As well as confirming the need to increase and employ better qualified staff responsible for the monitoring and inspection processes (B1, B2, B3, B5 & B6), they made some additional and pertinent points, such as:

- Increase the cooperation between PME and other relevant governmental departments and private bodies such as: Modon, the Ministry of Commerce and Industry, Saudi Customs, the Jeddah Municipality, the Jeddah Chamber of Commerce and Industry, Universities and research centres (B1, B4, B5, B6, B7, B11 & B12).
- Improve the PME's ability to conduct its duties by, for example, providing measurement devices and laboratories. The problem is the limited annual budget. No action plan exists at present to provide a budget large enough for the additional equipment and facilities that are evidently needed. This may be a reflection of the lack of general awareness of the enforcement difficulties facing the PME on the

part of the upper echelons of government, in particular those who allocate budgets (B2 & B3). This is affected by the prevailing political and administrative culture; the KSA, as an absolute monarchy, has a centralized decision-making process, and Ministers may not be fully appraised of the importance of the PME (Al-Gilani and Filor, 1999).

- PME needs to determine its goals and work through an appropriate and specific programme (B6).

4.3.3 Identify the obstacles facing the implementation of EMSs

The main obstacles facing the implementation of EMSs in the IC in Jeddah as derived from the first set of interviewees' answers to this theme's questions (see 2.6.2.1), can be summarised as follows:

- Lack of legal information, enforcement and monitoring of the environmental legislation and rules (A1, A2, A3, A4, A6, A7, A9, A10, A12, A13 & A14).
- Low environmental awareness, whether on the part of managers, workers or society in general (A2, A3, A4, A5, A6, A7, A9, A10, A11, A12 & 14).
- The high cost of environmental initiatives and modifications that might be requested (A1, A2, A4, A5, A8, A10, A12 & A13).

The second set of interviewees also emphasized these obstacles: lack of legal information (B1), enforcement and monitoring (B2, B3, B4, B5, B6, B7, B8, B9 & B10); low environmental awareness (B1, B2, B4, B5, B6, B7, B8, B9 & B10); and the high cost of environmental initiatives and modifications (B1, B2, B3, B4, B7, B8, B9 & B10). They added some other points, which are detailed below.

B6 was concerned by the fact that environmental responsibilities are not well-defined in the organizations; there is no specialized section or department to address environmental issues in most organizations in the IC. He also said that the lack of understanding of the term 'sustainable development' and the need to control the use of resources represent obstacles to the implementation of EMS in the IC, from his point of view. A further point emphasised by B6, and which is supported by A8 in the first set of interviews, was that there are no incentives for organizations to commit themselves to the environmental laws.

B1, B11 and B12 spoke about the lack of cooperation, integration and coordination between the PME and relevant government departments such as Modon, the Ministry of Commerce and Industry and Saudi Customs.

B2 was concerned about the limited number of companies specializing in the safe disposal of liquid and solid waste, which means that the waste companies cannot satisfy all the demand for their services, allowing them to charge higher prices. Also there is a shortage of energy optimization companies in the KSA, making it difficult for Saudi organizations to comply with some of the national environmental rules and guidelines.

A8 and B5 highlighted the fact that small industrial establishments find meeting the environmental requirements very expensive.

When the organizations that do not have an EMS were asked "How do you avoid legal sanctions, for example, forfeiture of operating permits and financial fines and penalties that hamper business activities?" their answers send strong signals that changes are needed. For example, several (A2, A5, A7 & A10) laughed when asked about penalties for noncompliance with environmental rules. They implied that essentially, there were no penalties. A1, A6, A8 and A12 confirmed that the monitoring and inspection processes were weak. A4 stated that one of his organization's neighbours reported his firm to PME, and subsequently in 2011 the PME inspection team fined them 30,000 SR (£5,250) for two violations (for not controlling their emissions (see Figure 4.1) and not having the PME licence). The representative of A4 (Factory manager) said "*I went to PME to discuss this issue with them and after long negotiations they kindly reduced the fine to 20,000 SR (£3,500) when I promised and wrote a pledge to apply some filters to control emissions*". The pertinent point here is that the Figure 4.1 photographs, taken in May 2012 (one year later and following the winter rains), reveal that the situation at the A4 site is still unacceptable; A4 was supposed to have improved the situation through adding filters to reduce the emissions from their stacks (as promised) but a layer of white dust from the factory still covers the trees and pavement on the opposite side of the road. The first and second pictures show that this dust is thick on the pavement and trees immediately opposite the factory but the trees further down the road beyond the boundary of A4 are still green and are not affected. The third picture shows a view of the roadside and trees directly opposite the A4 organization; everything including a small building is white with A4 dust. Although the trees still retain their leaves, the one on the right is dead and the one next to it is probably dying. This case was not followed up by the authorities and this organization has made no attempt to obtain an EMS, ISO14001 or the PME environmental licence. This emphasizes that the monitoring, follow-up processes and legal sanctions are very weak in the IC in Jeddah.

Figure 4.1: Environmental pollution continues one year after fines were imposed (photos: May 2012) a) the factory on white dust deposits in the immediate vanity; b) trees further down the road are unaffected; c) the environment opposite the factory is covered in a layer of white dust.

The second set of interviewees also stressed that the monitoring and inspection processes were very weak (B6 & B7) and added that the inspectors were not specialists or well-qualified (B2 & B3). B5 laughed saying "*it depends on luck. The inspection process happens rarely and the inspectors select the organizations randomly, unless they have received a report about them or if they happen to notice something which attracts their attention while they are in the vicinity*".

B1, Director of the Environmental Licences department at PME, stated "*I do not really know how these organizations can avoid legal sanctions but I would confirm that our staff did inspection tours and the evidence is that there are many organizations in the IC which have the PME environmental licence*". In this respect the researcher continued "*Yes, but all organizations in KSA should have had this licence by 2006 and yet the percentage of organizations that obtained PME licences is still very low*". B1 replied "*actually, the* *environmental inspection department in the PME suffers from a shortage in its capabilities to cover all the western region of the KSA that they are responsible for; consequentially, we have a shortage in monitoring and inspection processes, but the PME does its best to do its duties".*

B8, B9 & B10 (EMS consultants and auditor), from their experiences, stated that the lack of legal enforcement and monitoring of the environmental legislation, low environmental awareness (whether on the part of managers, workers or society in general), and the high cost of environmental initiatives and modifications are the main challenges facing the implementation of EMS in KSA. In addition, B6, B8, B9 & B10 confirmed that these are also challenges to EMS adoption in the wider Middle East region. They stressed that bodies engaged in environmental legislation in KSA should look to any other successful initiatives being adopted in the region, particularly in raising environmental awareness and in monitoring compliance with the current environmental legislation as well as in promoting the concept of sustainable development.

In this context, A9, for example, noted two successful environmental initiatives in the Kingdom of Jordan to overcome the challenges facing EMS implementation. The first one is related to addressing the low levels of environmental awareness in the Kingdom (both on the part of managers and workers as well as society at large); it entails participation in the Eco-Schools programme, which is the largest international award programme for sustainable schools in the world. This programme is operated by the Foundation for Environmental Education (FEE) and aims to raise awareness of sustainable development issues among students through school as well as through community action. The national representative of Eco-Schools in Jordan is 'the Royal Marine Conservation Society of Jordan' known as (JREDS). JREDS, in collaboration with the Ministry of Education in the Kingdom of Jordan, conducts a competitive contest between Jordanian schools, during which the school follows a simple seven-step process and commits itself to a set of environmental management standards relating to particular environmental issues, ranging from rationalizing the consumption of water, energy and natural resources, through managing waste streams, to healthy living and biodiversity. The participating schools (95 schools in 2013) develop an action plan to be adopted based on the results of the evaluation of the environmental situation at the school. This action plan should include activities and steps to be taken by the school to resolve any environmental problem that falls under the identified themes, coupled with the required tasks and a timetable for completion. A specialised committee consisting of JREDS and the Ministry of Education choose four schools each year as winners, raising a green flag above them, which symbolizes that these institutions have applied sustainable development programmes for a full year (see further discussion in Chapter 5).

The second environmental initiative mentioned by A9 is the creation of the Environmental Police Department in Jordan; this relates to addressing the current lack of monitoring and enforcement of environmental regulations. This department was established by royal decree in June 2006. At the end of 2008, it was renamed the Royal Department for Environment Protection (RDEP), wherein the officials are known as Rangers. This department represents an environmental institution that is unique both in Jordan and in the Middle East. The Rangers operate as a unit of the Public Security Directorate (PSD), and as the executive arm of the Ministry of the Environment (ME). Although they work to improve the quality of the environment and its various elements through the effective compliance-monitoring and enforcement of the environmental legislation, they also work to increase public awareness of environmental issues by disseminating informative materials. In other words, the Rangers are fulfilling the duties (in Jordan) that should be undertaken by the PME (in the KSA); this issue will be discussed in the next chapter.

4.3.4 Identify the possible environmental benefits to be derived from implementing EMSs

4.3.4.1 Environmental and economic benefits of implementing EMSs

All the interviewees in the second set of interviews are agreed that EMS has a dominant role to play in the effective and sympathetic management of natural resources and in achieving environmental improvements within the business and industry sectors for achieving sustainable development. This role has been confirmed by those organizations that have an EMS (A3, A9, A11, A13 and A14) in this research. They are agreed on the environmental benefits that they have experienced in implementing EMSs in their businesses, especially in terms of reducing their use of energy and water as well as in the production and management of waste streams.

A3 stated that his organization has been certified to ISO14001 since 2005. A3 said: "*every year we satisfy the Surveillance Auditor, and every 3 years the whole factory is recertified for the next 3 years based on improvements and sustainability*".

Accordingly, A3 stated that they had improved their environmental performance by implementing formal EMS. Indeed, they reduced their total for hazardous and non-hazardous waste annually by 133.78 tonnes between 2008 and 2013. They reduced their hazardous waste by 19.38 tonnes annually; it was about 190 tonnes in 2008 but fell to 93.1 tonnes in 2013, which represents a 49% reduction in total hazardous wastes over this timeframe. For non-hazardous waste, A3 stated that they had reduced it by about 48% over the same period; it was 1,100 tonnes in 2008 but this fell to about 528 tonnes in 2013, which is about 114.4 tonnes of annual reductions.

A3 further stated that his organization had reduced its consumption of water from 110,000 m^3 in 2008 to 94,600 m^3 in 2013, which means that they have saved about 14% (15,400 m^3) of their water consumption. In addition, their energy usage has been reduced by 35%; it was 120,000 GJ in 2008 but was reduced to 78,000 GJ by 2013. A3 also stated that they have reduced their CO_2 emissions by 53%; they were 25,000 tonnes in 2008 but fell to 11,750 tonnes in 2013, representing a reduction of 2,650 tonnes in CO_2 emissions annually.

A9 reported that his organization has improved the environment of their production area by decreasing the average noise levels and temperatures; the previously high levels were affecting the employees' health. They decreased the noise level from an average of 94 decibels down to 88 decibels, and decreased the temperature from an average of 30.16 $^{\circ}$C to 28 $^{\circ}$C by using specialized engineering techniques. A9 added that they had greatly reduced the consumption of water, from 10-15 m^3 per tonne of their production to 6-6.5 m^3/tonne. Additionally, electricity consumption in the production processes area was decreased from 35,000 kWh/month in 2010 to 34,500 kWh/month in 2013, which means that they saved about 6,000 kWh/year.

A13 stated that, although their total production had increased by about 183,000 tonnes (as of 2013; it was 9,130,000 tonnes in 2012), they have been able to make a number of improvements, particularly in decreasing their consumption of water and energy (electricity), and in the production of solid and liquid wastes. Table 4.3 presents the consumption of water, showing that per-unit consumption has been reduced by 1.87%; it was 10,933 m^3 in 2012 whereas it was 10,944 m^3 in 2013 despite the total increase in production. Likewise, energy consumption (electricity) was decreased by 1.96% during 2012 – 2013; the per-unit consumption of energy in 2012 was 229,560 kWh but become 229,583 kWh in 2013. The total reduction in waste (solid and liquid) between 2012 and

2013 was 5.79%, despite the increase in production. Solid waste in 2012 was 760,000 tonnes, whereas in 2013 it was 750,000 tonnes (a 3.25% improvement); liquid waste in 2012 was 8,490 m^3, whereas in 2013 it was 8,440 m^3 (a 2.54% reduction).

Table 4.3: Environmental reductions and percentages of environmental improvements in A13

	2012	2013	2012	2013	Improvement %
			Ratio	Ratio	
Total Production (tonne)	9,130,000	9,313,000	-	-	
Solid waste (tonne)	760,000	750,000	0.083242	0.080533	3.25%
Liquid waste (m^3)	8,490	8,440	0.000930	0.000906	2.54%
Water consumption (m^3)	10,933	10,944	0.001197	0.001175	1.87%
Electricity consumption (kWh)	229,560	229,583	0.025144	0.024652	1.96%

A11 and A14, although claiming to have an EMS and being agreed that environmental performance can be improved by implementing EMSs, do not have the environmental records, information or data to explain the improvements that they have achieved. They just noted the financial benefits of selling their wastes to the contractors who resell to other organizations that use this waste in their activities or export it to other countries such as China or India. A14, for example, said: "*the disposal of our solid waste was costing us about 850 SR* (£150) *per tonne, but now we sell one tonne of waste of broken glass by 200 SR* (£35)*, we earn about 30,740 SR* (£5,380) *from selling 150 tonnes of waste glass per month. Also we sell one tonne of waste plastic by 5000 SR* (£875)*, which is about 67,500 SR* (£11,814) *of 13.5 tonnes per month*".

For those organizations that have an EMS A3, A9, A13, and also A11 and A14 who claim to have it (see Table 4.1), the motives for implementing an EMS are varied; this was evident when they were asked "Why did you adopt EMS or ISO14001?" Supply chain pressures play a part, for example, A3 a supplier for some international organizations, and A9 & A13 are part of a group of multinational companies. The organization's image is also important, and in this respect, the attitude of A11 is significant. This is a popular organization in the food industry locally and regionally. It was founded in 1974 in Jeddah and soon became one of the most popular fast-food chains in the Middle East. This food organization is classified as one of eight foreign fast-food chains "worth a taste" in the world, according to a CNN report entitled 8 Foreign Fast-food Chains Worth a Taste (CNN, 2011).

Interestingly, A11 complies with all food safety-related regulations/legislations and ISO 22000:2005 and ISO 9000 requirements. It says it has an EMS and yet this is only partially true as it is not accredited to ISO14001 and/or PME. This organization appears reluctant to admit this as it would be bad for its image.

A13 was asked "Why do you have an EMS and ISO14001 accreditation and do not have a PME environmental licence, which is easier to get?" A13 replied "*to get a PME licence I have to conduct an environmental impact assessment study through one of the authorised environmental consulting offices, and this will cost me a lot of money while my business will not be affected without this licence*". In other words he would have to go to much trouble and expense for a licence which would not enhance his business.

The answers given by A3, A9, A11 and A13 strongly indicate that enhancing the image of the organization (by obtaining environmental accreditation) provides them with economic advantages in the local and international markets, although a causal link between having an EMS and deriving economic advantage cannot be proven. A13 stated that having an EMS accredited to ISO14001 had improved the environmental performance of his organization (an important fact for a multinational organization such as his), but he also argued that their approach had brought economic benefits. A13 is attempting to increase the customer trust in their product, strengthen the brand and increase product proliferation, and reach some markets that prevent the import of products from environmentally non-certified companies (A9 & A13).

When A13 was further asked about his accreditation to ISO14001, he said: "*just to show*" by which he meant that it was necessary to have documents to demonstrate his compliance, and he later confirmed this was the case. Thus, it appears that his organization is keen to achieve its environmental and management objectives, but also there are economic motives for improving its image and enhancing its reputation, and therefore they have obtained EMS and ISO14001 accreditation because of their good reputation. This may contrast with his comment above about the extra costs involved in obtaining the PME environmental licence (relative to any benefits to be gained), as he is otherwise keen to promote his business in the eyes of the public; this possibly reveals an uncomfortable perception – that the PME licence carries little credibility in the Kingdom and therefore in the eyes of managers.

A14 suggested a different motivation for applying EMSs, saying that it was in order to "*assist in avoiding potential legal sanctions, so we are accredited to the PME environmental licence*". Most of the replies, however, have shown that the threat of legal sanctions is not the main incentive for implementing environmental initiatives in the IC. Awareness of environmental legislation on the part of the general public is at a very low level in the KSA (Tortell, 2004; Magram, 2009; Zabin, 2010), so there is no customer pressure over environmental concerns. This point was also confirmed by the interviewees who were asked '*what about public pressures?*' Most (19 interviewees) agreed there was no environmental pressure from customers in the KSA except for B3 and B5 who said there was some pressure but it was very weak. Further examples indicating the need to raise environmental awareness among Saudi society were given in the answers from B1: "*as a result of low environmental awareness in KSA society, there is no pressure from customers and the general public for change*" and B6 who added: "*it is necessary to focus first on raising environmental awareness to bring about customer pressure*".

This set of interviewees stated that environmental and economic benefits are the main benefits resulting from implementing EMS in the IC, and B6 added that promoting the concept of sustainable development cannot be ignored in this context. B1 & B3 claimed that legal enforcement was the main reason behind implementing EMS in the IC, whereas the rest of the interviewees (eight of the twelve) agreed that economic reasons such as enhancing the image of the organization and supply chain pressures, are the main reasons that encourage the implementation of EMS in organizations in the IC, and "*legal enforcement is weak*" (B2, B4, B5 & B7), and also "*there is no legal enforcement of environmental legislation and rules*" (B6).

4.3.4.2 The cost of implementing EMSs in the IC in Jeddah

In this context, to provide a more compelling case of the benefits to be derived from implementing EMS in the IC, the researcher asked the organizations that have formal and informal EMS about the cost, management, hurdles, staff engagement and consultancy use that they have experienced in their adoption of EMSs.

ISO14001 accreditation costs (for those organizations who are ready and who feel that they do not need to engage EMS consultancy bodies to learn about the systematic implementation and the benefits of EMS) are about 35,000 SR (£6,125), but for those need to use consultants the cost ranges between 45,000 SR (£7,875) and 60,000 SR (£10,500) due to the cost of consultancy services and annual review visits (by auditors who may or may not belong to an EMS consultancy service), which is about 3,500 SR (£612.5) per visit (A3, A9, A13, B8, B9 & B10).

A3 who implemented EMS under ISO14001 and did not use consultants, for example, stated that EMS implementation cost them about 105,000 SR (£18,377); ISO14001 accreditation processes cost 35,000 SR (£6,125) and 70,000 SR (£12,251) for environmental modifications and improvements.

Adoption of ISO14001 for A9 cost them 80,000 SR (£14,000); about 50,000 SR (£8,750) was the cost for ISO14001 accreditation and consultants, and about 30,000 SR (£5,250) for environmental changes. Whereas A13 was accredited to ISO14001 for a total of 65,000 SR (£11,376); 45,000 SR (£7,875) was the cost for consultants and ISO14001 accreditation processes, and the rest was for making environmental modifications.

A11 stated that applying informal EMS in their organization cost them about 46,000 SR (£8,050) for environmental initiatives. Having an EMS cost A14 40,000 SR (£7,000) for the consultants and environmental improvements.

The interviewees were asked about the practical processes they have instituted within their organization for managing their commitment to EMS. The answers given by A3, A9 and A13, who have an EMS / ISO14001, are typical in that they now have environmental departments in their organisations. A3 added that his organization now has an Environmental Department as well as a Quality Assurance Department, and stated that these two departments now have their own managers; it is their responsibility to consult with or to seek advice from the PME on all environmental standards. A9 concurred, saying that his organization now has an environmental and safety department; again, this department has its own manager, whose responsibility it is to check the waste levels against the PME criteria at regular intervals. A13 reported that they now test their waste in their own laboratory on a daily basis, but it is the production manager who is responsible for checking that the organization’s waste meets all the PME criteria. A11 and A14 were also asked about this issue; they assert that they have an EMS, and that they manage the necessary processes through the Safety Department (in A11) and through the Departmental Manager (A14).

When asked “where did you find the hurdles to adopting EMS?” A3, A9, A13 & A14 stated that the implementing step of the five basic EMS steps represented a significant hurdle, as it includes documentation as well as employee training and awareness; this was confirmed by B8 & B9. A9 added that the planning process represents a major hurdle in the initial stage due the need to define the activities and products that interact with the environment and safety, and their impact on it. A11 considered checking and monitoring to be the main hurdles in the process of implementing EMS in their organisation.

All the organizations that have an EMS or ISO14001 (A3, A9, A13, A11 & A14) confirmed that all staff, from top managers to the workers, were engaged in the process of implementing EMS in their organisations. All staff therefore have the opportunity and responsibility to contribute to environmental achievement (A3). Staff engagement is the guarantee to being awarded ISO14001 and to continual improvement (A9). The environmental responsibilities and authorities within the organization are well-defined and clear for all of the staff members and departments (A13).

4.4 Summary of the findings of the qualitative data analysis

This stage of the research’s analysis pertains to the qualitative data covering interviews and documents. A number of findings have been delivered and issues of particular themes (i.e. related to the four objectives) are highlighted below.

- **Determine the current scope of EMSs in the various industrial plants.**

Most of the interviewees in the first set of interviews (A1, A3, A5, A7, A9, A10, A12, A13 & A14) felt strongly that the environmental situation in the KSA in general, and more particularly in the IC in Jeddah, was unsatisfactory. This view was confirmed by all the interviewees in the second set. Both sets of interviewees identified the industrial sector as bearing a large part of the responsibility for this. There were, however, five organizations in the first set of interviews (A2, A4, A6, A8 & A11) who contradicted the majority view about the environmental situation in the IC in Jeddah describing it as satisfactory and dismissing any suggestions that their impact on the environment was harmful.

All interviewees (including those who thought the environmental situation satisfactory) recognised the necessity of implementing EMSs in the industrial sector, even those who said they did not know what EMS was but still had a general idea of its purpose. They felt that it was important to confront the serious dangers that these activities might further degrade the environment and have more of a negative impact on society. In addition, they admitted that in their opinion, private Saudi organizations were lagging behind with the implementation of environmental management, when comparisons are made with organizations in the developed world. This situation is thought to be a result of the absence of legal enforcement of environmental legislation and rules; the absence of legal monitoring; low environmental awareness among management and workers in the industrial sector; the high cost of environmental compliance; and the scarcity of sources of environmental information.

Although the environmental situation in general in the IC is unsatisfactory, the organizations that do not have any form of EMS, in the absence of environmental monitoring and control, tend to disclaim responsibility for any negative conditions, and prefer instead to blame other organizations, for example, the Food manufacturers who blamed both the Metal and the Chemicals and plastics industries.

Three organizations have an EMS under ISO14001 in the IC and are generally committed to the basic processes of EMS (policy-making, planning, implementing, checking, and reviewing); they also use local criteria or standards for controlling and assessing their environmental performance, and recycle and reuse their solid and liquid wastes and sell the remainder to waste disposal companies. They therefore claim to be implementing full EMS compared with organizations that have just an EMS and/or a PME environmental licence.

Organizations that have an EMS and/or PME environmental licence may claim to apply an EMS when in fact they only implement a small portion of one or some environmental initiatives that assist in controlling their activities. Ostensibly, they appear to be making efforts to comply and may even seek to gather official papers to confirm that they are taking steps to achieve compliance with national environmental legislation and rules. Generally, the organizations that had an EMS or a PME environmental licence gave more positive answers to environmental questions than organizations that did not have any practice of EMS – and the latter are the majority of those surveyed (nine out of fourteen).

In this context, the activities of these organizations that had an EMS, ISO14001 or a PME environmental licence ranged between Chemicals and plastics, Food, Building materials and glass, and Paper and printing. Furthermore, 80% (four out of five) of them can be classified as large-sized organizations, which suggests that large-sized organizations are more likely to take environmental initiatives than medium and small-sized organizations in the IC in Jeddah. This is also the case, for example, in China (Zhang *et al.*, 2008), Spain (Aragón-Correa *et al.*, 2008) and Italy (De Marchi and Grandinetti, 2012).

- **Assess the current level of the PME's awareness raising and control efforts**

As a result of the absence of clear goals, plans or programmes, the PME's efforts in raising environmental awareness and controlling the worsening environmental situation in the IC in Jeddah are very weak. There are shortcomings in PME's environmental efforts in: awareness, information, training, enforcement, monitoring and control. Therefore, a large number of organizations' representatives in this survey do not have any clear idea what "EMS" and "environmental protection" mean, although in some sectors this is not unreasonable. Furthermore, some of these organizations have never even heard about the PME environmental licence and they were surprised when the researcher asked them if they had it.

The PME needs to increase its efforts in raising the level of environmental awareness among society and the workers in the industrial sector, and in monitoring and controlling the environmental situation in the IC in Jeddah. This could be done by increasing the number of its staff as recommended by several of the respondents (see section 5.2.2 for further discussion). It also needs to raise the professional qualifications and standards of PME's staff, particularly among those who are responsible for the monitoring and inspection processes. The cooperation between the PME and other relevant governmental departments and private bodies needs to be strengthened and the PME needs more authority, and of course, the means to apply that authority. Specific goals must be identified and an appropriate programme developed to achieve them.

- **Identify the obstacles facing the implementation of EMSs**

The obstacles facing the implementation of EMSs, as derived from the qualitative data analysis, are:

- Low environmental awareness, whether on the part of workers or society as a whole.
- Lack of legal information, enforcement and monitoring of the environmental legislations and rules.
- The high cost of environmental initiatives and modifications that might be requested.
- The poor definition of environmental responsibilities; there is no specialized section or department devoted to environmental issues in the majority of organizations in the IC.
- The lack of cooperation, integration and coordination between the PME and relevant governmental departments such as Modon, The Ministry of Commerce and Industry, and Saudi Customs (who are in a position to support the PME in its efforts to enforce the environmental regulations by checking that no permits are issued for the importation of machinery or equipment to any organization that violates the environmental regulations of the KSA; this supports the PME by encouraging organizations to comply with these regulations through adopting an EMS approach).
- The lack of companies specializing in the safe disposal of liquid and solid waste, and of energy optimization companies in the KSA, which could assist Saudi organizations in complying with the national environmental legislations and rules.
- The small size of the industrial establishment; this can make instituting the environmental requirements in some organizations very expensive.
- Lack of understanding of the term ‘sustainable development’ and the need to control the use of resources.
- The absence of incentives for organizations committed to environmental laws.

Some suggestions were provided to address the main challenges to implementing EMS in the IC in Jeddah. These suggestions included raising environmental awareness within society (e.g. the Eco-School programme) as well as in the business sector, and bemoaning the absence of an effective environmental regulatory authority.

- **Identify the possible environmental benefits to be derived from implementing EMSs**

The possible environmental benefits to be derived from implementing EMS, in the absence of an effective environmental regulatory authority, and without public and customer environmental pressures, can be summarised as:

- Improving the environmental capability and performance of organizations with consequent improvements to the health and society of the KSA.
- Reducing consumption and associated costs relating to water, resources and energy.
- Reducing effluent, general waste and CO_2 emissions.
- Increasing environmental performance enhances the image of the organization.
- Providing economic advantages for the organization in local and international market (supply chain – multinational organizations).
- Promoting the concept of sustainable development.
- Avoiding legal sanctions.

The cost, management, hurdles, staff engagement and consultancy use that organizations have experienced in the adoption and implementation of formal and informal EMSs have been addressed to provide a compelling case for others to implement EMS in the IC.

Chapter 5:

Discussion of the research findings (quantitative and qualitative data)

5

5.1 Introduction

This chapter discusses the findings that have been derived from the quantitative (questionnaire) and qualitative (interviews and documents) data. The discussion is structured according to the objectives of this research.

5.2 Discussion of research findings

183 out of 573 organizations in the IC in Jeddah participated in this research, which used both quantitative and qualitative methods in an embedded single case study; this further entailed engaging 14 of the organizations (that had already participated in the questionnaire) to be interviewed as well. In addition, a second set of interviews (12 interviews) was conducted with various relevant governmental departments and some private bodies (see Table 4.2).

The objectives of this research are to:

- Determine the current scope of EMSs in the various industrial plants.
- Assess the current level of the PME’s awareness raising and control efforts.
- Identify the obstacles facing the implementation of EMSs.
- Identify the possible environmental benefits to be derived from implementing EMSs.

A number of findings were delivered and issues of particular interest (i.e. related to the four objectives) are discussed below.

5.2.1 Determine the current scope of EMSs in the various industrial plants in the IC

At the start of this research, it was hard to locate an appropriate person in each organization to complete the questionnaire and answer the questions. In fact, one of the most significant findings was that almost 94% of organizations in the IC that participated in this study do not have a dedicated environmental manager specifically responsible for addressing environmental issues and controlling emissions. This is supported by the negative attitudes (Disagree) in the overall results pertaining to the organizations' attitudes to statement 16 of the questionnaire (the environmental responsibilities and authorities within our organization are fixed and clear) (see Table 3.7). In addition, examination of the relationship between the responses to questions 10, 12 and 13, which relate to having an EMS, ISO 14001 and the PME environmental licence, and statements 14 to 21, which relate to the characteristics and efficiency of any already-established EMS (Table 3.12), showed a high number of negative answers ('Disagree' and 'Strongly Disagree') to this statement (16).

Furthermore, Table 3.7 also showed the negative attitude (Disagree) of the organizations to statement 19 (in the organization specific environmentally focused training programmes are established for employees whose work may have deleterious impacts on the environment). This negative attitude of the organizations was also emphasised in Figure 3.11 and Table 3.12 by the high number of ('Disagree' and 'Strongly Disagree') answers to this statement (No. 19) with a large margin between these and the other responses. Altogether there were 183 responses to the statement; 149 (81.4%) 'Disagree' or 'Strongly Disagree' that there are adequate training programmes. As expected, of the 149, as many as 139 (93.3%) come from organizations that do not have EMS and answered negatively to this statement (No. 19). Organizations that claimed to have an EMS and PME environmental licence also delivered high numbers of ('Disagree' and 'Strongly Disagree') answers to statement 19 (EMS-only organizations 10 out of 30 and PME-licenced organizations 16 out of 32. ISO14001-accredited organizations (20), which should have environmentally focused training programmes, responded more positively. Only 4 (2.7%) 'Disagree' (none of them 'Strongly Disagree'); 6 were 'Neutral' and the remaining 10 both 'Agree' or 'Strongly Agree', implying that in these organizations there are appropriate training programmes. This, in general, suggests that there are insufficient numbers of personnel adequately trained in environmental matters across the IC, from which we may infer that there is insufficient awareness of the possible consequences of their work on the environment.

As mentioned in the literature review, implementation of EMS is negatively influenced by the lack of knowledge, skills and relevant qualifications of many practitioners of EMSs. Consequently, the greatest predicted problems in the implementation of EMSs in industry is the scarcity of qualified staff (Gunningham, 2007; Chan, 2008; Lam *et al.*, 2011), in particular in developing countries (Massoud *et al.*, 2010b). In addition, Chan (2008) in his study on barriers to EMS in the hotel industry in Hong Kong considered the lack of professional advice as the second most important barrier to EMS implementation and suggested that the organizations needed experienced consultants that might assist them to develop the system. Only 11 (6%) of the 183 organizations studied had explicit and well-defined responsibility for environmental management issues, although the respondents may have been expressing subjective and imprecise views. Nearly all the respondents who took part in this research were graduates but their education background/specialisms varied, 105 (57.4%) Engineering, 57 (31.1%) Management, 14 (7.7%) Chemistry, 4 (2.2%) Arts and 3 (1.6%) Business.

Where there were no environmental managers (in up to 94% of the organizations questioned), the owner/manager in most organizations was contacted in order to seek permission for this survey to be conducted; approximately 45% replied to the questionnaire and/or interview themselves, others nominated the best suited of their senior staff, or the most knowledgeable on environmental issues to answer the questions. This indicates that environmental concerns are a very low priority for these organizations when compared with other responses from previous studies on manufacturing organizations whose respondents had explicit responsibility for environmental concerns, for example, Darnall and Pavlichev (2004) found that 85% of their study's respondents in the USA had explicit responsibility for environmental concerns, 71% in Canada by Henriques and Sadorsky (2004), 66% in Germany by Frondel *et al.* (2004) but only 26% in Malaysia by Sambasivan and Fei (2008). Furthermore, these percentages also emphasise the point that a lack of well-defined responsibility for environmental management is one of the main obstacles facing the implementation of EMSs (Morrow and Rondinelli, 2002) especially in developing countries (Zeng *et al.*, 2005; Rodríguez *et al.*, 2011). All the 6% (11) organizations with environmental managers are accredited to ISO14001 and all these organizations are large-sized. 6 of these 11 organizations are also licensed to PME (see Table 3.2).

When exploring the current environmental situation in the KSA, all participants considered it was unsatisfactory and agreed that industry had played a major role in its deterioration. The participants included B1, a representative of PME, and B2 from Modon, the government authority responsible for developing Saudi industrial cities. In addition, B1 added: "*The official environmental concerns in the KSA just started a few years ago. We are just at the beginning*". However, B2 claimed "*We (as a governmental department) have taken great strides in controlling the industrial pollution*". Another respondent (B6) gave 20% as the level of concern about the environment in the KSA. All these opinions indicate that environmental degradation has not been stopped and there are deficiencies in applying the environmental legislation and rules that have been adopted in the KSA.

All 26 interviewees also agreed about the necessity of implementing EMSs in the industrial sector in KSA. It is worth mentioning here that some of the first set of interviewees (A1, A2, A4, A6 & A7) had admitted they did not know what EMS meant when the researcher administered the questionnaire to them.

This research has shown the implementation of EMS in the IC in general is very low. Only 16%, 30 out of 183 organizations that participated in the questionnaire and first set of interviewees have EMS. This information came from the section of questionnaire 'the general information about the attitudes of organizations to EMS' questions about having an EMS, ISO14001 and PME licence (10, 12 &13) (see Table 3.1 and Appendix B). This section also showed the percentages having ISO14001 accreditation and the PME environmental licence in the sample is very low too. 10.9% (20) are accredited to ISO14001 and 17% (32) are licenced to PME. 9 organizations (4.9%) claim to have an EMS (but are not accredited to ISO14001); 133 (72.7%) organizations do not have an EMS, ISO14001 accreditation or a PME licence, which is quite a high percentage (see Tables 3.4 & 3.5).

Although the majority of the IC organizations do not have EMS, they apply elements of one or several environmental practices that assist the control of their activities. In this research, of the 32 organizations that have the PME environmental licence, only 18 organizations have both the PME environmental licence and an EMS but their EMS is not accredited to ISO14001. 14 (7.7%) have the PME environmental licence but do not have an EMS. This means that PME-licenced organizations do not necessarily have an EMS. The PME licence can be obtained by conducting an environmental impact assessment of the organization's facilities and activities, and detailing how they will control their environmental impacts. This study must be submitted through private environmental consulting offices that are accredited and authorised by the PME.

It is axiomatic that all ISO14001-accredited organizations (20) have an EMS but not all ISO14001-accredited organizations have a PME licence. Having a PME licence (which can be obtained without EMS) would be an easy matter for the organizations that have ISO14001 and yet only 11 out of 20 are licenced to PME, which raises many questions over the PME's awareness and control efforts.

The percentages having an EMS and ISO14001 accreditation are very low when compared with the responses to previous studies on manufacturing organizations. Price (2007), for example, conducted a survey on 109 EMAS- or the UK's Control of Major Accident Hazards (COMAH)-registered organizations (contacted via a postal questionnaire). He found that 70% of his sample were accredited to ISO14001 and that the vast majority of the others were accredited to other EMS standards such as: BS 8555, Welsh Green Dragon Standard and The Acorn Scheme (Price, 2007). It should be noted, however, that the sample size is relatively small and that Price only contacted organizations that had taken the trouble to register themselves for EMAS (which is not mandatory, although COMAH registration is). In Argentina, Albornoz *et al.* (2009) found that 55% of their sample of domestic manufacturing sector have an EMS. Chan and Wong (2006), found that 66% of their survey sample of the hotel industry in Hong Kong have an EMS, 28% of them accredited to ISO14001. Furthermore, in Malaysia, Sumiani *et al.* (2007) found that 72%, of their survey sample of top Malaysian companies have an EMS, and that 36% of them are accredited to ISO14001, i.e. about 28% do not have an EMS (Sumiani *et al.*, 2007).

The ISO survey of Environmental Management Systems (ISO14001) Standard Certifications 2013 was published on 12 December 2014 on the ISO website; this is the latest freely available survey. Up to the end of December 2013, at least 301,647 ISO14001:2004 certificates had been issued, a growth of 6% (+ 16,993), more certificates than in the 2012, in 171 countries (ISO, 2014). The top five countries with certificates were China, Italy, Japan, the United Kingdom and Spain, while the top three for growth in the number of certificates in 2013 were China, Italy and India, respectively (Ibid). In the UK, 16,879 organizations are accredited to ISO14001 (ISO, 2014); it should be borne in mind that the total number of registered companies in the UK, covering all manner of enterprises, is over 3 million (GDS, 2014).

From the ISO survey, KSA organizations have only 288 ISO14001 certificates whereas there are 104,735 certificates in China, 24,662 in Italy, 2,244 in Malaysia, 1,733 in Turkey, 16,879 in the UK and 16,051 in Spain (ISO, 2014). Although the adoption of

ISO14001 has been popular among firms in many developing countries (Tambunlertchai *et al.*, 2013), Middle East countries have only 1.1% (3,434) of all ISO14001-certified organizations worldwide, but it represents a growth of 17% (+ 587) more certificates than in 2012 across the region (ISO, 2014). In developed countries, the increasing numbers of organizations obtaining a certified EMS could be due in part to the legal pressure being put on them (Price, 2007).

However, it is widely recognized that implementing ISO14001 in developing countries (such as KSA) that have limited regulatory capacity to monitor and enforce environmental laws and regulations, lack sufficient infrastructure and have weak institutions that are unable to vigorously promote EMS standards cannot guarantee environmental improvement (Price, 2007; Massoud *et al.*, 2010b; Sakr *et al.*, 2010; Tambunlertchai *et al.*, 2013).

From comparisons with the number of accreditations in other countries, the need for this research (which investigates the implementing of EMSs in the IC in Jeddah) becomes apparent; indeed, as mentioned above and as became evident during the administration of the questionnaire, the respondents from the organizations that do not have any accreditation seemed very unclear about what EMS even means. However, there is considerable variation in the answers to each of the questions as to whether organizations had an EMS, ISO14001 or PME licence, and there are some organizations which claim to have an EMS (4.9%), but do not practice EMS as a recognized process.

Chapter 1 discussed the distinctions between ISO14001, a PME licence and the application of EMS. It stated that EMS consisted of five basic environmental procedures (policy, planning, implementation, monitoring and reviewing), which are considered to be fundamental to any full form of EMS (Szymanski and Tiwari, 2004; Arimura *et al.*, 2008; Chan, 2008; Cordano *et al.*, 2010; Sakr *et al.*, 2010). PME licence conditions, on the other hand, merely commit Saudi organizations to take environmental initiatives to control their activities, for example, fitting filters to restrict emissions (as in the case of A4). EMS, however, has a much wider remit and a systematic approach to the management of all environmental aspects including environmental measures, policy targets, planning continual improvements and reviewing achievements to reduce any adverse impacts on the environment (as is evident in the case of the A4 dust deposits in the immediate environs; see Figure 4.1) (Hilal, 2004; Sakr *et al.*, 2010; Heras-Saizarbitoria *et al.*, 2011; Lam *et al.*, 2011).

This research has shown that the 4.9% of organizations that claimed to have an EMS without formal ISO14001 accreditation could not justify this claim as they did not follow all the requirements for the five basic environmental procedures required for full EMS (as mentioned above). Some partially follow EMS standards and considered that what they do is enough to say they have an EMS. Some, while claiming to have an EMS although not practising EMS as a recognized process, have certain environmental management practices and initiatives in place which are related to their particular activity. For example, one such organization in the Food industry made it clear that his organization does not generally have their own environmental policy, keep environmental records or revise their environmental targets periodically, but they disposed of waste products in a way that was environmentally acceptable. He did not think it necessary to apply full PME measurement standards. In fact, the results relating to the attitudes of organizations towards the fundamental characteristics of the EMS in the IC were mainly negative. The five characteristics of EMS (see above) are represented through 8 positive statements (Ques. 14-21 in Part II section A of the questionnaire). The overall results pertaining to the organizations' attitudes towards characteristics of the EMSs are such that 2 median responses to the 8 statements were 'Neutral' and as many as 6 were 'Disagree'; in terms of responses, the organizations in this sample have no positive attitudes toward a full implementation of EMS. This means that the organizations' attitudes towards the characteristics of EMSs in general are largely negative; this is particularly the case when one considers that the respondents who were 'Neutral' may have been unable to say whether or not their organization had a well-defined EMS.

Furthermore, eight interviewees out of fourteen in the first set admitted that they do not apply any of the basic five processes (A1, A2, A4, A5, A6, A8, A10 & A12). A7 did not claim to have an EMS but yet applied two of these processes, planning and implementation. Two organizations, A11 (which does not have a PME licence) and A14 (which has a PME licence) claimed to have an EMS and also said that they applied the same two processes. On the other hand, the organizations that were accredited to ISO14001 (A3, A9 & A13) applied all these processes, an indication of the better control exerted by ISO. Some of the second set of interviewees (B2, B5 & B6) agreed the organizations that have ISO14001 follow all the processes of EMS but that the others follow some but not all of the five processes.

The quantitative data findings relating to the relationships between the general information of the organizations' EMS attitudes (10, 12 & 13) and the characteristics of the EMSs in the organizations in the IC (14 – 21) were negative (see Table 3.12). This is to be expected for those organizations that do not have any EMS; however, for those that do, this reflects the fact that the fundamental characteristics and implementation of EMSs in the organizations in the IC are low, although they are higher in those with accredited EMS.

Three respondents from the first set of interviews stated that the implementation of EMSs in the IC was acceptable in general but they were the two (A4 & A6) who did not have any form of EMSs, and a third (A11) who claimed to have an EMS but did not follow all the processes. All the respondents from the second set of interviews and ten out of fourteen from the first set, all agreed that the implementation of EMSs in the IC had been unsatisfactory. From this evidence and the quantitative data findings, these three organizations (A4, A6 & A11) might have responded in the way they did because of poor knowledge of environmental issues and EMS, or because they were content with the current situation, which reflects their lack of environmental awareness (Gunningham, 2007; Massoud *et al.*, 2010a; Lam *et al.*, 2011), or just because they wanted to hide their failure to follow all EMS processes.

Thus, low levels in terms of implementing EMSs in the IC are clearly observed among organizations that have some form of EMS and the PME environmental licence. Even in some organizations that are accredited to ISO14001, low levels of knowledge about EMS were reported in the questionnaires; some also do not implement their environmental policy in full. Seven respondents reported having an EMS and 12 have the PME environmental licence, two even have ISO14001 (which should have ensured that they have an implementation policy), but the respondents were unable to demonstrate knowledge or show evidence for fulfilling the five steps (policy, plan, implement, check and review). In addition, these organizations do not revise their environmental targets periodically (8 with an EMS and 14 with the PME environmental licence). Again, the two with ISO14001 also failed to revise their targets reflecting the fact that the respondents who answered these statements are not fully aware of all the aspects within EMS and ISO standards. This means that implementing even the basic aspects of EMS may be poor. Indeed, of the few organizations that claim to have an EMS, Darnall *et al.* (2008 p38) makes a relevant comment, "*some organizations may claim to have an EMS when in fact they only have portions of one*".

The research has also shown that most of the organizations in the IC that are ISO14001-accredited are implementing their EMS more carefully, that is, following the five basic steps and applying the PME environmental standards, than those that claim to have an

EMS but, for example, admitted that they only carry out two of these five basic steps, or those who have the PME environmental licence but no EMS. Indeed, overall 83.6% of the organizations admitted that they do not follow an EMS; two from the first set of interviews claiming to have an EMS (without ISO14001) said that they applied just two of these processes: planning and implementation (A11 & A14). Among those organizations that claim to have an EMS such as A11 and A14, this finding confirms the statement made above by Darnall *et al.* (2008 p38), or alternatively, may reflect the fact that the respondents are not fully aware of all the procedures required for EMS.

The answers to the statements relating to determining organizations' attitudes to EMS are important. Overall, attitudes are negative as 'Disagree' is given to six out of eight statements in Table 3.7 but 'Neutral' answers are given to statements 15 and 18 (i.e. within our budget, there is a special item for environmental affairs in the organization; and our organization takes into account any potential sources of pollution resulting from its activities while planning these activities). In addition, from Table 3.12 (the relationships between the general information of the organizations' EMS attitudes (10, 12 & 13) and the characteristics of EMSs in the organizations in the IC (14 – 21)), although the negative answers to these statements are higher than the positive ones, organizations that do not implement any form of EMS, gave more positive answers. Some of them have a budget for environmental affairs and some admit to being aware of pollution that their activities might cause and take this into account. Furthermore, interviewee A7 did not claim to implement an EMS and yet carried out some of the EMS's processes (planning and implementation). These three pieces of evidence suggest that there are some environmental management practices even among the organizations that do not apply any form of EMS in the IC. However, these practices may be inferior to established ones and therefore may be weak, limited and not integrated.

From Table 3.7, overall, organizations' attitudes to statement 21 (there is an effective system within the organization to enforce the application of the organization's instructions concerned with environmental affairs) was negative (Disagree). In addition, Table 3.12 shows that there is a high number of both the 'Strongly disagree' (55) and 'Disagree' (74) responses to this statement, with a large margin between these and the other responses, for all the three questions (10, 12 & 13). This emphasises that environmental concerns and compliance with Saudi legislation and standards are very low among the organizations in the IC; indeed, even those with the PME licence gave significant numbers of ‘Strongly disagree’ and ‘Disagree’ responses to this statement, but ISO14001 accredited organizations responded more positively.

This situation of noncompliance was also emphasised by the answers given in the first set of interviews when interviewees were asked about the criteria or measurement standards that were applied by their organizations for controlling and assessing their environmental performance. It should be noted that there is a list of environmental measurement standards laid down in the Saudi General Regulations and Rules enforced by PME that are mandatory for all Saudi organizations without exception. Eleven organizations out of fourteen who answered the question about implementing EMS in their organizations negatively, did not apply any of the government measurement standards to control their activities. These eleven organizations included A14 who claimed the organization had an EMS and had the PME environmental licence and should have been following these standards. The eleven organizations justified their answers by claiming there were no negative environmental impacts in their organizations or claimed ignorance of the official environmental standards. One other interviewee who claimed to have an EMS, answered that his organization used other standards such as Occupational Health and Fire Protection but these are not environmental standards. In the interviews, all organizations that are accredited to ISO14001 use local and mandatory PME environmental measurement standards to control their activities.

The negative responses to questions concerning the implementation of measurement standards are not altogether surprising as these standards were defined in 1989 and although reissued in 2001 (PME, 2006b), they were not updated. The World Health Organization (WHO), for example, reviewed its guidelines for air quality pollution in 2005 (WHO, 2006) and its current update has not been incorporated into Saudi environmental legislation. Saudi air pollution standards are based on WHO standards issued in 1976 (PME, 2006b p70). In the 21st century, in view of all the developments and changes that have taken place in the KSA in the last 25 years, it is time for these rules and standards to be reviewed as well as enforced.

Further evidence of extensive noncompliance with environmental regulations was revealed in PME’s Report No. NMEC-WQ (2006a) which showed environmental standards for liquid wastes in the industrial cities in Riyadh, Jeddah and Dammam had been exceeded. Also the newspaper article ‘The contamination of Jeddah’s beach has exceeded global standard' by Eshqy (2013), showed serious sewage and liquid waste contamination from industrial activity (see Page 188).

Noncompliance with environmental measurement standards such as those laid down in the Saudi General Environmental Rules (as mentioned above), is believed by some authors in general to cause excessive consumption of natural resources, which in turn threatens sustainable development (McDonach and Yaneske, 2002; Szymanski and Tiwari, 2004; Watson and Emery, 2004; Arimura *et al.*, 2008; Zorpas, 2010). In a sensitive desert environment such as the KSA, a sharp increase in the consumption of natural resources, in particular the use of water from aquifers (Al-Sefry and Şen, 2006), together with uncontrolled industrial activities, have caused severe damage to Jeddah's environment (Vincent, 2003; Al-Sefry and Şen, 2006; Magram, 2009). Therefore, it is essential to enforce the environmental standards to control industrial activity. The standards and laws cannot clean up industrial activity or the environment if they are not rigorously enforced and monitored by governments or their responsible agencies (Tosun, 2012).

The main purpose of implementing EMSs in organizations is to improve their environmental performance and provide a systematic continual improvement process to limit negative environmental effects of their activities (Hilal, 2004; Darnall and Edwards, 2006; Sakr *et al.*, 2010; Heras-Saizarbitoria *et al.*, 2011) as well as to avoid legal sanctions that might include forfeiture of operating permits and financial fines and penalties that affect their business (Davidson and Worrell, 2001; Jiang and Bansal, 2003; Darnall *et al.*, 2008) by following local regulation and legislation (Tam *et al.*, 2006). From the evidence provided above, it seems safe to assert that having a list of standards to measure and assess environmental impacts against in order to control industrial activities, without incentives/deterrents, monitoring and follow-up, is likely to be ineffective (Cohen, 1998; Tosun, 2012). This seems to be the conclusion that this study suggests. This research has provided evidence that there is extensive noncompliance with environmental measurement standards and in such a situation, there is likely to be environmental damage. Indeed, uncontrolled industrial activities as a result of rapid industrialization and urbanization in Jeddah have been accompanied by severe environmental degradation (Magram, 2009) and is one of the main reasons for air quality deterioration (Vincent, 2003; Magram, 2009) and soil pollution (Kadi, 2009). In addition, the potential for serious air quality problems are promoted by the climatic conditions of the Jeddah region, typified by light winds and high temperatures (Zerbonia *et al.*, 1986).

The reuse, recycling and reduction of waste has to play an important role in achieving improvements in the environment in the IC. This was discussed in chapter 4 (see Section 4.3.1) and all of the first set of interviewees responded positively and indicated that if there was a commercial incentive, more could be achieved in this direction. In the IC, the organizations that apply the full form of EMS, especially those that are accredited to ISO14001, reuse and recycle their waste (solid and liquid) themselves and benefit economically from sales of the remainder. The problem at present, as explained by six interviewees, is the shortage of contractors who assist the organizations to dispose of their unwanted and dangerous liquid and solid waste, and the high fees they charge. The cost of environmentally friendly methods of waste disposal is not likely to decrease. Significantly, in recent years, the price of waste disposal has increased and can be expected to continue to do so in the coming years, as efforts are made to place less reliance on landfills and to increase recycling and reuse (Barlaz *et al.*, 2004). The government, working in conjunction with the PME, should consider offering incentives for a reduction in the amount of waste produced and for recycling it economically; a landfill tax would promote waste management, and the funds raised could be employed in prosecuting unauthorized dumping. There is much discussion in western and developed countries about modern methods of waste disposal many of which can be used to generate electric power. These methods should be studied and lessons learned (Rentizelas *et al.*, 2014).

This research has hypothesized that organizations accredited to ISO14001 in the IC are generally committed to the basic processes of EMS (policy-making, planning, implementing, checking, and reviewing); they also use local criteria or standards for controlling and assessing their environmental performance, and recycle and reuse their solid and liquid wastes and sell the remainder to waste disposal companies. They therefore claim to be implementing full EMS compared with organizations that have just an EMS and/or a PME environmental licence. Furthermore, obtaining certification of EMS means that the organization’s EMS has been successfully audited by one of the accredited certification bodies (Price, 2007).

This confirms the findings of a number of researchers that many organizations which attain certification of a formal EMS, such as ISO14001, have more beneficial impacts on environmental performance than organizations that do not possess an EMS certificate (Melnyk *et al.*, 2003; Gavronski *et al.*, 2008; Nishitani, 2009; Heras-Saizarbitoria *et al.*, 2011).

It transpires from quantitative and qualitative findings that organizations that are ISO14001-accredited are all classified as Large-sized. Large-sized organizations of the study's sample represent 47.0%, 29.0% are Small-sized and 21.9% Medium-sized; there were very few Micro-sized organizations (2.1%). None of the Medium, Small or Micro-sized organizations have ISO14001 accreditation. In addition, Large-sized organizations have higher percentages of EMS, ISO14001 and PME licences than Small and Medium-sized organizations. Even if they do not have an EMS, Large-sized organizations are more likely to have environmental initiatives than SME organizations in the IC in Jeddah (see Tables 3.9 and 3.11). Furthermore, in the interviews, A8 and B5 suggested that the small size of an organization was one of the barriers obstructing implementation of EMS in the IC. This can be associated with previous research that has demonstrated the economic implications of adopting EMS, and this research has also shown that environmental initiatives generally benefit publicly listed organizations more than SMEs. Various authors have therefore suggested that the lack of resources of SMEs lead them to take proactive environmental initiatives that do not assist them in providing full regulatory compliance (Howarth and Melton, 2001; Darnall and Ytterhus, 2005; Utting, 2005; Darnall and Edwards, 2006; Aragón-Correa *et al.*, 2008; Chen, 2008; Zhang *et al.*, 2008). Large organizations tend to be more image-conscious and accord their '*societal visibility*' more weight (Darnall *et al.*, 2010), generally because they are exposed to larger markets. On the other hand, small organizations are often more resource-sensitive than large organizations, and so seek to hone their competitive edge in other ways (Ibid). This position is also strongly supported by others, for example, De Marchi and Grandinetti (2012) assessed Italian manufacturing organizations through a community innovation survey (CIS), and they found significant evidence that larger organizations (including multinationals and those that form groups) are more likely to introduce environmental innovations (De Marchi and Grandinetti, 2012). Furthermore, in Spain Aragón-Correa *et al.* (2008) and Zhang *et al.*, (2008) in China stated that larger organizations tend more often to institute environmental programmes, and therefore these three studies support our research in that an organization's size is an important factor in the extent of environmental proactiveness (Aragón-Correa *et al.*, 2008).

Many previous studies (Burns, 2000; Howarth and Melton, 2001; da Silva and De Medeiros, 2004; Darnall and Ytterhus, 2005; Magbool, 2009) have found that the operational sector to which the organization belongs has a major role in the level of the organization's commitment to become more environmentally friendly and proactive in environmental initiatives. In this investigation, quantitative and qualitative findings showed that Food and Chemicals and plastics, are the major activities of the organizations that have an EMS, ISO14001 and PME licence (see Figure 3.6 and section 4.3.1). Organizations in the food sector need to gain customers' trust, which is why they more often seek accreditation as this sector is strongly related to hygiene and thence to human health. Chemicals and plastics contain many kinds of pollutants such as gases, liquids and dust and particles, and therefore organizations involved in these activities must take some environmental initiatives to control them (Burns, 2000; Howarth and Melton, 2001; Darnall and Ytterhus, 2005).

In their interviews, the organizations that do not implement any form of EMSs, attributed this to the fact that their negative environmental impacts are relatively small when compared with the activities of chemical and heavy industries, and yet some of them (e.g. A1 & A2 metal and A4 chemical) are actually involved in these industries. Organizations which believe their environmental impact is relatively small is one of reasons delaying the implementation of EMS (Cooper, 2011). Zeng *et al.* (2005) and Yasamis (2007) predicted that disclaiming responsibility for environmental impacts was likely to occur in developing countries if mandatory government policies and controls were not implemented.

Finally, this research has shown that there is no relationship between the location of an organization in the IC and its implementation of EMS. This was the expected result as all the organizations in the study are in the IC which covers a relatively small area (12.7 million m^2 (see Table 3.8 and Figures 1.8 & 1.9)).

To summarise, the research has clearly shown that with exceptions such as the few organizations with ISO14001, the basic requirements of EMS are inadequately implemented and environmental concerns, awareness of legislation and compliance with it are extremely limited. As a result, the environmental situation in the IC is not being adequately addressed through the currently available legislation and this needs to be tackled on a number of fronts such as publicity and enforcement.

5.2.2 Assess the current level of the PME's awareness raising and control efforts

This research has shown many weaknesses in the PME some of which can only be changed if decisions to do so are taken at a high level in government. Public pressure is needed to encourage such changes but the influence of public pressure is limited in the KSA because of the prevailing political and administrative culture (Al-Gilani and Filor, 1999). Chapter 1 quoted literature sources that discussed problems caused by the distribution of authority and described institutional structures in the KSA that hindered environmental management (Ibid). Magram (2009) wrote that Jeddah does not have a single agency with full power and authority to manage the environment.

The PME, however, is the primary body responsible for environmental protection affairs and the main coordinator for enforcing environmental regulations and standards (Al-Gilani and Filor, 1999; PME, 2014). This research has confirmed the continuing existence of the problems noted by these authors, the lack of power and influence of the PME and its shortage of resources for coordinating environmental activities and for monitoring the implementation of its environmental standards. There are, however, many changes that the PME has the authority and ability to implement without the need for further government legislation but an increase in its budget would provide the additional equipment, staff and facilities needed.

The PME has been charged by the government to disseminate environmental information as well as monitoring and controlling environmental impacts; it does so through the media (principally TV and newspapers) and seeks to keep the public and industry aware of any legislative changes (B1). However, responses to the interview questions revealed that owners, workers and administrative staff are seldom, if ever, given any information from PME in the form of booklets or pamphlets and none of the respondents had taken part in a formal training session given by the PME. These organizations cannot receive electronic information about standards and regulations as the internet is not well developed in the IC in Jeddah (see the discussion in section 2.7.2 Chapter 2 about the research problems involved in obtaining information by email). The PME should be issuing much more information on environmental standards, explaining why they have been set and detailing their legal application in a more direct manner (e.g. through training programmes). According to Zhang *et al*. (2008), the State Environmental Protection Administration (SEPA) has been involved with a wide variety of stakeholders to inform and educate them in environmental issues; there are even environmental departments in some of the other government ministries, working to further promote the concept of environmental protection. The combination of awareness-raising and the imposition of fines for violators has resulted in reductions of recorded pollution emissions and in improved compliance (Zhang *et al.*, 2008). Accordingly, the PME should make it a prime objective to ensure all manufacturing organizations are at least aware that an environmental licence exists. This research has revealed the extent of the lack of understanding of the importance of protecting the environment. There is no pressure on the PME to carry out their work effectively as the general public as well as manufacturing organizations do not take much interest in environmental problems. As a result, training programmes are not implemented. This is despite the introduction of regulatory pressures for compliance and market pressures relating to an organization's reputation and image.

Some of the respondents in both sets of interviews (A3, A9, B1, B2, B3, B5, B6, B11 and B12) recommended an increase in the number of staff responsible for the monitoring and inspection process. China, for example, has shown what can be achieved when government pressure is applied. In 1998 the Chinese government put pressure on governments of all the provinces, cities and counties to focus attention on environmental protection. Ten years later there were "*3226 environmental protection administration departments at different levels all over the country, with 167,000 people engaging in environmental administration, monitoring, scientific research, publicity and education*" and "*3854 environmental supervision and environmental law enforcement organs with more than 50,000 staff members*" (Zhang *et al.*, 2008 p1038). This clearly reflects an improvement in public awareness and political commitment, which has subsequently increased the regulatory pressure to improve environmental protection (Ibid); the results have been encouraging as certain pollution levels are being reduced but they are driven by supply-chain and customer demands as well as monitoring and enforcement. Consequently, since 2007, Chinese organizations have been the top ones worldwide in seeking to obtain certificates for formal EMS (ISO14001) (ISO, 2014). For example, from the ISO survey for 2013, it is evident that the number of Chinese organizations seeking ISO14001 certificates is fourfold that of the country in second position (Italy); China sought 104,735 and Italy 24,662 (Ibid).

PME needs to prioritise training and the dissemination of information in their duties. For example, Article Three of the General Environmental Regulations and Rules for Implementation in the Kingdom of Saudi Arabia (issued in 2001) states, among other requirements, '2. Document and publish the environmental information. 3. Prepare, review, develop, interpret and issue environmental protection standards' (PME, 2006b) but this research has shown these conditions are not being fully implemented. The respondents also made the point that the PME failed to enforce the legislation that existed. As an example of this, many older organizations have exceeded the limit of the grace period offered by these Regulations; this grace period finished on 15th of October 2006 and the PME has failed to take action against them. They have completely missed the target of all organizations having an environmental licence by that date. From this research sample only 7 out of 64 organizations which were established in the period from 2002 - 2011, were awarded a PME environmental licence (see Figures 3.5 & 3.8). In fact only about 15% of the total organizations in the IC had this licence by 2011 (PME, 2011).

Further examples of the weakness in the PME's monitoring, follow-up processes and enforcement of legal sanctions were given by respondents who were asked how they avoided legal sanctions. One said that there were no penalties for the first infringement; another said there were no penalties at all. There is an example given in the text Page 189 where a fine for failure to control emissions was substantially reduced on the promise to apply filters, but no action seems to have been taken after a year when the pollution was just as bad (see Figure 4.1).

Furthermore, organizations committed to good environmental practices receive no special encouragement. This is despite the argument that efforts should not be limited only to enforcing rules on those who violate them, but should be coupled with measures to reinforce good behaviour (Govindarajulu and Daily, 2004).

In addition, the dual significance questions in Part II Section B (Ques. 2, 3, 6 & 10) of the questionnaire (see Table 3.1 and Appendix B) deal with obstacles to implementing EMS as well as indicators of the awareness-raising efforts of the PME. In terms of the latter, i.e. assessing the PME's efforts in order to spread environmental awareness and to control environmental abuses, this research finds that the PME's efforts are inadequate. This and the lack of legal enforcement, represent the most important obstacles facing organizations in implementing EMS in the IC in Jeddah (see section 3.3.2.2 and Table 3.13). This will be discussed further in the next section.

5.2.2.1 Action plan for the PME

The first national comprehensive environmental legislation in the KSA 'General Environmental law and its Rules for Implementation' was developed by the Presidency of Meteorology and Environment (PME) in 2001. The PME is charged with verifying compliance with the relevant regulations and standards, offering guidance to violators in order to resolve their deficiencies, and providing information services (see Section 1.8). The list of standards and guidelines (for all the activities relating to environmental monitoring and evaluation) became legally enforceable in that year. The PME's remit includes promoting the efficient use of non-renewable resources in order to prevention depletion, and disseminating the concept of sustainable development. These include limiting pollution, enhancing public health, protecting natural resources and raising environmental awareness among the society (PME, 2006b; PME, 2014).

The Environmental Inspection department at the PME was created in 2010; it is responsible for monitoring compliance and for implementing the environmental regulations and standards. This department is in charge of monitoring all the industrial plants inside and outside the industrial cities, auditing and checking any works completed for the PME environmental licence, monitoring crusher plants and petrol stations inside and outside the cities, ensuring the safety of water sources and coastal areas in the Kingdom (which includes identifying and verifying any sewage contamination or waste from the industrial and desalinations plants located on the cost), monitoring solid-waste landfill sites, and dealing with complaints pertaining to environmental problems (B1, B11 & B12) and (PME, 2014).

There are financial and technical deficiencies within the Environmental Inspection department (B1, B11 & B12); principally, it suffers from shortages in staff numbers, as it has only thirteen employees that are responsible for inspection works in its Jeddah branch. This branch is the main one in the KSA but it is responsible for all the above tasks in the whole of the Western Province, which includes 16 governorates (the most important of which are: Jeddah, Makkah, Taif, Yanbu and Rabigh, and they all have their own ICs). This is becoming a pressing matter, as important new industrial developments are being planned approximately 45 km from Jeddah city centre. 900 new factories are expected to be established there, conducting a wide variety of activities such as metalwork, chemicals and plastics, food manufacturing, furniture and papermaking, glassmaking, and the provision of building materials (Modon, 2014).

The problem of staff shortages generally is compounded by the lack of qualified personnel in particular; throughout the Kingdom, there is an insufficient number of specialists in the fields of environmental management and sustainable development, although this issue is best addressed by the Higher Education establishment. The PME and its employees must be seen to be acting in an entirely impartial manner, although this may necessitate judicial oversight and periodic reviews. The employees in this department are not sufficiently qualified to deal with toxic and hazardous chemical materials. They have not had training on, for example, inspection planning, inspector health and safety, collecting evidence, protection and control, and documenting inspections (as in the example of the Rangers in the following Section). In addition, there is a lack of simple devices for measuring noise and gaseous emissions, and there are insufficient laboratory facilities and cars (only 2 cars for this department) (B1, B11 & B12) (see Section 4.3.2).

There are two inspection teams within the Environmental Inspection department every Monday and Wednesday; each team consists of about four members. They conduct inspection visits on two days a week, and then spend three days on preparing and writing the reports for these visits, conducting follow-up of pending cases (which may be expedited over the phone or through meetings at the PME's offices) as well as dealing with environmental complaints. Each team visits only one establishment per day; some of these visits are to undertake an audit in order to check the organization that has applied for accreditation to the PME environmental licence (this is conducted in coordination with the Environmental Licences department). They work from 8 am – 3 pm, 5 days per week; they do not work night shifts or over the weekend, as they claim that there are no overtime incentives (B1, B11 & B12).

However, the PME's efforts at monitoring and control, and at raising environmental awareness, are inadequate and need to be improved, as evident in the quantitative and qualitative outcomes of this research (see Sections 3.3.2.2 and 4.3.2). The PME needs to raise the qualification status of its inspection and monitoring teams; this could be achieved by arranging and conducting special practical sessions to improve their skills in dealing with toxic and hazardous chemical and materials. The teams should also seek to improve their knowledge of this field by attending sessions and courses on environmental management, occupational health, and environmental impact assessment, for example. It is recommended that the PME cooperate and undertake agreements with distinguished and reputable environmental institutions worldwide in order to advance its efforts in terms of compliance and enforcement (of its environmental regulations). Capacity-building was addressed in the Netherlands by Van Der Schraaf (2008), where it was concluded that the country's inspectors (at the Dutch VROM-Inspectorate) needed to be upskilled if they were to adequately address the environmental problems; indeed, countries that are committed to environmental compliance should have adequately qualified inspectors (Ibid). Capacity-building has also been a focus for the Organisation for Economic Co-operation and Development (OECD), who have been promoting such measures in Eastern Europe, the Caucasus and Central Asia (OECD, 2004). It is widely recognized that in developing countries, environmental compliance depends solely on legal enforcement and the effectiveness of official monitoring together with the need to spread environmental awareness. EMS standards must be implemented effectively by regulatory pressures in the first place (Zeng *et al.*, 2005; Yasamis, 2007; Zhang *et al.*, 2008; Tambunlertchai *et al.*, 2013)

Also, the PME should seek to enhance the role of the inspector in terms of inspection planning, inspector health and safety, collecting evidence, protection and control, and documenting inspections. The experience of the 'Rangers' in Jordan is particularly instructive; the Jordanian Royal Department for Environment Protection liaised with the US EPA to train and further upskill Jordanian environmental inspectors, and, as a result, the number of prosecutions for environmental violations greatly increased (see the next Section on environmental policing experiences, where this matter is discussed in detail). It is suggested by B11 & B12 that, under such cooperation, a number of experts could be recruited from such institutions to participate in the PME's inspection teams, or that PME employees could be dispatched to participate in the inspection processes of these institutions in order to learn (practically) how to carry out such work.

Better qualified inspection staff should be coupled with improved facilities and equipment, and better measurement devices. Therefore, the PME should equip its inspection teams with the necessary measurement devices to carry out their work effectively, and should provide them with laboratories that have the wherewithal to test their samples (see Section 4.3.2). Aside from the numbers and qualifications of the employees, the PME is in need of its own laboratory facilities, even at a minimal level (outsourcing may be appropriate for some contaminants); nevertheless, having its own laboratory would greatly facilitate the work of the PME and would ensure that the data are secure and reliable. Furthermore, the PME should establish a regime of random inspections; these should ideally be unannounced, although this may be difficult to achieve politically. Nevertheless, inspections should form the cornerstone of the PME's efforts, as the principle of deterrence is central to the concept of compliance in order to deter potential violators, thereby ensuring that no competitive advantage can be gained from non-compliance (OECD, 2004).

This in turn raises the issue of standards; the KSA could consider adopting WHO environmental standards in full, ensuring that the PME is acting, enforcing and arbitrating in line with all the up-to-date internationally recognized criteria. As mentioned above, the PME's air pollution standards are based on the WHO's recommendations of 1976 (PME, 2006b p70). The PME must also take more concerted action on penalties; some organizations in the IC simply do not take seriously the threat of financial sanctions on their behaviour, and penalties must be codified, transparent and publicised. As some of the organizations in the IC have asserted that they are driven by cold economics rather than by any desire for the well-being of society and the environment at large, penalties must be enforced consistently and in an equitable manner. A further issue for the PME to consider is the establishment of key performance indicators (KPI); these could be disseminated throughout the IC so that inspectors and organizations alike would have clear benchmarks in the assessment of an organization's efforts (or lack of them) (Hřebíček *et al.*, 2014). These KPI should incorporate all the WHO criteria for environmental management as well as locally established criteria pertaining to the needs and practicalities of the IC and Jeddah as a whole, but chiefly they should include indicators relating to water and energy consumption, all waste streams and the use of natural resources as well as considering the organization's carbon footprint.

Raising environmental awareness among society and the workers in the industrial sector is a priority for the PME, as discussed above (see Section 5.2.2). It is important that the PME embraces an integrated programme to raise environmental awareness; it could last, for example, for five years. The PME needs to focus on this very important duty by conducting environmental lectures, courses, sessions and training, and by publishing and distributing brochures and booklets on environmental awareness, distributing them among society and particularly to the industrial sector. The PME should at least disseminate information on its environmental legislation and rules in an unambiguous manner and ensure that all workers and stakeholders in the industrial sector are aware of them.

Furthermore, it is suggested by seven of the second set of interviews that the PME increase its cooperation with other relevant governmental departments and private bodies, such as: Modon, the Ministry of Commerce and Industry, Saudi Customs, the Jeddah Municipality, the Jeddah Chamber of Commerce and Industry, and universities and research centres. The objective of this collaboration would be to support the PME's work and for these external departments to play their part in making sure that Saudi government environmental regulations and rules are enforced. For example, the Ministry of Commerce and Industry and Modon could play an important role in enforcing these regulations as they control permission for all activities in Saudi ICs, including infrastructure and building. This permission could be withheld if environmental conditions do not meet the appropriate guidelines. As discussed in Chapter 1, the PME already obliges project owners who request loans from the Ministry to obtain an environmental licence. The Customs Department is another government organization that has the power to refuse or delay the granting of import licences for raw materials, machinery and equipment, and could apply this if the company in question does not have an environmental licence. This will encourage organizations to comply with the environmental rules and to apply environmental management techniques, but only if these powers are used and enforced.

Universities could play a much larger part in supporting environmental initiatives. Higher Education has a responsibility to increase knowledge and skills and to make the recommendations needed to create a just and sustainable future (Cortese, 2003). The PME will require many more trained staff as industry expands, and universities and research centres may consider setting up courses and training sessions to improve the environmental skills of PME employees, as mentioned above in the capacity-building efforts of the Dutch VROM-Inspectorate (Van der Schraaf, 2008). Promotion of these values is also being encouraged in several universities in the USA; they are seeking to increase sustainability awareness by means of research, courses, conferences and workshops involving local communities as well as students. For example, Unity College, Maine, has helped a local community concerned with the water quality of Lake Winnecook by developing a complete curriculum around a study of the lake. Through this university's involvement with the local community, stakeholders have developed skills for promoting and engaging in sustainable living (Cortese, 2003). The Carnegie Mellon University developed the Adam Joseph Lewis Center, one of the most environmentally sustainable buildings in any university. This involved interacting with professionals and others in the local community through a class specifically developed for this purpose (Ibid).

Saudi Arabia is striving to diversify its economic base through reducing the Kingdom's dependence on oil revenues as the main financing source for its economic and development projects. Thus, the government is encouraging the private sector to diversify into a wide range of new industrial fields, and always seeks to facilitate this process of diversification (Rice, 2004; Ministry of Commerce and Industry, 2015). However, the KSA is a developing country and among such nations, especially those dependent on the export of natural resources, the public believe that any diversification away from dependence on a resource must not entail economic hardships. Nevertheless, the Kingdom's government has stated that it is fully committed to national economic development, and that it will pursue this goal in line with recognized international and regional environmental laws and conventions (Swazo, 2010). Should this diversification be focused on cleaner and 'greener' technologies as opposed to heavy industry, then the objectives of both the government and the PME would be largely be met. To this end, the PME could also provide incentives and support for the industrial sector in the KSA to achieve this economic strategy, thereby improving the overall environmental performance of the industrial sector without compromising the ultimate aim, which is achieving sustainable development. The PME, for example, could organize environmental lectures, courses, sessions and professional training for workers in the workplace (i.e. on site), as the owners argue that such courses and training would be costly to the organization if the workers were taken away from the workplace. These courses and training could cover topics such as: environmental health, safety, environmental management, and waste and emissions treatment. The PME should couple the pressure it exerts through its environmental regulations with technical assistance and suitable financial support, such as: providing financial support for environmental initiatives that cannot be afforded by the organization (in particular for small- and medium-sized organizations, which are a vital and growing part of any national economy (Gupta *et al.*, 2009), and that comprise the majority of private businesses in the KSA (Kayed and Hassan, 2011)), offering tax cuts on environmental friendly equipment, and ensuring rapid licencing for compliant organizations that wish to import raw materials. In addition pilot trials and success stories should be enhanced and disseminated, as suggested by Massoud *et al*. (2010a). It was also suggested by two of the interviewees that committed organizations be publicly acknowledged and rewarded, i.e. the 'carrot and stick approach' (see Section 4.3.2). A colour-coded environmental performance rating, for example, has been successfully introduced by the Chinese government, where two colours (black and red) denote inferior performance, one (yellow) denotes compliance with minimum emission regulations but failure to comply with stricter requirements, and two ratings (blue and green) denote superior performance. The results are made known to the public, organizations and banks, and are given publicity through the media. They have attracted public attention and improved environmental performance to some extent (Zhang *et al.*, 2008).

B6 suggested that the PME provide an integrated treatment plant to treat industrial fluid within the IC in order to ease the treatment obligations now being imposed on organizations in the IC. In addition, the PME should encourage and support organizations that recycle and re-manufacture to help industries that produce products made from waste that is recycled as well as to assist all organizations in managing their waste streams environmentally. In addition, treated industrial wastewater could be utilized in appropriate ways, such as in cooling processes. It is also suggested that the PME provide a directory for each industrial category in the KSA, detailing the main environmental impacts, for example, in the use of fuel, emissions and method of waste management, to help all the industrial plants reduce their environmental impact.

On the other hand, to make it easier for the PME in its efforts to ensure that the Saudi government's Environmental Regulations and Rules are implemented, the PME should oblige all industrial plants in the KSA to provide environmental records and measurements, and to update them periodically against the PME's standards, as the statutory authority. Due to lack of knowledge on the part of many organizations in the IC on the amount of liquid and gaseous emissions they produce, the PME should force such organizations to install devices and equipment to monitor and measure all gaseous pollution and fluid flows from their processes, obliging organizations to conduct periodic tests to check their pollution status. Time-scales would be industry- or process-specific and dependent on legislation (OECD, 2004); however these matters are beyond the remit of this research. In this regard, the aforementioned OECD report details a self-monitoring programme, whereby the organization and the statutory authority agree upon a division of responsibilities vis-à-vis implementation, analysis and reporting (Ibid). In addition, the PME should oblige organizations to attend up-skilling sessions and professional training (whether inside or outside the organization) to improve their workers' knowledge and awareness of environmental issues; this would reflect positively on each organization's environmental performance. China, which has also witnessed an expansion in its industrial base (and concomitant pollution) is developing supportive policies (including the extension of training programmes and short-term subsidies) to promote environmental compliance (Zeng *et al.*, 2005).

In developing countries such as the KSA environmental awareness is very low (Tortell, 2004; Sakr *et al.*, 2010; Zabin, 2010). In such circumstances it is particularly important to ensure that the legal sanctions that do exist are effectively enforced and compliance is taken seriously and non-compliance is penalised accordingly. This point of view is supported by the results found in earlier studies by Faure and Niessen (2006) and Studer *et al*. (2006) that the main barriers contributing significantly to the comparatively poor environmental management among the organizations in Indonesia and Hong Kong respectively, are inadequate government enforcement and social attitudes.

However, to conduct its duties to the fullest, the PME needs to seek practical ways to enhance its power. The limitation of the PME's annual budget is the main problem facing any improvement in its environmental awareness and control efforts. The PME needs a budget that would allow for the purchase of additional measurement devices and for the establishment of laboratories with testing facilities (these are evidently needed), for the engagement of additional and better qualified members of staff (responsible for the inspection processes), and for covering the expenses incurred in raising the level of environmental awareness among the community (see Section 4.3.2).

The PME should thus seek for an increase in its annual budget in order to fulfil its duties. This may take time because the decision-making process in the KSA is highly centralized; the prevailing political and administrative culture in an absolute monarchy, wherein delegation is not widely practiced (Al-Gilani and Filor, 1999). The level of the current budget reflects a general lack of awareness about the difficulties that the PME is facing (in the upper echelons of the government) rather than any shortage of government funds (B2 & B3). For example, B11 and B12 stated that the sole financial resource for the PME is its annual budget, as all fines and penalties for non-compliance with the environmental regulations must go to the Ministry of Finance. The PME should directly benefit from these fines and penalties, even if only to a limited extent (to eliminate the possibility of perverse incentives) (OECD, 2005). In some countries (e.g. Poland and Bulgaria), environmental inspection agencies may withhold a portion of a penalty to cover its own capital expenses (to update equipment or for wear and tear), although the bulk goes to the central government coffers (Ibid); given the current need for equipment on the part of the PME, such a measure should be considered. However, such a source of funding is not deemed stable in the long term, and so it is important that monies raised from fees cover the actual expenses incurred by the PME (inspection and monitoring activities). In the UK, 70% of funding for environmental enforcement authorities is sourced from fees and the remaining 30% is from direct government grants (Ibid); in the case of the KSA, staff remuneration should remain the responsibility of the central government.

It is also possible that the PME's accreditation process be recognized across the region; should other regional governments officially recognize the PME stamp, then organizations across the Middle East would adopt the PME certificate. The PME could arrange for a system of fees for this, although the logistics for monitoring would have to be settled on a country-by-country basis. Nevertheless, this represents an alternate revenue stream that should be considered.

The effective implementation of the environmental regulations and rules (by the PME), and the ceasing of abuses and uncontrolled activities that affect the environment (the land, the water and the air) and the health and well-being of future generations (not just in the IC in Jeddah but across the country as a whole), will assist in achieving sustainable development; this is the ultimate aim that all countries are seeking to reach and enjoy. Indeed, through having an atmosphere free of air pollutants, through ensuring that all water is free of harmful substances, and through the rational exploitation and optimal utilization of natural resources (with a long-term perspective), the welfare and well-being of society as a whole will be ensured.

By taking the lead in this matter and by taking the aforementioned steps towards achieving sustainable development in the KSA, will greatly enhance the reputation of the Kingdom in the region. It will also assist in meeting its urgent need to rationalize its energy consumption, which has reached a quarter of its oil production (2.9 million barrels a day), placing the KSA in the position of the world's sixth largest consumer of oil in 2013 (EIA, 2013). Achieving sustainable development will allow the KSA more fully to enjoy its development, having controlled its air quality, having stopped polluting its coasts, and having achieved balanced industrial development on a regional basis; these will further promote its economic and its leading position in the Middle East and the world. Saudi Arabia plays a very important role in the global economy, as it ranks as the largest exporter of oil (Al Turki and Faris, 2010); Saudi Arabia is also the largest country by land area in the Middle East and one of the leading economies in the Middle East, which should further encourage it to take the lead in the region.

5.2.3 Identify the obstacles facing the implementation of EMSs in the IC

The quantitative and qualitative data obtained from this research (see Table 3.13 & section 4.3.3) have shown that the most important obstacles facing the implementation of EMSs in the IC are the lack of legal enforcement and monitoring of environmental legislation and rules, the low environmental awareness of workers and management, customers and society and the cost and economic implications of environmental initiatives. The existing standards, while not as comprehensive as they could be, would do much to safeguard the environment if they were used properly and fully enforced (Cohen, 1998; Tosun, 2012). As mentioned above, EMS standards must be implemented effectively through regulatory pressure (see previous references by: Zeng *et al.* (2005); Yasamis (2007); Zhang *et al.* (2008); Tambunlertchai *et al.* (2013)), and one of the most important factors influencing an organization's decision-making process in relation to the potential for pollution is government regulation pertaining to compliance (such as through inspections and fine-imposition) (Zorpas, 2010). Darnall *et al.* (2008) suggested that organizations embrace environmental initiatives in order to avoid legal sanctions and to protect their business from fines and other punishments but if legal sanctions are not enforced, there is no pressure to take such initiatives. This is confirmed in the view of Yasamis *et al.* (2007 p 575), "*The most important reason for inadequate performance is the lack of an effective national and local environmental compliance management system*". It is therefore evident that the lack of enforcement of environmental legislation and rules represents the major obstacle facing good environmental management (Faure and Niessen, 2006). In this context, respondents to this research often reported that they had never heard of the environmental licence and had not seen an inspection team for years, if at all. The likelihood of receiving penalties for non-compliance is therefore extremely small; indeed, the idea appeared to be a joke to some respondents.

The low level of environmental awareness and concern is, in fact, another significant obstacle affecting the implementation of EMS in the IC. This research has shown a surprising degree of ignorance about the EMS. Sakr *et al*. (2010) suggested that the lack of awareness and resistance amongst an organization's employees, particularly in developing countries, is generally considered a major obstacle facing EMS implementation. This research has shown that it is not just an organization's employees but also owners and managers of organizations who pay very little attention to environmental controls. The workers will follow their lead, therefore, the commitment of top managers has a positive and significant role on the environmental performance of the organization (Zutshi and Sohal, 2003), and on the implementation of environmental proactive initiatives and comprehensive EMSs (Berry and Rondinelli, 1998; Buysse and Verbeke, 2003; Zutshi and Sohal, 2004; Chen, 2008). This has also been confirmed by Jahamani (2003) who conducted his study on Jordan and the United Arab Emirates (UAE) and found that low levels of environmental awareness, inadequate top management commitment, and the low environmental awareness of society in general, were major obstacles in applying good environmental management.

Tortell (2004), Magram (2009) and Zabin (2010) all reported that awareness of environmental legislation on the part of the general public is at a very low level in the KSA. One of the respondents (B6) emphasised in his interview that to bring about customer pressure for environmental improvements, it was necessary to focus on raising environmental awareness. He was speaking about the KSA in general and it is recognised that public pressure about the environment, which does not yet exist in the KSA, could bring about changes. Nineteen out of 26 responses to the interviews suggested that this lack of awareness of environmental concerns extends to the wider public and therefore customers are unlikely to put pressure on organizations to conform to EMS standards (B1, B8 & B10).

The next most significant obstacle facing the implementation of the EMS in the IC is the economic implications for the organizations concerned. About half of the respondents to the quantitative survey (see Table 3.13) and thirteen out of the total number of interviews (21) agreed that adopting an EMS was a costly process. This was emphasised especially if modifications to machinery and processes were required and most felt that there were no significant economic advantages to be gained in the local market when applying environmental improvements. The lack of an incentive from the local market was ranked by respondents to the questionnaire as the fourth most important obstacle facing the implementation of the EMS and, therefore, it was expected in the absence of public and customer pressure to be ranked as being of least benefit in implementing EMS in the IC (see Tables 3.13 & 3.14).

However, shareholders and investors are attracted by environmentally responsible organizations due to their belief that financial success is associated with organizations with a good environmental reputation (Zutshi and Sohal, 2003; Zutshi and Sohal, 2004). In addition, organizations' environmental behaviour, even in developed countries such as the UK and Spain, is reactive and economically-oriented. The environmental management initiatives are limited by economic considerations such as cost and risk reductions and achieving compliance with environmental legislation and rules (Dahlmann et al., 2008; Murillo-Luna et al., 2011). The cost of adopting EMS processes is expected to be high (Johnstone and Labonne, 2009; de Oliveira et al., 2010). In the IC in Jeddah, however, in the absence of legal, social and customer pressures, the cost of environmentally proactive initiatives is considered an unnecessary expense that influences organizations' competitiveness and prevents them from implementing EMS standards.

One of the problems is that many of the organizations in this research do not fully comprehend the financial benefits of environmental compliance, and therefore lack the motivation to implement EMS. The financial benefits include improving the organizations' image and enhancing their reputation in the public's eye, which can raise their level of competitiveness (King et al., 2005; Darnall et al., 2008); many of these organizations have already reported that selling their waste products has reduced their running costs. These measures taken together might increase the opportunities and conditions for further environmental initiatives and implementation of EMS in the IC.

Other factors were identified as contributing to the difficulties of implementing EMS in the IC. These included the poor definition of environmental responsibilities, which was emphasised by B6 and ranked by respondents to the questionnaire as a moderately important obstacle (see Table 3.13). Also, there was no specialized section or department devoted to environmental issues in the majority of organizations. As discussed earlier, in this research only 11 out of 183 organizations had environmental managers or the equivalent. Several authors (for example, Morrow and Rondinelli (2002), Zeng *et al*. (2005) and Rodríguez *et al*. (2011)) have argued that lack of well-defined responsibility for environmental management is one of the main obstacles to the implementation of EMS; according to Zeng *et al*. (2005), this is the case "particularly in developing countries" (p.645) with respect to tackling environmental issues and achieving sustainable development.

The lack of cooperation, integration and coordination between the PME and relevant governmental departments, such as Modon, the Ministry of Commerce and Industry and Saudi Customs, was given by B1 (the Director of the Environmental Licences Department at PME) as a reason for the difficulty in implementing EMS in the IC, as these other departments are not focused on an applicant's need to have the PME licence before engaging in, for example, any licencing negotiations to import equipment. Thus, this lack of integration makes it more difficult to encourage organizations to obtain environmental qualifications such as the PME licence and ISO14001, and also to monitor and fine those that do not comply with the government regulations, as discussed earlier in this chapter (section 5.2.2).

Some respondents cited the lack of companies specializing in the safe disposal of liquid and solid waste and their costs. Some mentioned the lack of energy optimization companies in the KSA, which could assist Saudi organizations in complying with the national environmental legislations and rules. Also, the small size of some industrial establishments makes the required environmental requirements in some organizations very expensive. This would be the case, for example, if a small organization had to install expensive waste disposal equipment for a limited amount of waste (see previous references by Dahlmann et al. (2008) and Murillo-Luna et al. (2011) on this subject). Nevertheless, it remains the case that the total volumes of waste being produced across the Kingdom are large (over 900,000 tonnes per year) (see: Alzain, 2013), and that small enterprises must bear their share of responsibility.

Furthermore, the issues of lack of environmental consciousness on the part of society and workers, lack of well-defined responsibility for environmental management, high costs, lack of an effective legal system, and lack of legal enforcement all closely reflect the obstacles discussed by Tortell (2004), Zeng (2005), Tarantini *et al.* (2009), Saker *et al.* (2010) and Zabin (2010) in their considerations of the obstacles that affect environmental initiatives in developing countries, and even in more developed countries such as Italy.

Additionally, the lack of understanding of the term 'sustainable development' and ignorance of the need to control the use of resources was a considerable problem for B6 (see his comments in Section 4.3.3). The importance of this issue was recognised in the Brundtland Report (WCED, 1987) 'Our Common Future' which was discussed in Chapter 1, and also by many other authors such as (Eisenblatter *et al.*, 2002; Cashmore *et al.*, 2007; Bond *et al.*, 2010; Sakr *et al.*, 2010); these issues were addressed in the Action Plan section above. One further point raised by B6 (in his interview) was the lack of incentives for organizations to commit themselves to the environmental laws. The PME should do more to encourage such organizations through public award ceremonies or government contract privileges and, as A8 suggested in his interview, offer some financial help. Govindarajulu and Daily (2004) wrote about the need to use a variety of measures to reinforce good behaviour. It was suggested by Massoud *et al.* (2010a) that environmental regulatory pressures should be coupled with suitable financial support such as "*low interest loans, tax deductions on environmental friendly equipments*". In addition, the government should enhance "*professional training and innovative diffusion principles such as pilot trials to disseminate success stories*" (Massoud et al., 2010a p208).

5.2.3.1 Challenges to EMS implementation in the whole region (Middle East)

Inadequate government enforcement and support, and low environmental awareness seem to be the shared main challenges that are facing the adoption of EMSs in developing countries (Tortell, 2004; Zhang *et al.*, 2008; Massoud *et al.*, 2010b; Sakr *et al.*, 2010; Lam *et al.*, 2011). This has been emphasized by certain authors in countries such as China, Indonesia, Hong Kong, Turkey and Thailand (see respectively: Zeng *et al.*, 2005; Faure and Niessen, 2006; Studer *et al.*, 2006; Yasamis, 2007; Tambunlertchai *et al.*, 2013).

However, the adoption of EMS standards under ISO14001 in Middle East countries have reached only 1.1% of all ISO14001 certified organizations worldwide (ISO, 2014). All countries in the Middle East are considered as developing countries. The major challenges that face the implementation of EMSs in the Middle East are the same challenges that are found in all developing countries. This has been confirmed through academic investigations of some countries in the Middle East, for example, Massoud *et al.* (2010a) stated that weak and ineffective enforcement of environmental laws and regulations coupled with low environmental awareness (on the part of customer and stakeholders) and the high adoption costs inherent within EMS adoption are all major barriers to adopting EMS in Lebanon. In Turkey, Yasamis (2007) found that the lack of an effective national environmental compliance management system followed by the low environmental consciousness of the public are the leading reasons for low levels of environmental management initiatives. O'Brien *et al.* (2007) stated that raising environmental awareness and strengthening the enforcement and monitoring body are the main needs in the UAE in order to gain environmental improvements. This is in line with the findings of Jahamani (2003), whose study conducted in Jordan and the UAE revealed that low levels of environmental awareness and inadequate commitment represented major challenges to applying good environmental management. In Egypt, Saker *et al*. (2010) found low environmental awareness and marginalized legal monitoring and enforcement of environmental regulations represented the main obstacles to adopting environmental management and ISO14001 standards.

It is confirmed by the second set of interviews that these challenges are not unique to the KSA. B6, B8, B9 and B10 also added adoption cost as one of the major challenges to EMS implementation in the region. However, adoption cost is an issue that can be partly resolved through raising environmental and EMS awareness, pressure from many and various sources (including regulatory pressure), community participation and market demand; all of these have an influence on an organization’s decision-making process, encouraging managers to be more engaged in environmental initiatives (Darnall *et al.*, 2008; Massoud *et al.*, 2010a; Zorpas, 2010).

However, KSA has a great deal to learn from the successful experiences of other countries in the region in order to overcome these challenges and possibility to make change. As suggested in section 4.3.3, participation in the largest international award programme of sustainable schools in the world (the ‘Eco-Schools’ programme), as has been done in the Kingdom of Jordan since 2009, can be instrumental in raising environmental awareness. ‘Eco-Schools’ was developed in response to this issue and to involve young people in local environmental projects (as recommended in the UNCED in Rio 1992), and it aims to raise awareness of sustainable development issues among students through school as well as through community action. This programme is operated by the Foundation for Environmental Education (FEE) and was launched in 1994 in Denmark, the United Kingdom, Germany and Greece with the cooperation of the European Commission. As of 2014, this programme is operating in 54 countries worldwide, in more than 40,000 schools and has 2,621,768 participants. In 2003, it was considered as a model initiative for the Education for Sustainable Development by the United Nations Environment Program (UNEP) (FEE, 2014).

The Eco-Schools programme is based on EMS ISO14001 standards but its remit is to raise environmental awareness and to build capacity more generally in society; ultimately, it seeks to facilitate the development and implementation of policies that reflect particular needs, and that incorporate objectives to address legal issues as well as gathering data on all the most environmentally significant aspects of modern development (FEE, 2014). For a participant school to be awarded the Green Flag, it needs to apply the following seven steps:

1. Establishment of an Eco-Schools Committee.
2. Environmental review – assessment of the environmental impact of the school.
3. Action plan – it should be achievable and realistic.
4. Monitoring and evaluation - monitor and measure the progress.
5. Curriculum work – linking existing subjects with environmental education concepts.
6. Informing and involving – as many people as possible (in or out of the school) can have the opportunity to take part.
7. Eco-code - a mission statement to demonstrate the commitment to environmental improvement.

(see FEE, 2014).

The environmental themes within Eco-School are various, and each school choses their own project from one or more of the following themes: Litter - Waste minimisation -

School grounds - Biodiversity - Energy - Water - Transport - Health and well-being - Sustaining our world (FEE, 2014).

Through national representatives for FEE in each country, any school that successfully achieves the objectives of the selected programme is awarded a Green Flag, which is now an internationally recognized symbol for environmental excellence. There are variations; some countries also give bronze and silver awards or stars to encourage further strides towards Green Flag accreditation. The ceremony and the award-giving process is subject to some flexibility but the schools being assessed must closely adhere to the FEE guidelines for the International Eco-Schools Programme (FEE, 2014).

Jordan launched its Eco-Schools programme in 2009 with only 15 participant schools; by 2014, participation had reached 95 public and private schools. The national representative for Eco-Schools in Jordan is 'the Royal Marine Conservation Society of Jordan' known as JREDS. England has the most Eco-Schools in the world; 70% (17,000 schools) of all schools are registered with the Eco-Schools programme. The programme is managed in England by the environmental charity 'Keep Britain Tidy' (FEE, 2014).

Jordan is not the only Arabian country to participate in this inspiring programme; the UAE has been operating an Eco-School programme since 2010, where the Emirates Wildlife Society (EWS) is the FEE representative. In the Middle East region, only four countries are participating in this programme, namely: Jordan, the UAE, Iran and Turkey (FEE, 2014).

Programmes such as Eco-School are specifically designed to promote environmental awareness within schools, encouraging pupils and the next generation to make positive changes in the field of environment protection; indeed, the students of today are the leaders of tomorrow. This programme also promotes environmental education in such a way that pupils can then transfer this knowledge to their homes and local community, spreading appropriate behavioural patterns more widely; this is especially important in light of the worsening environmental problems evident around the world (FEE, 2014).

The second suggestion for a successful environmental experience, and as a good example to follow (see Section 4.3.3), also comes from the Kingdom of Jordan; it is the creation of the Environmental Police Department. This department was established by royal decree in June 2006, and was renamed the Royal Department for Environment Protection (RDEP) at the end of 2008; its officers are known as Rangers. This department is a unique environmental institution both in Jordan and in the Middle East. The Rangers operate as a unit of the Public Security Directorate (PSD), and as the executive arm of the Ministry of the Environment (ME). Although they work to improve the quality of the environment and its various elements through the effective compliance-monitoring and enforcement of the environmental legislation, they also work to increase public awareness of environmental issues by disseminating informative materials (Rangers, 2014).

The Rangers' mission is to improve the environment's quality in Jordan through effective and proper enforcement of environmental regulation and laws, through promoting cooperation and coordination with and between all the relevant authorities, and through increasing national support for the environment (Rangers, 2014).

The Rangers conduct their mission in cooperation with representatives from the partner institutions. The rangers' duties are:

- *Control of acts which constitute a violation of the environment laws and take legal action against the perpetrators.*
- *Implement decisions of the competent ministries on removal of environmental violations/hazards and precautionary closure of facilities*.
- *Control irregularities on grazing, logging, over-fishing and encroachment on wildlife, marine and forest resources.*
- *Control the import of environmentally harmful materials through border posts.*
- *Controls of vehicle exhaust fumes.*
- *Protection and control of natural and pastoral reserves*.
- *Handover of cases and evidence to the responsible courts*.
- *Support ministries and other partners with campaigns and the dissemination of materials on awareness creation.*
- *Participation in seminars and conferences.*

(see: Rangers, 2014).

There is coordination and cooperation between the Rangers and nine strategic partners (government institutions and environmental conservation organizations). Today, 15 branches in the six police regions in Jordan and about 650 officers are assigned. The Rangers are qualified and trained; GIZ Entwicklungsdienst (former German Development Service / DED) advisers have been supporting the Rangers since the end of 2009 technically in the following fields:

- Institutional support and liaison with strategic partners
- Identification and documentation of water pollution
- Preventive measures in water protection zones
- Data acquisition and processing
- Environmental awareness creation

(see: Rangers, 2014).

It is evident from the RDEP website that the Rangers tend to seek technical expertise from their German colleagues but seek assistance in strategy and policy-making from their American colleagues (Rangers, 2014); indeed, the Rangers tend to seek support from a range of international organizations depending on the services they have to offer (Ibid).

The USA and Jordan have signed a free-trade agreement, and under its terms the US Environmental Protection Agency (EPA) assists Jordan in the compliance and enforcement of its environmental regulations. Cooperation also extends to determining the role of the inspector; inspection planning; inspector health and safety; collecting evidence; protection and control; and documenting inspections. Further, the EPA advises on how to raise public awareness of current environmental challenges; it also assists in generating solutions to particular problems. EPA personnel have travelled to the Kingdom to provide training for the Royal Rangers and their team of inspectors, and to advise the Ministry of the Environment on appointing criminal investigators and judges (Rangers, 2014; EPA, 2015a).

The total number of pursued cases for environmental violations has increased from 7,781 in 2007 to about 56,000 in 2013. The Rangers` department is keen to simplify the procedures and to respond directly to complaints by providing all means possible, such as a hot line for emergencies, an email address and contact through their website (Rangers, 2014).

In this context, it is important for the government to provide initiatives to encourage the introduction and use of renewable energy. An example is the experience of the United Arab Emirates (UAE), whose government has sought to rationalize energy consumption by exploiting solar energy. The UAE plans to use renewable energy in the desalination of highly saline groundwater and seawater. In this regard, Environment Agency-Abu Dhabi (EAD) stated that the emirate of Abu Dhabi has constructed 30 solar-powered desalination plants as of the end of 2012; each plant generates 1,050 kWh of clean energy and 6,600 gallons of clean water daily. The 30 desalination plants operate in various locations around Abu Dhabi, and this has been part of an integrated plan to convert all desalination plants to clean and renewable energy by 2030, through the adoption of innovative solutions for the production of potable water (EAD, 2014).

In addition, in 2013 the UAE launched the largest solar project in the world. The Shams 1 project uses concentrated solar power (CSP), in other words thermal energy, to produce electricity through several special design technologies. Shams 1 is the world's largest financial transaction for a solar power project, costing some $600 million. The Shams 1 plant was awarded 'Middle East Renewable Energy Deal of the Year 2010' by the Project Finance magazine. The energy production capacity of the plant is intended to reach 100 MW. The project is predicted to displace 175,000 tonnes of CO_2 every year, taking the equivalent of approximately 15,000 cars off the road or planting 1.5 million trees (Shams, 2015).

The success of inspiring environmental experiences tends to vary around the world, and particularly so in the Middle East or in developing countries, some of which may have environmental and cultural characteristics that are similar to the KSA. They may also share similar obstacles and may have difficulty in promoting EMS standards, meaning that they are unable to guarantee environmental improvement. They may suffer from: a lack of sufficient infrastructure, limited regulatory capacity to monitor and enforce environmental laws and regulations, and weak institutions that are unable to vigorously promote EMS standards (Massoud *et al.*, 2010b; Sakr *et al.*, 2010; Tambunlertchai *et al.*, 2013).

The Chinese government, as mentioned earlier, has introduced a system of colour-coding for organizations in terms of the 'green' credentials: black and red denote inferior performance, yellow denotes compliance with minimum emission regulations (but failure to comply with stricter ones), and blue and green denote superior performance. The government then publishes the results so that the public, other organizations and interested banks are fully appraised of the relative performances of a wide variety of organizations. This approach has been enthusiastically accepted by consumers and has resulted in some improved environmental performance, as mentioned in Section 5.2.2 (Zhang et al., 2008).

Successful experiences have been witnessed, largely through increasing the remit and powers of the agency or body responsible for environmental issues in the country. Malaysia, for example, at the end of the last century was a pioneer among developing countries by establishing a national environment agency and a Ministry for the Environment backed by a national environment law, which raised the importance of environmental issues

(Hezri and Nordin Hasan, 2006). In China, responsibility for environmental protection used to rest with the State Environmental Protection Bureau, a small department (this was a similar arrangement to the present situation in the KSA) but in 1998 the department's name was changed to the State Environmental Protection Administration (SEPA) and it was given Ministerial status (Zhang et al., 2008).

Some of these successful and inspiring experiences can be followed, i.e. in this field it is possible to benefit from the experience of others. Saudi Arabia is the largest country by land area in the Middle East; however, the KSA's global and regional position as the largest oil exporter worldwide and one of the leading countries in the Middle East, should encourage it to take similar innovative environmental initiatives to pave the way for improved environmental performance and the effective use of natural resources (toward achieving sustainable development). In addition, the KSA urgently needs to rationalize its energy consumption; it consumes a quarter of its own oil production, about 2.9 million barrels a day, and as of 2013 it is the world's sixth largest consumer of oil (EIA, 2013) (see Section 1.3). All Middle East countries, not only the KSA, should derive some benefit from the successful environmental experiences of other countries, in an attempt to shorten the time and effort needed to achieve sustainable development for the benefit of the region's people.

5.2.4 Identify the possible environmental benefits to be derived from implementing EMSs.

5.2.4.1 Environmental and economic benefits of implementing EMSs

The respondents considered that the most important benefit to be derived from implementing EMSs would be an improvement in the environmental capability and performance of their organization, including an improvement in operational safety. Implementation would help them to define environmental objectives and targets, and (by means of training sessions) would also raise the level of environmental awareness among workers in their organizations (see Table 3.14).

This research has shown that there has been an improvement in environmental performance within the organizations that implement EMS standards in the IC (see Section 4.3.4). Rationalizing the consumption of energy and water, increasing natural resource efficiency, and managing waste environmentally are all essential in moving forward towards a more sustainable society (Watson and Emery, 2004; Arimura *et al.*, 2008; Chan, 2008; Cordano *et al.*, 2010; Sakr *et al.*, 2010). A3, for example, stated that EMS standards have been applied in their organization since 2005, and that they have helped them to reduce their totals for hazardous and non-hazardous waste annually by 133.78 tonnes between 2008 and 2013 (see Section 4.3.4.1). Furthermore, they reduced their water consumption from 110,000 m^3 in 2008 to 94,600 m^3 in 2013, and saved about 15,400 m^3 (14%) of their water consumption; their energy usage has also been reduced by 35%, as it was 120,000 GJ in 2008 but was reduced to 78,000 GJ by 2013. Additionally, A3 claimed stated that their CO_2 emissions had fallen 53%; they were 25,000 tonnes in 2008 but by 2013 they were 11,750 tonnes; this was a reduction in their annual CO_2 emissions of 2,650 tonnes.

Further, A9 stated that their environmental capability and operational safety had been improved by adopting EMS. Their working environment is now measurably safer, thanks to decreases in the average noise and temperature levels; hitherto, these levels were affecting the employees' health. The noise level was decreased from an average of 94 decibels to 88 decibels, and the ambient temperature was decreased from an average of 30.16 ºC to 28 ºC by using specialist equipment in their production processes. They also greatly reduced their consumption of water, from 10-15 m^3 per tonne of their production to 6-6.5 m^3/tonne. Furthermore, the organization managed to reduce the electricity and water consumption of their production processes; it fell from 35,000 kWh/month in 2010 to 34,500 kWh/month in 2013, i.e. a saving of about 6,000 kWh/year.

A13 stated that their total production was about 9,130,000 tonnes in 2012 but that this had risen by about 183,000 tonnes the following year. In that time, the organization was able to undertake certain improvements; they have decreased their per-unit consumption of water and electricity (as well as their generation of solid and liquid wastes), i.e. their resource use has decreased relative to their production costs per tonne. Their water consumption was 10,933 m^3 in 2012 whereas it was 10,944 m^3 in 2013, representing a reduction of about 1.87% in terms of unit costs (albeit an increase overall). Likewise, their consumption of electricity was 229,560 kWh in 2012 but it became 229,583 kWh in 2013, representing a unit-cost reduction of about 1.96%. The reductions in their waste streams were also calculated; between 2012 and 2013 it fell by 5.79%. In 2012 the organization generated 760,000 tonnes of solid waste but in 2013 it was 750,000 tonnes (representing a 3.25% reduction in terms of per-tonne generation); in 2012 the organization generated about 8,490 m^3 of liquid waste but in 2013 it was 8,440 m^3 (a 2.54% reduction).

A3, A9 and A13 all considered that these reductions (as environmental achievements) were facilitated by adopting an accredited EMS regime (specifically, ISO 14001), and by implementing it in full (i.e. adhering to the five steps). They added that the systemic approach for managing environmental issues allowed their organization to reduce its environmental impact, thereby reducing its running costs, merely by following the suggested procedures for policy-making and achieving targets, i.e. in the case of these reductions, utilizing an EMS was the only variable. It should be noted that the government offers various subsidized energy packages to industry, meaning that electricity is relatively cheap in the KSA, and so reducing consumption is not a high priority for managers. Indeed, support for electricity is among a number of incentives offered by the state to help the private sector develop and advance its services; electricity for industrial consumption is subsidized by the Government such that the price per kilowatt/hour is only SR 0.05 (or five Halalas, which is equal to £0.008). Also, water is subsidized by the Government and the price per cubic metre is SR 0.25 (or 25 Halalas, which is equal to £0.04). As for gas and liquid fuel, they are even cheaper; for example, the higher octane unleaded petrol (95 RON) in the KSA is SR 0.60 (£0.11) per litre, whereas for the lower octane unleaded petrol (91 RON), it is SR 0.45 (£0.08), and the price for diesel fuel is SR 0.26 (£0.05) per litre (Ministry of Commerce and Industry, 2015).

Additionally, all commodities involved in industrial production in the Kingdom are exempt from customs duty. All Saudi companies, industrial or otherwise, enjoy full exemption from all company taxes, but they are subject to Zaka'ah, which is a small Islamic tax calculated as 2.5% of all liquid assets. The Saudi Industrial Development Fund grants loans to industrial institutions of up to 50% of total project costs; these funds are to be repaid within five or ten years, following a grace period of a year and a half starting from the production date. The Fund does not receive any profit on these loans except for administrative fees, which amount to 2.5% of each loan (Ministry of Commerce and Industry, 2015).

A3, A9 and A13 are large organizations and are accredited to ISO14001. They all are committed to implementing the five basic processes of EMS (policy-making, planning, implementing, checking and reviewing); furthermore they use local criteria and standards for controlling and assessing their environmental implications and for managing their liquid and solid wastes environmentally by reusing and recycling them and then selling the remainder to waste disposal companies (see Section 5.2.1). Implementation of a full form of EMS (i.e. one that incorporates all the basic EMS processes) is voluntary but it can play a significant role in achieving environmental improvements within the business and industry sectors in the KSA. From both the qualitative and quantitative data, it is evident that those organizations in the IC that do implement the full form of EMS have witnessed many and various improvements in their environmental performance and awareness, particularly so when compared with other organizations who only implement a small proportion of an EMS or who only have the PME environmental licence (see Section 5.2.1). However, these improvements are relative to previous performance, i.e. they are not relative to the performance of organizations that do not implement their EMS in full, and it must be further noted that organizations that do not have any form of EMS, or that only implement a partial EMS, also do not have any records pertaining to environmental issues.

This lack of records is problematic; organizations that have not adopted an EMS may indeed make efficiency savings but they do not have data collated in a form that would facilitate comparisons with organizations that have adopted an EMS. Although an organization does not need an EMS to make savings (it merely needs the well-directed enthusiasm of the management team), the evidence gleaned from this investigation leaves one in little doubt that having an EMS (and implementing it in full) greatly assists managers in initiating programmes intended to deliver efficiency savings in terms of resource consumption and waste disposal. This is largely because of the discipline and the systematic approach taken to resolve inefficient resource usage as well as pollution issues through improved management.

However, this research has revealed that the majority (84%) of the organizations in the IC in Jeddah do not have and do not apply any form of EMS, whereas about 5% (9 out of 183) organizations have an informal EMS, and about 11% (20 out of 183) have certified their EMS through ISO 14001. The widespread adoption of EMS in the KSA is therefore advancing at a relatively slow rate, and it seems that the government is not fully cognisant of the issues or of the importance of taking measures such as EMS, and has not fully embraced the principles behind EMS. This is unfortunate as the rapid adoption of such measures through government support could represent a significant step towards achieving sustainable development for the Kingdom and the whole region. The global and regional position of the KSA and its urgent need to manage its natural resources effectively require it to embrace this voluntary and self-monitoring approach, which involves innovative technologies, more flexible processes, more self-monitoring within industries, and more participation on the part of all sections of society (Holling and Meffe, 1996; Szymanski and

Tiwari, 2004). EMS is a systematic approach that ensures continual improvements to all environmental aspects of the operation of a business (Darnall and Edwards, 2006; Sakr et al., 2010); it is thus a useful tool in improving resource efficiency in order that the country may move forward toward achieving sustainable development (McDonach and Yaneske, 2002; Arimura *et al.*, 2008; Chan, 2008; Sakr *et al.*, 2010; Zorpas, 2010).

The issuing of new local environmental laws and strict monitoring have been appropriate solutions, but the most important solution to alleviating pollution problems is the application of self-monitoring and the adoption of a voluntary approach by the organizations themselves. Zeng *et al*. (2005) described China's experience in relation to the concept of 'self-monitoring' in his paper. The country has witnessed the rise of pollution to levels that are far worse than international standards; this is due to the current industrial revolution, which is having a measurable impact on people's health. This has resulted in the Chinese government embracing this concept by encouraging the industrial sector to implement EMS standards under ISO14001, and to obtain certification if possible, in order to reduce and control pollutant emissions. Certified organizations have their EMS audited by an accredited certification body (Price, 2007).

In the KSA, the PME is the primary body responsible for disseminating information as well as enforcing the environmental legislation in the KSA, in order to improve the environmental performance of the private sector through encouraging firms to adopt EMS, and through setting the standards to obtaining the PME licence, which could reflect the standards inherent within internationally recognized EMS (see the distinctions between EMS and PME in Section 5.2.1). This combined approach was recommended by a seminar entitled the Saudi Experience in Environmental Management, which was given in order to enhance the role of EMS in all industrial projects, albeit through the application of EIA beforehand (Alsolei, 1998).

The cost of environmental improvements often creates difficulties and can be financially onerous, particularly for small- and medium-sized organizations; it is therefore recommended that the government offer the private sector incentives by providing financial support, technical assistance, training, etc. for making such improvements (Massoud et al., 2010a). Despite the costs, A3, A9 and A13 approved of their organization's claim to be implementing full EMS, compared with organizations such as A11 and A14 that have an EMS but are not yet committed to the all basic processes of EMS (they only apply two of them: planning and implementing). In addition, they do not have environmental records and do not use local standards for controlling their environmental impacts (see Sections 4.3.1 & 5.2.1). A11 and A14 merely noted the financial benefits of selling their wastes to the contractors who resell them to other organizations that use this waste in their activities, or that export it to other countries such as China or India. This waste was costing the organizations in the IC a great deal, but now they are gaining some economic benefit from selling them. This was emphasised quantitatively by A14, who stated that their solid waste in the past cost them about 850 SR (£150) per tonne, whereas now they earn about 30,740 SR (£5,380) from selling 150 tonnes of waste glass; this is in addition to about 67,500 SR (£11,814) from selling 13.5 tonnes of plastic waste monthly. A14 added that they sold one tonne of plastic solid waste for 5,000 SR (£875), and the contractor exported it to China, where the waste was then refabricated ready for export (as a new product); this process increases its value by about 25,000 SR (£4,375).

From the interview answers received, it is evident that legal regulations relating to environmental issues were not the main reason for implementing environmental initiatives. Some respondents stated that an EMS helped them to avoid legal sanctions that could result in fines or other penalties, but as the evidence from this research has shown, such penalties are seldom enforced, and therefore this aspect of EMSs cannot be considered a major environmental benefit.

Another reason for implementing an EMS, as derived from this research in the IC, is economic, such as enhancing the organization's image and providing economic advantages such as improving national and international market competitiveness in the longer term, as well as responding to supply chain pressures. In addition, the respondents felt that EMS raises the reputation of their product in the eyes of the consumer, that it assists in local market penetration, and that it allows the organization to export to countries that have strict environmental regulations. This was especially important if the organization was part of a multinational group or supplier to such a group or even if they were well known in the KSA and in the Middle East. This is in line with the findings that have been emphasized by some authors, such as Tan (2005), Darnall et al. (2008) and Manley et al. (2008), in that many large multinational organizations adopt EMS standards in accordance with market demands and in the belief their adoption could improve market competitiveness in the longer term, or to the fact that their competitors have already adopted it (King et al., 2005; Potoski and Prakash, 2005a). They are attempting to improve their image, enhance their reputation and raise their level of competitiveness (King et al., 2005; Darnall et al., 2008), although they may be generating income from selling their waste rather than allowing it pollute the local environment. However, some authors have argued that well-implemented EMS standards most definitely results in an improvement on a company's environmental performance and technical innovation (Iraldo *et al.*, 2009), which, in turn, can be associated with financial performance (Zahra, 1993; Rais and Goedegebuure, 2009; Ferron *et al.*, 2012).

The suggestion that an EMS provides economic advantages for the organization in the local market was ranked by the questionnaire participants as relatively the least important of the environmental benefits of implementing EMS in the IC. This was because of the lack of interest and pressure for environmental improvements among the population as a whole and therefore among local customers. Indeed, there is an incremental relationship between customers' environmental awareness and economic advantages. If customers' environmental concerns and awareness increased, competitive pressures on the organizations would be intense (King et al., 2005; Potoski and Prakash, 2005a; Darnall et al., 2008) but there is no sign of this occurring in the KSA.

Further environmental benefits provided by EMSs include a harmonized system for managing an organization's environmental impact and also assistance in incorporating environmental considerations when designing plans and executing industrial projects. Regular monitoring through the provision of periodic reports about the extent of adherence to established environmental standards and regular and periodic measurements of the levels of environmental impact derived from the organization's activities are other environmental benefits that can be derived from implementing an EMS in the IC in Jeddah. It is now generally established that organizations that adopt EMS are in a better position to deliver improvements in terms of operational safety and environmental monitoring of business processes and practices (Sayre, 1996; Christensen and Rasmussen, 1998; Pun *et al.*, 1998; Tan, 2005).

5.2.4.2 The cost of implementing EMSs in the IC in Jeddah

This research has provided a compelling case for the environmental and economic benefits that can be obtained from the adoption of EMS in the IC in Jeddah. Accordingly, organizations that have formal and informal EMS were asked about the cost, management system, hurdles, staff engagement and consultancy use that they have experienced in implementing EMSs in order for them to be used as examples to other organizations.

The cost of ISO14001 accreditation is generally based on an organisation's activity, size and number of employees. The organizations who were new to the ISO14001 standard and who needed some guidance or consultation on its requirements found that they needed an action plan and training courses relating to successful preparation and adoption. They needed firstly to sign a contract with a specialized consulting and auditing firm to guide them through the implementation of EMS standards as well as the certification process. The lack of professional advice, knowledge and skills in terms of EMS practitioners is one of most important barriers to EMS implementation (Gunningham, 2007; Chan, 2008; Massoud *et al.,* 2010b; Lam *et al.,* 2011). Nevertheless, it is suggested that using experienced consultants will assist the organization to develop their own system (Chan, 2008). For those who need to use consultants, this process will cost between 45,000 SR (£7,875) and 60,000 SR (£10,500); this is due to the cost of the consultancy services and annual checking visits (the required annual reviews to ensure the organization continues to meet the requirements of ISO14001), which is about 3,500 SR (£612.5) per visit. Although the ISO14001 certificate lasts for three years, an annual review is required to ensure that the organization is following and maintaining the requirements of the standards. On the other hand, if the organization is ready and has its own experts, and therefore does not need the help of EMS consultancy firms, they only need to audit their EMS through firms that are accredited by the national certification body. The cost in this case is about 35,000 SR (£6,125) including checking visits (A3, A9, A13, B8, B9 & B10).

It is worth mentioning here that the auditing firms (after checking the organization's files and reports, and conducting a formal audit assessment) send the relevant documents to the national certification body; this would be the United Kingdom Accreditation Service (UKAS) in the UK and the ANSI-ASQ National Accreditation Board (ANAB) in the USA, but there is no accreditation body for ISO14001 standards in the KSA. UKAS is world's first accreditation body, and UKAS certificates are well recognized around the world. UKAS undertakes a rigorous verification procedure to ensure full and complete compliance on the part of approved certification bodies; indeed, it is known to be uncompromising in this respect and may revoke its certificate of accreditation if there is evidence that a firm is not in full compliance. Many certification bodies accredited by UKAS are currently working in the KSA, providing consultancy and auditing services, such as: DAS Certification Limited, Lloyd's Register Quality Assurance Limited, and SGS United Kingdom Limited (B8, B9 & B10).

Table 5.1 below summarises the cost of implementing EMS standards by some organizations in the IC in Jeddah. A3 represents an organization that decided not to engage consultants in adopting EMS; this organization has been accredited to ISO14001 since 2005. A3 stated that the necessary environmental modifications and improvements cost them about 70,000 SR (£12,251). On the other hand, A9 and A13 felt the need to engage consultants in adopting their ISO14001; for A9, the environmental modifications and improvements cost them about 30,000 SR (£5,250). Accreditation to ISO14001 cost A13 about 20,000 SR (£3,500) to effect the necessary changes.

It was evident that A11 and A14, who claimed to have an EMS and yet are unable to substantiate their claim, only implement a small proportion of the environmental initiatives that are available to assist in controlling their activities (see Sections 4.3.1 and 5.2.1). A11 stated that applying even an informal EMS in their organization cost them about 46,000 SR (£8,050), whereas A14 (who has the PME environmental licence) stated that their EMS cost them 40,000 SR (£7,000), mostly for the consultants and environmental initiatives. However, this EMS cost as stated by A14 may actually have been the cost of the PME environmental licence, which he considered as an EMS.

Table 5.1: The cost of adopting EMS in some organizations in the IC in Jeddah

Organization	EMS cost		Consultancy use	Notes
	Total cost of EMS	Accreditation cost for formal EMS		
A3	105,000 SR (£18,377)	35,000 SR (£6,125)	No	Has ISO 14001 and the PME environmental licence
A9	80,000 SR (£14,000)	50,000 SR (£8,750)	Yes	Has ISO 14001 and the PME environmental licence
A11	46,000 SR (£8,050)	_	Yes	Has informal EMS
A13	65,000 SR (£11,376)	45,000 SR (£7,875)	Yes	Has ISO 14001
A14	40,000 SR (£7,000)	_	Yes	Has informal EMS and the PME environmental licence

Many organization have undertaken a number of different practical processes to manage their commitment to EMS standards. Having explicit responsibility for environmental concerns and employing an environmental department are the two most important aspects that organizations apply in the full form of EMS. In this research, only 6% (11 out of 183) organizations in the IC had environmental managers. All these 11 organizations are accredited to ISO14001 and are large-sized; 6 of these 11 organizations have the PME environmental licence (see Table 3.2). A3, A9 & A13 from the first set of interviews stressed that they have a department that is solely responsible for environmental issues and for implementing EMS standards in their organization (see Section 4.3.4.2). This is in line with the findings of Morrow and Rondinelli (2002), Zeng *et al*. (2005) and Rodríguez *et al*. (2011) in that well-defined responsibility for environmental management in an organization is one of the success factors behind good environmental practice and EMS standards implementation.

However, there is consensus among those organizations that have an EMS or ISO14001 (from the first set of interviews, and confirmed by B8 & B9 from the second set of interviews) that the implementation stage of the five basic EMS steps represents a significant hurdle. They reasoned that this is due to it including documentation and monitoring as well as employee training and awareness. In addition, in the initial stage the planning process is a major hurdle, as it includes defining the activities and products that interact with the environment or that affect safety (see Section 4.3.4.2). This is in line with the findings of Mohammed (2000), whose studied the ISO14001 EMS implementation process and its implications in the central part of Japan, which consists of eight prefectures and is known as the Chubu region (this region has a dominant role in developing modern industry and technology in Japan as well as in addressing environmental problems). He found the documentation process and employee training and awareness to be the most problematic processes during the EMS implementation stage.

Those organizations that have an EMS or ISO14001 from the first set of interviews also emphasised that having all the staff, from top managers to shop-floor workers, fully engaged represents a significant move forward in the implementation of EMS in their organisations. They stated that all staff should have the opportunity and responsibility to contribute in achieving continual improvement in terms of environmental performance and in ensuring that they will be rewarded with ISO14001 accreditation. Active participation and the level of employee engagement influence an organization’s environmental attitude and strategies (Knowles and Espinosa, 2009; Sharma, 2014). Again, this should be conducted in the light of well-defined environmental responsibilities and authorities, and should be clear for all staff members and departments within an organization (Morrow and Rondinelli, 2002; Zeng *et al.*, 2005; Rodríguez *et al.*, 2011).

Chapter 6:

Conclusions

6

6.1 Introduction

After a brief reminder of the study objectives and data collection, this chapter draws a number of conclusions based on the findings. The subject is a critical investigation into the barriers and opportunities for EMS implementation for the delivery of environmental benefits to the IC in Jeddah, KSA. Thereafter it makes recommendations for increasing the opportunity for implementing EMS in the IC in Jeddah (as a result of this case study) and in industrial sectors in the KSA in general. This is followed by a discussion of the study's limitations and difficulties, and of its potential contribution to research and policy, as well as further research.

6.2 Research findings

Jeddah is the second largest city in the KSA and is regarded as the key industrial and commercial centre. Jeddah is suffering from serious environmental problems such as air quality deterioration and soil pollution resulting from industrial activities as well as increasing population levels and numbers of vehicles (Magram, 2009); this was referred to in Chapter 1. Furthermore, it lacks a comprehensive sewerage system, rainwater drainage system and adequate solid and hazardous waste management systems (Abdulgani, 1993; Vincent, 2003; Al-Sefry and Şen, 2006; Adel Faqih, 2009; Kadi, 2009; Magram, 2009; Al Saud, 2010; Ramboll, 2013).

The first Industrial City (IC) in the KSA was established in Jeddah at the end of the 1960s. This was planned to be adjacent to Jeddah city but due to the rapid population expansion, it is now inside Jeddah and surrounded by residential neighbourhoods. This IC was built in a time when there were no environmental controls and where less consideration was given to environmental concerns in the KSA than has been the case in more recent years

(Ministry of Commerce and Industry, 2004). As a result, the IC has created levels of liquid hazardous and toxic elements, air pollutants and solid waste exceeding their environmentally allowable limits by unacceptably high margins. These reached some thousand times above the acceptable limit in some cases, and would doubtless have serious environmental, health and economic consequences for the KSA (Vincent, 2003; PME, 2006a; Magbool, 2009; Magram, 2009).

At the end of 2001, General Environmental Regulations and Rules for Implementation in the KSA were issued in order to control, monitor and protect the KSA environment from these threats (PME, 2006b). PME, as a legislative and regulatory body, has the responsibility of pursuing and monitoring each organization's environmental situation and also of fining them for non-compliance (PME, 2006b).

The main factor implicated in pollution is energy use, and one of the main consumers of energy is the industrial sector; this is typical of rapidly developing economies such as China (Sinton and Levine, 1994). It is also clear that industrial sectors are the major causes of environmental problems worldwide (Baas, 1998; Vincent, 2003; Magram, 2009), and this research has described many sources of pollution emanating from the Jeddah IC that may be partly responsible for the environmental problems facing Jeddah and its locality. A possible solution for addressing the problem of uncontrolled industrial activities is for government bodies to legislate to enforce reductions (Baas, 1998; Baas and Boons, 2004). The implementation of environmental regulations and rules in an organization is at the heart of any environmental management system through the use of environmental projects, goals and management programmes. The implementation of environmental policy internationally is strictly controlled by the specifications found within EMS standards. In general, academics are agreed that adopting EMS standards leads to improved operational safety, more environmental monitoring of business processes and practices, and improved environmental outcomes (King et al., 2005; Tan, 2005; Zobel, 2008; Massoud et al., 2011). Darnall et al. (2008) have suggested, however, that adoption of the ISO14001 EMS standards is an attempt to improve the image of an organization and actually does little to reduce its impact on the environment, especially as the body issuing ISO certificates rarely rescinds them where organizations fail to maintain the standard (see discussion in section 1.2.2).

EMS is a tool that can improve an organization's environmental performance; it can monitor, control and help to clean up an organization's processes (Sakr et al., 2010). As explained in Chapter 1, EMS was established as a standard by which organizations holding such accreditation could claim they had a systematic approach to environmental aspects of operating their businesses but, as previously discussed, many organizations in the KSA have developed their own interpretation of EMS.

This research has aimed to conduct a critical investigation into the barriers and opportunities for EMS implementation for the delivery of environmental benefits to the IC in Jeddah. As stated in Chapter one, the objectives of this research are to:

- Determine the current scope of EMSs in the various industrial plants.
- Assess the current level of the PME's awareness raising and control efforts.
- Identify the obstacles facing the implementation of EMSs.
- Identify the possible environmental benefits to be derived from implementing EMSs.

In order to achieve these aims, this study has used a case study research design based on multi-method data, and quantitative and qualitative methods (questionnaire, interviews and documents) to develop a more detailed understanding of EMS implementation in the IC in Jeddah.

Conclusions based on research findings have been drawn for each of the four objectives:

6.2.1 Determine the current scope of EMSs in the various industrial plants

This research has carried out an extensive investigation into the scope of EMS implementation in the IC. The conclusions are based on a large questionnaire sample (32%) of all organizations in the IC supplemented by many interviews. 183 organizations participated by questionnaire and 14 of them by interview as well. Also, twelve interviews were conducted with various relevant governmental departments and some private bodies (see Table 4.1).

It is evident from the research findings that the vast majority of organizations in the IC do not have a manager who is directly responsible for environmental affairs, which supports the finding that, in general, environmental concerns represent a low priority for managers; it is also the case that, in the IC and according to the data herein, there are too few personnel with adequate qualifications or training in environmental matters. Indeed, the majority of the interviewees (in both sets) agreed that, in general and within their organization in particular, the implementation of EMS in the IC has been unsatisfactory; even among those that do have an EMS, the questionnaire respondents admitted that they do not periodically update their environmental targets. Thus, the scope of compliance with environmental regulations in the IC is inadequate. This lack of compliance may be contributing to the excessive consumption of non-renewable resources (fossil fuels and fossil water), which compromises the Kingdom's efforts to promote sustainable development.

Thus, this research has reached the conclusion that the basic requirements of EMS are not being adequately met by the majority of the organizations in the IC. Some, especially those with ISO14001 and large-sized organizations, performed better even if this was for image or economic reasons rather than any underlying belief in the importance of environmental protection. At the other end of the scale are the majority of organizations who did not apply any form of EMSs at all, some of whom did not even know what EMS meant.

The statistics of the research revealed that 153 (83.6%) of the organizations sampled, a very large majority, did not apply any form of EMS. Of the remaining 30 (16.4%) who claimed to have EMS, 20 organizations (10.9%) have EMS under ISO14001 and seek to adhere to the stipulated standards; this is a relatively reliable indication of good environmental practice. Of the other 10 (5.5%) claiming to have an EMS, 9 (4.9%) do not carry out all the required processes and therefore are not fully compliant with EMS, but do have certain environmental initiatives. One manager did not know whether or not his organization is accredited to ISO14001, which is an example of the lack of environmental knowledge of some of the respondents to the questionnaire.

The PME environmental licence should be mentioned here. The differences between this licence and EMS are discussed in Chapter 1 (section 1.4.2), but in essence, while the PME licence includes elements of EMS, it is not as comprehensive as an EMS. Out of the 183 organizations in the survey, 32 (17.5%) have the PME licence; these 32 organizations include 18 (9.8%) organizations with an EMS and 14 (7.7%) without an EMS but who claim to be compliant with the environmental elements in the PME licence.

To comply with EMS (and also with the PME licence) organizations must follow local environmental regulations and standards (Tam et al., 2006), which in this case would be Saudi government regulations. Because these are legal requirements, all organizations whether or not they choose to apply EMS, must comply with these rules (PME, 2006b). This research has provided widespread evidence not only of non-compliance with EMS but also of non-compliance with the legal measurement standards, which are not enforced or adequately monitored by the PME. Only the organizations which have EMS accredited to ISO14001 fully comply with these standards.

Other aspects of this research into the current scope of EMS in the IC covered the relevance of the size of organizations and the activities they followed. It concurs with the conclusion found in previous research such as De Marchi and Grandinetti (2012) in Italy, Aragón-Correa *et al.* (2008) in Spain and Zhang *et al.* (2008) in China, that large-sized organizations are more likely to implement EMSs than medium and small-sized organizations who cannot afford the costs of some environmental practices such as installing filters. Large-sized organizations, which probably have the administrative capacity to develop and monitor an EMS, are more likely to be part of multi-national companies and to be more conscious of their image (Darnall et al., 2010). In this research the findings showed that the Food and the Chemical and plastics sectors are most commonly the activities that have EMSs, ISO14001 and PME licences. This is related to the fact that organizations in the Food sector must make every effort to win the trust of their customers and maintain hygiene standards. Chemicals and plastics contain many pollutants and these organizations usually recognised the need for environmental initiatives to control them.

The belief that their organization does not have an adverse environmental impact is also a reason that has limited the implementation of EMS in the IC. Organizations that believe this compare themselves to heavy industries such as Metal and Chemical, and are unaware of the pollution they themselves create (Bosco et al., 2005).

6.2.2 Assess the current level of the PME's awareness raising and control efforts

The findings that resulted from the quantitative and qualitative surveys make it clear that the PME's efforts to spread awareness of the environmental situation and to bring it under control are inadequate. There are deficiencies in every aspect of the PME's work, awareness, information, training, enforcement, monitoring and control. Some of the interviewees did not know what EMS meant, some had not heard of the environmental licence, and some even confused environmental protection with wildlife conservation.

To improve environmental conditions in the IC, organizations must first be aware of the problems they are causing and the effects these are having on the environment. There is legislation in the KSA to deal with these problems, in particular, the General Rules and Regulations of 2001 (see section 1.8), and the PME was charged with their implementation. This research has shown that some organizations in the IC are totally unaware that these regulations and licence exist (A1, A2, A7, A10, A12 & A13). This indicates a failure on the part of the PME to carry out one of its primary duties, to spread public awareness of environmental legislation. Many respondents to this research commented they had received no information from the PME. Some organizations (A1, A2 & A10) in the IC neither knew about environmental standards nor about the existence of an environmental licence. Communication should be one of the PME's fundamental objectives and it appears that this is not ensured by this organization.

One of the most devastating criticisms of the PME's work is the revelation in this research that the PME has failed to enforce existing legislation, i.e. the General Rules and Regulations of 2001. These regulations specify that all industrial organizations in the KSA must have applied for an environmental licence by 15 October 2006 (PME, 2006b). When this research was carried out in 2012, only 15% of the organizations in the IC had this licence (PME, 2011). The PME does not publicise this fact, so it is hard to know whether there has been any increase since then (but it seems unlikely).

Analysis of the interviews indicates weaknesses in other aspects of the PME's work, in the monitoring, follow-up processes and their reluctance to impose fines and legal sanctions. Enforcement action by the PME is generally seen as so weak that their instructions can be ignored with impunity. Not all organizations flout the rules but those that behave in an environmentally responsible way, or that at least make some attempts to protect the environment, receive no encouragement.

The interview with B6 (see section 4.3.3) and also the interviews with B1 and B2 reveal that there is no clear programme or specific goals in place to raise the level of environmental awareness in the IC and to increase the number of organizations that have an environmental licence.

The PME is also charged with disseminating information on environmental matters to the wider public, which includes the owners, workers and administrative staff currently employed within the IC. However, the interviews revealed that the PME has not hitherto provided any general environmental information in the form of booklets or leaflets (electronic communication is limited in the KSA) in the IC, and therefore, by extension, the wider public is not being informed. This is important because, as in China, significant changes can be initiated by public pressure (as well as pressure emanating from the supply chain) (Zhang *et al.*, 2008). This lack of pressure on the part of the general public may have resulted in less pressure on the PME to vigorously pursue their stated objectives.

This research has assessed and criticised pertinent portions of the PME's work. Some of this could be blamed on the shortage of resources, insufficiently qualified staff and lack of equipment. The limits to the PME's annual budget were mentioned in the interviews and this occurs not because of any shortage of money in the KSA but because of the bureaucracy involved in decision-making (Al-Gilani and Filor, 1999; Vincent, 2003). In fact, many of the PME's problems can be attributed to the centralised decision-making process and the political culture of the KSA (Ibid).

This political culture is not likely to be affected by any public pressure for more environmental protection as this topic is seldom discussed in the Kingdom. It is interesting that none of the interviewees, knowledgeable men from government and academia, mentioned another problem that affects the PME's ability to seek an improvement in the current level of awareness and control, i.e. the pressure that is coming from the government in the KSA to increase industrial output that does not depend on oil and gas. Environmental protection can be seen as a hindrance to such development; long-term problems caused by pollution are being ignored in favour of short-term needs.

In order to support and improve the efforts of the PME vis-à-vis its mission, this research has proposed an action plan for the PME, which is detailed in Section 5.2.2.1. This is intended to address any lack in its monitoring and enforcement efforts, and in its role as disseminator of environmental information. It also considers the wider role that the PME can play in the region. However, the financial resources allocated to the PME need further examination if this organization is to develop and succeed in promoting sustainable development and in supporting the government in its drive to diversify the economy.

Accordingly, this research suggests that the staffing numbers be increased such that it is commensurate with the workload, i.e. such that the PME may, to a much greater extent, effectively monitor pollution and enforce the regulations. This would entail engaging staff who are adequately qualified; this has ramifications for Higher Education institutions as, at present, there are too few sufficiently qualified personnel in inspection works. Indeed, the staff currently employed at the PME are in need of training and up-skilling in the fields of inspection planning, inspector health and safety, collecting evidence, protection and control, and documenting inspections. Building the PME's capacity would enable it to undertake more inspections (currently a maximum of two per week) and to conduct follow-up visits to monitor compliance. The PME also suffers from a lack of equipment and resources; there is a very definite need for the PME to have its own laboratory where it can conduct its chemical analyses without fear of data contamination or compromise. There is also a need for more specialist measurement equipment to accurately measure emissions and noise.

The PME could also enhance the role of the inspectors charged with monitoring by training them in inspection planning, inspector health and safety, collecting evidence, protection and control, and documenting inspections. This may entail cooperating with reputable institutions around the world, possibly by inviting foreign experts to participate in the PME's regular schedule of inspections; it may also entail the PME availing itself of the training opportunities offered by Saudi universities. However, the prevailing belief evident in the interviews is that there is little enforcement, and it may be the case that the limited capacity of the PME has exacerbated this common perspective; these attitudes undermine the role of the inspectors, and so the issue of enforcement and of issuing penalties becomes paramount, and the threat of incarceration must also be real. A further issue is that the inspectors are sometimes trying to enforce standards that are based on out-of-date criteria. In this regard, it may be opportune for the KSA to adopt current WHO standards as its environmental criteria baseline. These standards could incorporate Key Performance Indicators (KPI) relating to water and energy consumption, all waste streams and the use of natural resources.

To complement the above, the PME could initiate its own training and awareness courses, and could publish its own brochures and leaflets to promote awareness amongst all stakeholders. The PME could also seek support from other relevant government departments, such as Modon, the Ministry of Commerce and Industry, Saudi Customs, the Jeddah Municipality the Jeddah Chamber of Commerce. Modon is responsible for the development of the infrastructure in all ICs in KSA, and the Ministry of Commerce and

Industry and Saudi Customs could, for example, hold up industrial permits until a PME licence had been obtained.

The Saudi government is seeking to diversify the Kingdom's industrial base. The PME could assist in this; by vigorously pursuing its objectives to reduce pollution and waste, it would be opening the door to organizations that are inherently cleaner and 'greener'. Thus, through the work of the PME, the KSA would witness industrial diversification, reduced emissions and resource waste, and a populace that was not being subjected to land, air and sea pollution. Neither diversification nor concern for the environment, if pursued through the PME, need result in serious economic consequences; economic development would then be in line with international and regional laws and conventions.

Some organizations in the IC, in particular the smaller ones, may struggle to purchase the necessary equipment for them to meet the PME's criteria, it may then be necessary for the PME to support such organizations through financial means, possibly through tax cuts on environmental equipment, i.e. the PME could adopt a 'carrot and stick' approach. The PME could further assist by providing a small liquid treatment plant within the IC, which would encourage organizations not to employ underhand methods in seeking to rid themselves of waste, and would mean that violators would have no excuse; this endeavour would be further supported by encouraging the establishment of private recycling plants in the IC also. Improved environmental governance goes hand-in-hand with voluntary compliance (Lugwisha *et al.*, 2008).

Should the Action Plan described above be instituted in full, the PME's workload will increase. This increased workload and level of responsibility could be ameliorated, as the industrial organizations in the KSA that attend training programmes would then better comprehend the need to produce periodic reports detailing all their emissions. This would encourage the organizations to install all the requisite equipment and to more closely adhere to the emissions criteria; it would further encourage them to send key personnel on training and up-skilling courses. These steps would greatly ease the onerous task of imposing fines on those organizations that continually violate the PME's standards. This raises the delicate issue of 'fine ownership'; currently all monies collected in fines are sent to the Ministry of Finance but should the PME be allowed to take ownership, then all monies would go directly to supporting the PME's work, which would serve as a significant motivational mechanism for the PME.

6.2.3 Identify the obstacles facing the implementation of EMSs

This research has explored various obstacles and has found that lack of legal enforcement is the most important one, as ranked by the questionnaire respondents. This conclusion has come from the qualitative as well as the quantitative data (see section 5.2.3) including, time and again, from the interviews (see 4.3.3). The problem is not unique to the KSA as researchers in other developing countries have come to the same conclusions (Faure and Niessen, 2006; Studer et al., 2006). The lack of legal enforcement encourages a culture that ignores existing environmental protection rules or disclaims any knowledge of them. Until this situation is changed it is difficult to see how EMS will ever be fully implemented. If legal pressure were applied to ensure that the regulations were implemented, organizations might then come to see that the way forward was to implement EMS as it is a useful tool for continual environmental improvement (Darnall and Edwards, 2006; Sakr et al., 2010).

This research has also shown that the low level of environmental awareness and concern on the part of management, workers and in the public in general is a very significant obstacle facing the implementation of EMS in the IC. Organizations will not take steps to apply EMS when there is no pressure from the public to do so. Pressure from customers would be likely to have the most immediate effect as the public, looking at the effects of uncontrolled pollution, will become more aware of the problems and will also contribute pressure for improvement. Environmental education is necessary to raise the general level of public awareness and here the PME has much responsibility. If managers can be educated in this respect, the workers will follow their lead (Zutshi and Sohal, 2003). A major environmental disaster would receive widespread publicity and would probably result in a demand for changes but more education and research to increase the level of environmental awareness and prevent such a situation would be a much better alternative.

The third most significant obstacle facing the implementation of EMS is cost. Many of the respondents to this research felt that adopting an EMS would be expensive especially if modifications to machinery were required; there would also be implications for staff time. These costs were more likely to have an adverse impact on small organizations, of which there are many in the IC. The cost of waste disposal facilities also hinders the implementation of EMS in the IC. To make expensive changes, organizations need to be influenced by perceived economic benefits and, although reducing water and energy waste saves money, environmental improvements do not generally offer such benefits unless enhancing their environmental credentials gives them a better image. This is more likely to influence overseas customers than the home market due to the lack of environmental awareness in the KSA. Encouragement and publicity for organizations that make important environmental improvements could help remove some of the obstacles facing the implementation of EMS.

When respondents were asked about the factors contributing to the difficulties of implementing EMS in the IC, many of them ranked ‘poor definition of environmental responsibilities’ as a moderately important obstacle. Environmental changes are more likely to be made if one person, team or department in an organization recognises that they have clear responsibility for complying with environmental regulations and standards. Lack of cooperation between the PME and other government department such as Modon is another factor which hinders the implementation of EMS in the IC.

Other obstacles raised by this research include the limited number of companies (6) specialising in the safe disposal of liquid and solid wastes (Alzain, 2013) and also the lack of understanding of what is meant by the term ‘sustainable development’. The latter is an issue that can only be rectified by environmental awareness education.

This research has shown that these challenges are not unique to the KSA. Almost all of the Middle East countries are facing these challenges, particularly inadequate government enforcement and support, and low environmental awareness. These major challenges that are facing the adoption of EMS in the Middle East are the same challenges that are found in all developing countries. This is confirmed by certain authors in countries such as China, Indonesia, Hong Kong, Turkey, Lebanon, Egypt, Jordan, the UAE and Thailand (see Section 5.2.3.1). This was also emphasised by the second set of interviews who added adoption cost as one of the major challenges to EMS implementation in the Middle East.

However, there are successful experiences, from other countries in the Middle East region or from other developing countries, some of which may have environmental and cultural characteristics that are similar to the KSA, as well as possibly sharing similar obstacles and having difficulty in promoting EMS standards. They may suffer from: a lack of sufficient infrastructure, limited regulatory capacity to monitor and enforce environmental laws and regulations, and weak institutions that are unable to vigorously promote EMS standards. Developing countries in general should seek to benefit from the experiences of nations with similar characteristics in the field of environmental protection and sustainable development, as this could accelerate the institution of measures that are proven to have a successful track record; such an approach would also reduce the costs entailed.

From these successful experiences, participation in the largest international award programme of sustainable schools in the world (the ‘Eco-Schools’ programme), which can be instrumental in raising environmental awareness, is a further recommendation. This programme aims to promote and raise environmental awareness among pupils through school as well as through community action as well as encouraging pupils and the next generation to make positive changes in the field of sustainable development; indeed, today’s pupils are tomorrow’s leaders. 54 countries around the world have adopted this programme; four are in the Middle East (Jordan, the UAE, Iran and Turkey). The United Nations Environment Program (UNEP) promoted this approach as a model initiate in its Education for Sustainable Development programme in 2003 (FEE, 2014).

Although many aspects of the Eco-Schools programme are drawn from ISO14001, its focus is to raise environmental awareness across society. However, on a deeper level, the programme is intended to facilitate the development of policies that reflect particular national needs, and then to promote effective implementation; this would entail gathering data on the environmentally significant aspects of any development as well as identifying objectives to address legal issues.

Of the successful experiences to overcome lack of legal enforcement one is of particular note: the ‘Environmental Police Department’ (Rangers) in Jordan. This is an independent body charged with carrying out the tasks of inspection and enforcement of environmental regulations and laws. The Rangers represents a unique institution in the Middle East region and operates as a unit of the Public Security Directorate (PSD), and as the executive arm of the Ministry of the Environment (ME) in Jordan. Today, 15 branches in the six police regions in Jordan (and about 650 officers) are involved. The Rangers are sufficiently qualified and trained but also tend to seek for support from a range of international organizations depending on the services they have to offer. They seek for technical expertise and assistance in strategy and policy-making from their German and American colleagues (Rangers, 2014). There is a free-trade agreement between the USA and Jordan, and under its terms the US Environmental Protection Agency (EPA) assists Jordan in the compliance and enforcement of its environmental regulations; in addition, the

EPA assists in training the Rangers in: inspection planning, inspector health and safety, collecting evidence, protection and control, and documenting inspections (Rangers, 2014; EPA, 2015a). As a result of the concerted actions of the Rangers, the total number of cases pursued for environmental violations increased from 7,781 in 2007 to about 56,000 in 2013 (Rangers, 2014).

Thus, various experiences are available for enhancing the adoption of EMS and overcoming its challenges; these include appropriate support and timely initiatives on the part of government towards embracing and encouraging the introduction and use of renewable energy and clean technology. Investing in pollution controlling technology, i.e. employing methods that obviate the need for stack scrubbers or emission filters, should assist organizations seeking to satisfy the relevant environmental criteria, which in turn would increase the opportunities to adopt an EMS. In addition, investing in renewable energy should help organizations seeking to reduce their fossil fuel or particulate matter emissions, which would assist the adoption of EMS; indeed, EMS supports environmental innovation, although innovation behaviour has been found to be mainly correlated with the stringency of the environmental policy (Frondel *et al.*, 2008). Nevertheless, if the government takes a lead in this matter then the private sector should be more encouraged to follow suit. In this context, it is worth mentioning the experience of the United Arab Emirates (UAE), whose government has sought to rationalize energy consumption by exploiting solar energy. The UAE has launched an integrated plan to operate all its desalination plants through the power of clean and renewable energy (solar energy) by 2030 (EAD, 2014). Furthermore, the UAE has launched the largest solar project in the world (the Shams 1 Project) to produce electricity through several specially designed technologies. This project costs some $600 million and the energy production capacity of the plant is intended to reach 100 MW. The project is predicted to displace 175,000 tonnes of CO_2 every year, taking the equivalent of approximately 15,000 cars off the road or planting 1.5 million trees (Shams, 2015).

From the available governmental initiatives that promote environmental issues and raise awareness about them is the example of a colour-coded environmental performance rating (for more details see Section 5.2.3.1) that was successfully introduced by the Chinese government. The government keeps the public informed of the ratings of a wide variety of companies by publishing them in the media; this is also of interest to banks and rival organizations. The system is now well known and respected, environmental awareness has been raised, and pollution (to a certain extent) has been reduced (Zhang et al., 2008).

Increasing the remit and powers of the agency or body responsible for environmental issues in the country is another successful experience; it has been successfully adopted in Malaysia and China, countries that are actively seeking to raise the importance of environmental issues (Hezri and Nordin Hasan, 2006; Zhang *et al.*, 2008).

Thus, it is possible to benefit from the experience of others in seeking to promote innovative environmental initiatives in order to pave the way to the successful implementation of EMS standards, as a useful tool for continual environmental improvement and the optimal utilization of natural resources (toward achieving sustainable development) (Darnall and Edwards, 2006; Sakr et al., 2010) .

6.2.4 Identify the possible environmental benefits to be derived from implementing EMSs

This research has explored the possible environmental benefits, such as improving the environmental performance of organizations as well as their operational safety. Implementing EMSs also helps them define environmental objectives and targets and, through training sessions, raises environmental awareness among workers.

This research has shown that the environmental performance of organizations that implement the full form of EMS standards in the IC in Jeddah is improved, and that they reduced their environmental impacts and rationalized their consumption of energy and water as well as managing their waste more efficiently. These improvements in rationalizing the consumption of energy and water, increasing natural resource efficiency, and managing waste environmentally are all essential in moving forward towards a more sustainable society (Watson and Emery, 2004; Arimura *et al.*, 2008; Chan, 2008; Cordano *et al.*, 2010; Sakr *et al.*, 2010).

These improvements are being achieved in spite of the incentives offered by the government through subsidized electricity, water, petrol and diesel (in order to help the private sector develop and advance its services). The reductions mentioned above (as environmental achievements) were facilitated by adopting an accredited EMS regime (specifically, ISO 14001), and by implementing it in full (i.e. adhering to the five steps). It is evident from this research that the EMS-enabled organizations have been able to reduce their environmental impact (and to reduce their general running costs through reduced resource consumption) mainly through following the detailed procedures within their EMS programme, reflecting a systemic approach to policy-making and achieving targets related to environmental concerns, i.e. in the case of these reductions, utilizing an EMS was the key variable. Consultants consider that international policies and standards, such as ISO 14001 and EMAS, should be exploited to underpin EMS; internationally recognized standards are deemed appropriate for the global business community if sustainable development is to become a reality (Watson and Emery, 2004).

Despite the fact that it is voluntary, the full form of EMS (i.e. one that incorporates all the basic EMS processes) can greatly assist organizations in the KSA to achieve environmental improvements. This research has shown that those organizations in the IC that have chosen the full form of EMS have seen marked improvements in their environmental performance and awareness; this is particularly the case when one compares them with organizations who only partially implement an EMS, or who only have the PME environmental licence, or who have no EMS whatsoever. It is therefore evident that the widespread adoption of EMS in the KSA could facilitate the government’s desire to achieve sustainable development in the Kingdom (reflecting its need to manage its natural resources more effectively), and the whole region.

Some organizations claim to have an EMS but are not yet committed to all the basic processes (they generally only apply two of them: planning and implementing). They are only implementing a small proportion of an EMS, they do not have environmental records, and do not use local standards for controlling their environmental impacts; yet they are still performing better than organizations that do not have any form of EMS.

Due to the lack of environmental records in organizations that do not have any form of EMS, or who only implement a small proportion of an EMS, even those who only have the PME environmental licence, conducting comparisons can be problematic; it is possible for organizations without an EMS to make efficiency savings and to reduce resource consumption through well-directed management, but they tend not to have data that are sufficiently well collated to facilitate comparisons with organizations that implement their EMS in full.

Some respondents mentioned that they implement EMS and take certain environmental initiatives to avoid legal sanctions. These actions bring some environmental benefits even though the motivation of the organization is not primarily concerned with the environment. These benefits, however, are limited because it has been demonstrated that legal sanctions are seldom enforced in the IC.

Research has shown that the main motivation for introducing an EMS is economic. It can enhance the image of an organization and its international competitiveness, and can ease supply chain pressures; it is therefore a way in which indirect benefits are brought to the environment. An economic benefit with a more direct environmental benefit is the encouragement provided by EMS for energy and water consumption reductions, and the sale, recycling and reuse of waste material instead of its unregulated disposal. Other authors argue that well-implemented EMS standards generally deliver both environmental improvements and technical innovation (Iraldo *et al.*, 2009), which, in turn, translate into enhanced financial performance (Zahra, 1993; Rais and Goedegebuure, 2009; Ferron *et al.*, 2012).

Implementing an EMS provides a systematic approach to achieve continual improvements to the environment through a harmonised system for managing an organization's environmental impact. When new industrial projects are planned, following EMS guidelines will ensure that environmental considerations are included; these will involve reporting on environmental standards and measuring the levels of environmental impact that arise from the activities of the organization. It is now generally accepted that adopting an EMS can result in more effective environmental monitoring of business processes and practices as well as improved operational safety (Sayre, 1996; Christensen and Rasmussen, 1998; Pun *et al.*, 1998; Tan, 2005).

However, in order to provide a compelling case on the environmental and economic benefits that can be obtained from the adoption of EMS in the IC in Jeddah, this research asked organizations that have formal and informal EMSs about the cost, management system, hurdles, staff engagement and consultancy use that they have experienced in implementing their EMS.

The cost of EMS adoption and ISO14001 accreditation depends on an organisation's activity, size and number of employees, and whether that organization needed to use consultants or decided not to engage consultants in adopting an EMS (see Table 5.1).

Having explicit responsibility for environmental concerns and employing an environmental department that is solely responsible for environmental issues and for implementing EMS standards are the two most important aspects that organizations apply in the full form of EMS. From the quantitative survey, only 6% (11 out of 183) of the organizations in this research's sample had environmental managers; all these 11 organizations are accredited to ISO14001 and are large-sized.

Organizations that have an EMS or ISO14001 (from the first set of interviews, and confirmed by B8 & B9 from the second set of interviews) found that the implementation stage of the five basic EMS steps was a significant hurdle. This is due to it including documentation and monitoring as well as employee training and awareness.

The organizations that have an EMS or ISO14001 also stressed that having all the staff fully engaged played a significant role in adopting an EMS. An organization's attitude toward the environment and its EMS is greatly affected by the perspectives of the employees (Knowles and Espinosa, 2009; Sharma, 2014), although it is important that those employees (in whatever department) have well-defined environmental responsibilities in their work (Morrow and Rondinelli, 2002; Zeng *et al.*, 2005; Rodríguez *et al.*, 2011).

6.3 The limitations of the study

The methodology of this research combined two methods. It used quantitative research combined with qualitative research and in both of these methods bias can be introduced through the choice of questions. One of the main limitations of such methodologies is that they depend on the quality of the information received and the possible bias of the researcher and respondents. This was found to be particularly true when analysing the questionnaires. The need to explain to some of respondents the meaning of EMS and its importance was not bias free which could have influenced some of the answers given. The documentation review which is part of the methodology was incomplete as it was hard to find relevant materials in a country where government data are not freely available.

Only one person in each organization responded and other members of staff might have held different opinions. The respondent was expected to be the Environmental Manager or someone in a similar position. In fact, some of the organizations contacted had no environmental department or specialist so some of the questionnaires and the first set of interviews were answered by the owners or others e.g. Maintenance Managers. The eleven environmental managers showed more knowledge and understanding of the aims of this research. There was a possibility that whoever replied could have had a vested interest in putting the best possible light on the environmental situation in their organization.

Another limitation of this research was the fact that it focused on the IC in Jeddah only and not the whole of the city where other businesses operate. This was due to the difficulties in obtaining information about the organizations outside the IC.

The lack of environmental records in organizations that do not have any form of EMS, or who only implement a small proportion of an EMS, even those who only have the PME environmental licence, is one of this research limitations. Thus, conducting comparisons between such differing groups would be problematic. It is indeed possible for organizations that do not have any form of EMS to make efficiency savings, but they do not have data collated for their environmental measurements, and this makes almost impossible any comparison with organizations that do collate such data. It is also the case that having an EMS is not a prerequisite to making efficiency savings or to better managing waste streams; indeed, all responsible managers care about running costs and waste and seek to reduce them to some extent. However, the findings of this research show that having an

EMS greatly enhances the efficacy of any move toward efficiency savings, as an EMS a is designed to assist the manager in such an endeavour through a systemic approach covering policy through to implementation targets, addressing a wide range of management issues.

The 30% sample used, which was actually increased to 32% (183 of 573), is recognised as 'big enough' and an effective percentage for a survey sample (Lenth, 2001 p187). The response rate was good, around 89%, but the method of selecting organizations to take part in this research could also be perceived as a limitation. This was, however, carefully balanced between the different sectors (Metals, Chemicals and plastic, Wood and furniture, Textiles and clothing, Paper and printing, Food and Building materials and glass) and between the numbers from each phase of the establishment of the IC. A further balance was desirable between large, medium and small organizations but because of the lack of information about the numbers of people each firm employed, there may be some doubts about the accuracy of the classification used.

In terms of the individual interviewees, they represent a selected sample, rather than a randomized one; due to the nature of this research, the researcher was unable to select interviewees at random from within an organization; rather, he was presented with an individual to interview by the General Manager or CEO. This may have introduced some element of bias; also, the interviewees may, through loyalty, have been reluctant to express anything that would shed an unfavourable light on their organization. Having interviewees nominated by anyone other than the researcher represents a limit on the researcher's level of control over the investigation. A further limitation is that some of the interviewees frankly announced that they had little knowledge of EMS implementation or its purposes; this may have limited the ability of the researcher to garner as much information as possible, although this issue only relates to those organizations that do not have any EMS.

6.4 Recommendations arising from the study

The recommendations below pertain to overcoming the challenges that currently face the implementation of EMS in the IC in Jeddah (and to increasing its use) in order to control industrial activities and to promote sustainable development.

This research has found that the widespread adoption of EMS in the KSA could play a significant role towards achieving sustainable development for the Kingdom. The global and regional position of the KSA and its urgent need to manage its natural resources effectively require it to embrace this voluntary and self-monitoring approach, which aims to introduce innovative technologies and more flexible processes in order to decrease the consumption of natural resources, to control polluting emissions, and to limit the generation of hazardous waste.

The responses to the questions in this research about environmental awareness have suggested that, in general, the public in the KSA does not take much interest in environmental matters; this is considered to be one of the main obstacles facing EMS implementation in the IC. Perhaps the most important recommendation is therefore to improve environmental education, publicising what abuses of the environment can do (and are actually doing) to the land, the water and the air, and to the health and well-being of future generations, not just in the IC in Jeddah but in the country as a whole. Research has shown that increasing awareness of environmental issues has raised demand for environmental-friendly business practices (Gadenne et al., 2009). There is also a lack of understanding of the term 'sustainable development' and the need to control the use of resources. Raising awareness and public concern about these issues is fundamental to improving the situation. It is only then that the government and other responsible organizations will feel obliged to act. This research has shown that the PME's efforts at awareness-raising have been neither successful nor sufficient; nevertheless, this situation can be remedied. Malaysia for example, a developing country that has had some impressive economic achievements, has tried to encourage sustainable development. A Malaysian national seminar on UNCED in 1990 "*initiated a series of consultations with stakeholders, which resulted in significant learning in the policy community*" (Hezri and Nordin Hasan, 2006 p43). At the same time there was an increase in media attention, which helped to raise public awareness of the concept of sustainable development (Ibid).

The PME has the main responsibility for carrying out environment protection in the KSA. At the most basic level, it is recommended that they focus on raising environmental awareness among management and the workers in industrial sectors by conducting environmental lectures, courses and training sessions, and by publishing and distributing brochures and booklets. To do this it is recommended that a structured strategy be put in place. In addition, Saudi universities, research bodies and academic staff who are already aware of environmental issues should cooperate with PME and contribute to programmes that target the spread of environmental awareness among workers and society in general.

It is also recommended that the PME look at the wider aspects of environmental education, for example, setting up teams to publicise environmental issues in the media and going into schools to ensure that environmental education is part of the curriculum. It is recommended that the PME, as a primary body responsible for environmental issues in the KSA, review the experiences of other countries in the region (the Middle East) and of other developing countries around the world to study the effects caused by neglect of the environment and the steps that have been taken to remedy them.

In this context, it is recommended that the PME encourage Saudi schools to participate in the largest international award programme of sustainable schools in the world (the ‘Eco-Schools’ programme), which has been adopted in 54 countries, including the Middle East (Jordan, the UAE, Iran and Turkey). Participation in such a programme would promote and raise environmental awareness among pupils, encouraging both them and the next generation (future leaders) to make positive changes in the field of sustainable development.

Lack of legal enforcement and monitoring is one of main challenges facing the implementation of EMS in the KSA and the whole region of the Middle East, as found in this research. There is a need for more inspections and more frequent monitoring and enforcement. Inspections of industries, such as those involved in chemicals, plastics and heavy metals, which have a particularly adverse effect on the environment, should take place on a regular basis (less often for industries that have less harmful outcomes). At present, the PME in Jeddah has just 13 staff involved in inspecting and monitoring all the industrial activities in the Western Province of the KSA, and this research has shown that they are unable to enforce existing regulations. Further research is necessary to estimate the numbers that could be considered adequate for the levels of monitoring and enforcement that are required. This is especially important as new industrial developments are just about to be established approximately 45 km from the city centre of Jeddah, and these are expected to attract more than 900 factories; they will carry out various activities such as metalwork, chemicals and plastics, food manufacturing, furniture and papermaking, glassmaking and the provision of building materials (Modon, 2014).

In addition to staffing numbers, the qualifications held by current and future employees of the PME must also be addressed. At present, there are too few specialists in the fields of environmental management and sustainable development across the Kingdom, and this issue must be addressed by the educational establishment. It is also important that the PME be seen as an independent body and that its employees always act in an impartial manner; this may entail some form of periodic judicial review.

The organization as a whole needs to have access to laboratory facilities; currently the PME sends samples to private labs for analysis, which can be time consuming for assessing certain easier-to-measure parameters, and which could compromise data security and reliability. Should the PME have its own laboratory, even a limited-capacity one, its work could be facilitated, saving both time and money in the long run. Furthermore, the PME should establish a regime of random inspections, which should be unannounced but this may be deemed unacceptable politically. Nevertheless, inspections and their legally binding findings should underpin the PME's efforts to maintain standards. The issue of standards also needs consideration; the KSA should consider adopting the WHO's environmental standards, thereby ensuring that the PME is acting, enforcing and arbitrating in accordance with up-to-date internationally recognized criteria. Currently, the air pollution standards being enforced by the PME are based on the WHO's recommendations of 1976. The PME also needs to concentrate on enforcement, particularly in terms of penalties; some organizations in the IC simply do not take them seriously and so do not adjust their behaviour. Penalties must be codified, transparent and publicised, which may include the threat of incarceration. Some organizations in the IC have stated that they are driven by cold economics rather than by any desire to protect or serve the well-being of society or the environment, and so penalties must be enforced consistently and equitably. The PME needs also to establish and disseminate key performance indicators (KPI), which would ease the inspection works for PME's inspectors and organizations and have clear benchmarks in the assessment of an organization's efforts (or lack of them). These KPI should include the PME and WHO criteria for environmental management as well as include indicators relating to water and energy consumption, and the generation of waste as well as the organization's carbon footprint.

To do all this, it is recommended that the PME have more resources and more staff with better qualifications. This research has also recommended that to overcome lack of legal enforcement and monitoring of environmental regulations and laws in the KSA, the government should assess (and possibly emulate) the successful and unique experience of the 'Environmental Police Department' (Rangers), as in Jordan, which is also in the Middle East. Should the PME's staff be boosted with a team of well-qualified inspectors, then the threat of sanctions would be raised, which in turn would further encourage organizations to adopt EMS in order to avoid being sanctioned for violations. Consequently, the level of

EMS implementation would rise as the owners and stakeholders would seek to protect their business margins from penalties, making an EMS a useful tool in controlling business activities; thus, improving the status of both monitoring and legal enforcement would increase the opportunities for implementing EMS in KSA and would greatly assist in overcoming the challenges to its implementation. This team of inspectors could be established as an independent body (as in Jordan) but may be better expedited as the executive arm of the PME (charged with carrying out the tasks of inspection and enforcement of environmental regulations and laws). This should initially be funded by the government, which may seek for technical expertise and assistance in strategy and policy-making support from a range of international organizations, depending on the services they have to offer (as occurred in Jordan).

As the government plans to build new industrial cities in many regions of the KSA (Modon, 2014), it is a fundamental recommendation that the new industrial cities be built far away from residential areas and the infrastructure developed to appropriate environmental standards. It is also recommended that specific places for each industry be allocated based on the particular type of industrial activity, for example, it is unacceptable to find a food factory surrounded by metal and petrochemical factories, as occurs in the IC in Jeddah. Research, for example, Bosco *et al*. (2005), has shown that potentially toxic airborne particulates spread through the atmosphere affecting soil and agriculture and could therefore contaminate food produced in a neighbouring factory. The new industrial city will cover 28 million m^2, more than twice the size of the present IC in Jeddah and development commenced at the beginning of 2014 (Modon, 2014). If the environmental problems that exist in the present IC are to be avoided in the new development, government departments and the PME must work together to ensure that environmental standards are applied from the beginning as it is much more difficult to make changes once industries start operating. Should those standards be applied immediately, the way would be paved for organizations in the new IC to adopt approaches such as EMS to control their activities, and to do so of their own volition.

It is further recommended that there be more and better cooperation between the PME and other relevant governmental departments and private bodies, in particular: Modon, the Ministry of Commerce and Industry, Saudi Customs, the Jeddah Municipality and the Jeddah Chamber of Commerce and Industry. Such collaboration should be designed to enhance the PME's efforts, i.e. the aforementioned departments should take some responsibility for seeing that Saudi government's environmental Regulations and Rules are enforced. In particular, the Ministry of Commerce and Industry and Modon could greatly assist as they control permission for all activities in the Saudi ICs including infrastructure and building. Should the environmental status not be adequate, then these departments could refuse to grant permission. As discussed in Chapter 1, the PME already obliges factory owners to obtain the environmental licence should they request a loan from the Ministry of Commerce or a bank. The Customs Department could also refuse (or delay) to grant an import licences for raw materials, machines and equipment if the organization not have the PME's environmental licence. These measures would encourage organizations to comply with the established environmental rules and to adopt environmental management techniques but only if these powers are used and enforced.

There is an urgent need to seek practical ways of improving the PME's powers to conduct its duties, for example, by obtaining more measurement devices and more laboratories with testing facilities. The PME should encourage cooperation with universities and research centres. Universities could play a much larger part in supporting environmental initiatives. Higher Education has a responsibility to increase the knowledge and skills and to make the recommendations needed to create a just and sustainable future (Cortese, 2003). Promotion of these values is being encouraged in several universities in the USA. They are seeking to increase sustainability awareness by means of research, courses, conferences and workshops involving local communities as well as students. For example, Unity College, Maine, has helped a local community concerned with the water quality of Lake Winnecook by developing a complete curriculum around the study of the lake. Through this university's involvement in the local community, they have developed skills for engaging in sustainable living (Ibid). The Carnegie Mellon University developed the Adam Joseph Lewis Center, one of the most environmentally sustainable buildings in a university. This involved interaction with professionals and others in the local community through a class specifically developed for this purpose (Ibid).

To achieve these aims, it is recommended that the PME determine its goals and priorities and work through an implementation programme that approaches all these tasks from recruiting and training staff to monitoring and inspecting organizations while creating an effective campaign for education and public awareness. This programme, for example, should plan for progress in the next five years.

The PME is central to improving the environmental situation in the KSA but it must be recognised that its work can only be strengthened and improved with cooperation and support from the government. In China, for example, fees are being levied on organizations that have measurable emissions (by volume); environmentally cleaner products as well as environmental management is also being encouraged by the government (Zhang *et al.*, 2008). Environmental improvements can be expensive and uneconomic; this is a particular problem for small- and medium-sized organizations, who represent an essential aspect of any national economy (Gupta *et al.*, 2009), and who comprise the majority of privately owned businesses in the KSA (Kayed and Hassan, 2011). It is thus recommended that the government offer such firms financial support, technical assistance, training, etc. to facilitate the necessary improvements. In addition, pilot trials and success stories should be enhanced and disseminated (Massoud *et al*., 2010a). Two of the interviewees recommended that good organizations be publicly acknowledged and rewarded. In China, for example, a colour-coded environmental performance rating was introduced; black and red denote inferior performance, yellow denotes compliance with minimum emission regulations but not with stricter ones, and blue and green denote superior performance. The results are publicized to the public, organizations and banks through the media. They have become a popular yardstick for the public and have forced organizations to improve their environmental performance (Zhang *et al*., 2008).

This research shows that the organizations which adopt EMS under ISO14001 are implementing EMS more effectively than those that have just an EMS and/or PME environmental licence. It is recommended that PME encourage organizations to obtain EMS under ISO14001. The increase in EMS accreditation worldwide has resulted in part from regulatory pressure being placed on organizations to obtain a certified EMS, that is, one which has been successfully audited by one of the accredited certification bodies (Price, 2007).

This research has shown many improvements are needed to protect the environment in the KSA and if these are to be carried out, real pressure for change must come from the government. Comparison with the EU is relevant, for there a strong centralised administration issues Directives that command the adoption of strict environmental policies. "*EU-membership has forced the central administration (in Portugal) to accelerate development of environmental legislation in order to meet environmental requirements and quality standards*" (Börzel et al., 2010 p13). A similar attitude from the government could have a real impact on the environment in the KSA. However, whereas the EU wants to eliminate the problem of market distortion, i.e. where lower levels of environmental protection give an economic advantage (Ibid), the government of the KSA wants to expand industrial production rapidly at the lowest cost and is not concerned with market distortion and EU problems such as cross-border pollution. It does however, recognise that national economic development should be consistent with international and regional environmental laws and conventions (Swazo, 2010).

The PME is a small department in the Defence Ministry and has little influence as part of such an important department, and has few powers (B1). It has been shown to be inadequate for the tasks it now undertakes and yet it can be argued that the protection of the environment is as important as defence for the future of the KSA. No official audits are taken for the PME's inspection and prosecution records, and so gathering such data is difficult. Should the PME be established as a separate Ministry, its records in these matters would be greatly clarified. Many other countries such as Mexico, India, Japan and Germany have their own Ministries for the Environment with high profiles and wide powers. The EU requires member countries to appoint Ministers to be responsible for environmental matters (Börzel et al., 2010). As the KSA becomes more industrialised and increasingly forms part of the global market, pressure for environmental reform will become even greater. The PME should not only have its size and scope substantially increased but it should have its own Minister and its own department. Malaysia, for example, has recently emerged as a pioneering nations in the developing world; it instituted a national environmental agency and a Ministry for the Environment supported by a national environmental law, which has elevated the importance of environmental issues (Hezri and Nordin Hasan, 2006). The example of China is also apposite; environmental protection used to be the responsibility of the State Environmental Protection Bureau, which was a minor department. This arrangement was not unlike the current one in the KSA. In 1998, the department was retitled the State Environmental Protection Administration (SEPA) and was accorded Ministerial status (Zhang et al., 2008). Only by fundamental changes, such as elevating the importance of environmental protection, can there be hope for changes to the environment, not just in the IC in Jeddah, but also in other industrial developments which are expected to play a major part in the future development of the country.

6.5 Study contribution and further research

The contribution of this critical investigation was to close a gap in the knowledge and pave the way to effective implementation of EMS in Jeddah, the first industrial city in the KSA. EMS is an important tool that can improve an organization's environmental performance; it can monitor, control and help to clean up an organization's processes. This research addressed the current scope of implementation of EMSs in the IC in Jeddah and the current level of regulatory effort that is being carried out to increase environmental awareness and control. The study also highlighted the opportunities for EMS implementation for the delivery of environmental benefits to the IC in Jeddah and the barriers which impede it.

Further research and work on the environmental management of organizations in the Saudi industrial sector across the KSA is needed to enrich the literature. It is also recommended that research look at industrial developments outside the various ICs to examine their environmental practices. They would help to reduce negative environmental impacts and increase the numbers of clean industries. Accordingly, this would contribute to achieving sustainable development and well-being in a country that produces and exports huge volumes of oil worldwide (Al Turki and Faris, 2010).

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Appendixes

Appendix A

- A letter from my primary supervisors Dr Alan Bond, explaining the importance of the study.

- Letters of permission from the PhD research sponsor (King Abdulaziz University (KAU)), the Presidency of Meteorology and Environment (PME), which is the body responsible for environmental licensing and enforcement and the Saudi Industrial Property Authority (Modon), which is responsible for the design, establishment, management and development of industrial areas and cities in KSA.

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To whom it may concern

5 January, 2012

Re: Waleed Alsiary

Dear Sir/Madam,

I write as supervisor of Mr Waleed Alsiary for his PhD programme with the School of Environmental Sciences, University of East Anglia.

As part of his PhD studies, it is essential that Mr Alsiary conduct field research in the Kingdom of Saudi Arabia for a period of three months starting February 2012. The nature of the research requires interviews to be undertaken with a number of representatives of government and business associated with Jeddah City, and this can only be done on site.

Yours sincerely,

A. J. Bond

Dr Alan Bond.

KINGDOM OF SAUDI ARABIA
Ministry of Higher Education
KING ABDULAZIZ UNIVERSITY
Faculty of Meteorology Environment
and Arid Land Agriculture

المملكة العربية السعودية
وزارة التعليم العالي
جامعة الملك عبدالعزيز
كلية الأرصاد والبيئة
وزراعة المناطق الجافة

مكتب العميد
Dean's Office

Ref. :

Date:

الرقم :

التاريخ :

إلى من يهمه الأمر

من مبدأ التعاون بين الجامعة والقطاعات الحكومية والخاصة في سبيل خدمة العلم والبحث العلمي في هذا البلد المعطاء، تفيد كلية الأرصاد والبيئة وزراعة المناطق الجافة أن الأستاذ/ وليد عبدالله الصيعري، المحاضر بقسم العلوم البيئية بالكلية، والمبتعث إلى جامعة إيست أنجليا ببريطانيا ، بصدد القيام ببحث ميداني استكمالاً لمتطلبات بحثه لدرجة الدكتوراه والذي يهدف منه إلى التحقيق في الفرص والعقبات التي تواجه التطبيق الفعّال لنظم الإدارة البيئية (EMS) والتي تقدم فوائد بيئية محتملة للمنطقة الصناعية بجدة.

عليه آمل التعاون معه وتسهيل مهمته ، لما في ذلك من النفع العلمي الذي يصب في مصلحة الوطن ورفاهية المجتمع.

شاكرين لكم كريم تعاونكم ودعمكم المعهود للبحث العلمي والباحثين.

وتقبلوا خالص تحياتي وتقديري ،،

عميد الكلية

أ.د. عبدالرحمن بن خلف الخلف

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المملكة العربية السعودية
الرئاسة العامة للأرصاد وحماية البيئة
Presidency of Meteorology & Environment
وكالة شئون البيئة

إلى من يهمه الأمر

السلام عليكم ورحمة الله وبركاته ،

نأمل التعاون مع الباحث الأستاذ / وليد بن عبدالله الصيعري ، في ملء الاستبيان حول " الفرص والعقبات التي تواجه التطبيق الفعال لنظم الإدارة البيئية EMS ".

كما نحث على بذل أقصى جهود ممكنة وذلك للمساهمة في العمل البيئي وتفعيل النظام العام للبيئة و لوائحه التنفيذية الصادر بالمرسوم الملكي الكريم رقم م/34 في 1422/7/28هـ.

وتقبلوا خالص تحياتي ، ، ،

الرئاسة العامة للأرصاد وحماية البيئة
العام الصادر
PME

د. سمير بن جميل غازي

مساعد الرئيس العام
لشؤون البيئة والتنمية المستدامة

الرقم : ١٨/٨/ ٥٨٢٩ التاريخ : ٢١/ ٣/ ١٤٣٣هـ
المرفقات :

ص.ب ١٣٥٨ جدة ٢١٤٣١ - المملكة العربية السعودية
هاتف : ٦٥٣٦٠٠٠ (٠٢) - فاكس : ٦٥١١٤٢٤ (٠٢)
www.pme.gov.sa

هيئة المدن الصناعية ومناطق التقنية
Saudi Industrial Property Authority
مدن
MODON

المدينة الصناعية بجدة
صادر : ١/٨/١٠٧١
التاريخ : ٢٢ / ٠٦ / ١٤٣٣ هـ
المرفقات: لا يوجد
0108--1-1071-74-2

السادة/مصنع المحترمين

السلام عليكم ورحمة الله وبركاته :-

إشارة إلى الخطاب الوارد لنا برقم ١/٨/١١٢٧ وتاريخ ١٤٣٣/٦/٢٢ هـ بخصوص إعداد دراسة حول التطبيق الفعال لنظم الادارة البيئية والتي طلبها الباحث وليد عبدالله الصيعري وذلك بتوزيع إستبيان للمصانع لاعداد تلك الدراسة.

آمل منكم تسهيل مهامه وتزويده بالمعلومات المطلوبة وذلك خلال شهر من تاريخه وقد أعطي هذه الافادة بناءً على طلبه دون أدنى مسؤلية على الهيئة.

ولكم أطيب تحياتي،،

مدير المدينة الصناعية الاولى بجدة

المهندس/علي بن عبدالله الزيلعي

هيئة المدن الصناعية ومناطق التقنية
الصادر العام
المدينة الصناعية بجدة

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ص.ب ٣٧٨٤ جدة ٢١٤٨١ الرقم المجاني : ٩٢٠٠٠٠٤٢٥ هاتف : ٦٣٨٠٨٠٠ ٢ ٩٦٦+ فاكس : ٦٣٦٤٧١٢ ٢ ٩٦٦+ فرع المدينة الصناعية جدة - المملكة العربية السعودية
P.O.Box 3784 Jeddah 21481 Free Toll : 920000425 Tel.: +966 2 6380800 Fax : +966 2 6364712 Industial City Jeddah - Kingdom Of Saudi Arabia

Appendix B:

Questionnaire

Dear Participant,

I am Waleed Alsiary, a lecturer at King Abdul Aziz University, Saudi Arabia. I am now undertaking the task of finishing my PhD at the University of East Anglia, UK. The aim of my study is to investigate the barriers and opportunities toward the implementation of environmental management systems (EMSs) for the delivery of environmental benefits to the Industrial City in Jeddah, KSA. As part of fulfilling the requirements for my degree, I am conducting a field research to evaluate the factors that help private organizations in the Industrial City in Jeddah to implement and adopt effective EMSs.

In this regard, your help is needed to complete the attached questionnaire as clearly and directly as possible; it should take approximately 15 minutes. Your identity and any comments revealed in this questionnaire are highly confidential and your anonymity will be protected. Any information you supply will be used only for the academic purposes of this research endeavour.

Thank you very much for agreeing to participate in this field research and for your valuable contribution.

Yours faithfully,

Mr. Waleed Alsiary

Part I: General Information

Please complete this section on general information about your organization in Industrial City in Jeddah.

1	Organization's name:	
2	Position/title of questionnaire respondent:	
3	The age of questionnaire respondent is:	□18 – 26 □27 - 35 □36 – 44 □45 – 53 □ > 53
4	Highest education level of questionnaire respondent (just tick one):	□ High school □ University graduate □ Postgraduate qualification □ Other: ....
5	Education background/specialism of questionnaire respondent:	
6	Type of activity/sector that your organization is involved with in Jeddah City:	
7	The phase (as per the address) in which your organization is located in the Industrial City:	
8	Number of employees that you have at this site:	
9	Establishment date at this site:	
10	Do you have an environmental management system (EMS) at this site:	□Yes □No If no, go to question 13
11	Date of initiating an environmental management system (EMS) at this site:	
12	Is your site in the Industrial City accredited to ISO14001	□Yes □No □Don't know
13	Does your site in the Industrial City have PME environmental license	□Yes □No □Don't know

Part II: Technical information

A- The characteristics and efficiency of the EMS in your organization in the Industrial City in Jeddah.

- Please mark (✓) the most appropriate answer to the following phrases:

No.	Phrase	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
14	Our organization has its own environmental policy.					
15	Within our budget there is a special item for environmental affairs in the organization.					
16	The environmental responsibilities and authorities within our organization are fixed and clear.					
17	There is an environmental record in our organization.					
18	Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.					
	If your answer is (Strongly agree) or (Agree) - Give an example, please:					
19	Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment.					
	If your answer is (Strongly agree) or (Agree) - Give an examples, please:					
20	The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.					
	If your answer is (Strongly agree) or (Agree) - How many times per year?:					
21	There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs.					
	If your answer is (Strongly agree) or (Agree) - What is this system?:					

B- The obstacles facing the implementation of EMSs in your organization in the Industrial City in Jeddah.

- Please, from your experience, rank the following obstacles from 1 to 10 according to its importance (1 is most important – 10 is less important):
- **Note that please:** just rank the following obstacles from 1 to 10, don't give them number of 10.

Obstacles	Ranking
The levels of environmental awareness and knowledge are very low on the part of the workers in our organization.	
There is difficult or poor access to environmental legislation and information.	
The customers' environmental concerns and awareness are very low.	
There is a lack of planning for environmental training for the employees in the organization.	
A competitive market is one of the major obstacles facing the implementation of effective EMSs in the organization.	
There is no adequate legal enforcement for the environmental laws in the KSA.	
EMS adoption is very costly.	
There is no significant economic advantage in the local market when applying environmental conditions.	
The environmental responsibilities are not well defined in our organization.	
Rarely apply the maximum sanctions (e.g., closure) in cases of repeated violation of environmental laws by industrial activities.	

C- The possible environmental benefits to be derived from implementing EMSs.

- Please, from your experience, rank the following benefits from 1 to 13 according to its importance as a result of implementing (EMSs) in your organization (1 is most important – 13 is less important):
- **Note that please:** just rank the following benefits from 1 to 13, don't give them number of 13.

Benefits	Ranking
EMSs improve the environmental capability and performance of organizations.	
EMSs provide a harmonized system for managing an organization's environmental impacts.	
EMSs define environmental objectives and targets.	
EMSs involve regular and periodic measurements of the levels of environmental impact derived from the organization's activities.	
EMSs improve the operational safety of the organization.	
EMSs raise the level of environmental awareness among the workers in the organization through training sessions.	
EMSs enhance employee participation in environmental management activities.	
Increasing environmental performance will enhance the image of the organization.	
EMSs provide economic advantages for the organization in the local market.	
EMSs can offer improvements in environmental performance and could possibly improve market competitiveness in the longer term.	
EMSs assist in incorporating environmental considerations when designing plans and executing industrial projects.	
EMSs assist in avoiding legal sanctions, for example, forfeiture of operating permits and financial fines and penalties that hamper business activities.	
EMSs assist in providing regular periodic reports about the extent of adherence to established environmental standards.	

Appendix C:

First set of Interviews

Dear Interviewee,

I am Waleed Alsiary, a lecturer at King Abdul Aziz University, Saudi Arabia. I am now undertaking the task of finishing my PhD at the University of East Anglia, UK. The aim of my study is to investigate the barriers and opportunities toward the implementation of environmental management systems (EMSs) for the delivery of environmental benefits to the industrial city in Jeddah, KSA. As part of fulfilling the requirements for my degree, I am conducting a field research to evaluate the factors that help private organizations in the industrial city in Jeddah to implement and adopt effective EMSs.

In this regard, I would be most grateful if you would agree to being interviewed, and should you so agree, please answer the brief list of questions enclosed. Your identity (and all the information in the list) and any comments revealed during the interview are deemed highly confidential and your anonymity will be protected absolutely. Any information you supply will be used only for the academic purpose (my PhD thesis) of this research endeavour.

Thank you very much for agreeing to participate in this field research and for your valuable contribution.

Yours faithfully,

Mr. Waleed Alsiary

1	Organization's name:	
2	Position/title of interviewee:	
3	The age of interviewee is:	□18 – 26 □27 - 35 □36 – 44 □45 – 53 □ > 53
4	Highest education level of interviewee (just tick one):	□ High school □ University graduate □ Postgraduate qualification □ Other: ....
5	Education background/specialism of interviewee:	
6	Type of activity/sector that your organization is involved with in Jeddah City:	
7	The phase (as per the address) in which your organization is located in the industrial city:	
8	Number of employees that you have at this site:	
9	Establishment date at this site:	
10	Do you have an environmental management system (EMS) at this site?	□Yes □No If no, go to Question 13
11	Date of initiating an EMS at this site:	
12	Is your site in the industrial city accredited to ISO14001?	□Yes □No □Don't know
13	Does your site in the industrial city have a PME environmental license?	□Yes □No □Don't know

- How would you assess the contribution of the industrial sector to the degradation of the environment in KSA?
- Do you think that implementing EMSs is necessary in the industrial sector in KSA? Why?
- Where do you think private Saudi organizations are in comparison with organizations in the developed world with reference to the implementation of environmental management? Why do you think so?

- How would you describe the environmental situation in your organization? And in the industrial city in general?
- From your experience, to what extent have EMSs been implemented in your organization? And in the industrial city in general?
- In your organization, what are the criteria or standards for controlling and assessing its environmental performance?
- How does your organization monitor its compliance with environmental requirements?
- Could you explain which EMS processes your organization applies (policymaking, planning, implementing, checking, reviewing)? Why?
- Does your organization promote the (reuse – recycle – reduce) of waste? How?

- In your opinion, are there any problems or obstacles that prevent implementing EMSs in your organization?
- What are the major obstacles? And how do you overcome them?
- Could you explain the challenges facing your organization in implementing EMS?

- **For those organizations that do not have EMS:**
- Why you do not have any EMS in your organization?
- How do you avoid legal sanctions, for example, forfeiture of operating permits and financial fines and penalties that hamper business activities?

- **For those organizations that have EMS:**

➢ Do you think that regulatory pressures (legal requirements) are the main reason for implementing environmental initiatives in your organization? What about public pressures (costumers – community - supply chain)? or other reasons?

➢ Could you explain the reasons behind implementing EMS in your organization?

➢ What do you think are the incentives that encourage your organization to adopt EMS?

➢ Have you noted any (environmental, economic and other) benefits resulting from the usage of EMS in your organization?

➢ How do you assess the PME's efforts, as the primary body responsible for environmental protection affairs, in addressing environmental concerns in KSA?

➢ Are there any particular strengths or weaknesses in the PME's environmental efforts in: awareness, information, training, enforcement, monitoring and control? Why?

➢ From your experience, what does the PME need to do in terms of its current environmental protection efforts?

Second set of interviews

Dear Interviewee,

I am Waleed Alsiary, a lecturer at King Abdul Aziz University, Saudi Arabia. I am now undertaking the task of finishing my PhD at the University of East Anglia, UK. The aim of my study is to investigate the barriers and opportunities toward the implementation of environmental management systems (EMSs) for the delivery of environmental benefits to the Industrial City in Jeddah, KSA. As part of fulfilling the requirements for my degree, I am conducting a field research to evaluate the factors that help private organizations in the Industrial City in Jeddah to implement and adopt effective EMSs.

In this regard, I would be most grateful if you would agree to being interviewed, and should you so agree, please answer the brief list of questions enclosed. Your identity (and all the information in the list) and any comments revealed during the interview are deemed highly confidential and your anonymity will be protected absolutely. Any information you supply will be used only for the academic purpose (my PhD thesis) of this research endeavour.

Thank you very much for agreeing to participate in this field research and for your valuable contribution.

Yours faithfully,

Mr. Waleed Alsiary

Second set of interviews

- **Interviews that will be conducted with the various relevant governmental departments (and some private bodies).**

14	Organization/department name:	
15	Position/title of interviewee:	
16	Type of responsibility/sector:	

- How would you describe the environmental situation in KSA? And particularly in the city of Jeddah?
- How would you assess the contribution of the industrial sector in KSA to the degradation of the environment?
- Do you think that implementing EMSs is necessary in the industrial sector in KSA? Why?
- Where do you think private Saudi organizations are in comparison with organizations in the developed world with reference to the implementation of environmental management systems? Why do you think so?

- From your experience, to what extent have EMSs been implemented in the industrial sector in KSA? And in the Industrial City in Jeddah?
- Could you explain which EMS processes Saudi organizations usually apply (policymaking, planning, implementing, checking, reviewing)? Why?

- In your opinion, are there any problems or obstacles that prevent implementing EMSs in the organizations in the Industrial City in Jeddah ?
- What are the major obstacles? And how do they overcome them?
- Could you explain the challenges facing Saudi organizations in general as well as those located in the Industrial City in Jeddah in terms of implementing EMS?

- **For those organizations that do not have EMS:**

➢ Why they do not have any EMS in your organization?

➢ How do they avoid legal sanctions, for example, forfeiture of operating permits and financial fines and penalties that hamper business activities?

- **For those organizations that have EMS:**

➢ Do you think that regulatory pressures (legal requirements) are the main reason for implementing environmental initiatives in these organizations? What about public pressures (costumers – community - supply chain)? or other reasons?

➢ Could you explain the reasons behind implementing EMS in Saudi organizations in general and those located in the Industrial City in Jeddah ?

➢ What do you think are the incentives that encourage these organizations to adopt EMS?

➢ Have you noted any (environmental, economic and other) benefits resulting from the usage of EMS in these organizations?

➢ How do you assess the PME's efforts, as the primary body responsible for environmental protection affairs, in addressing environmental concerns in KSA?

➢ Are there any particular strengths or weaknesses in the PME's environmental efforts in: awareness, information, training, enforcement, monitoring and control? Why?

➢ From your experience, what does the PME need to do to in terms of its current environmental efforts?

Appendix D:

- **Declaration of Informed Consent by Questionnaire and Interview Participants**

University of East Anglia
School of Environmental Sciences

Declaration of Informed Consent by Questionnaire and Interview Participants

Assessment of Environmental Management Systems in the Industrial City in Jeddah, KSA

Purpose of this declaration: In order to protect the human right to privacy of questionnaire and interview participants, their right to be informed, and right to be protected from any harm that might occur. It is also intended to encourage transparency and accountability for this research project.

Please answer the questions below to indicate what it is that you are prepared to consent to, and then sign at the bottom. The questionnaire and interview can then be conducted on the basis you have specified, and the researcher can countersign prior to the questionnaire and interview taking place.

I confirm that: (please tick boxes)	**Yes**	**No**
I have read the introduction to this research and I understand the reasons why the research is being conducted.	☐	☐
I agree to give the face-to-face interview / questionnaire-based survey to the researcher.	☐	☐
I understand that there is no payment for participation in this study.	☐	☐
I understand that my anonymity will be protected.	☐	☐
I agree to the interview being recorded (subject to no comments being attributed, or used in any way, without my prior agreement).	☐	☐
I would like to know the findings and results of this study.	☐	☐
On the basis of the answers given above, I willingly agree to participate in this research study.	☐	☐

Signed (questionnaire and interview participant): ………………………………….... Date: ………………

Signed (researcher): ……………………………………………………………………….. Date: ………………

If there are any queries or if there is need for clarification, please contact **Waleed Alsiary** (Tel. +44(0)1603741204, email: w.alsiary@uea.ac.uk).

Appendix E:

- **Approval from the UEA Ethics Committee**

12	02	01
Official use only – ref. number		

PART B – Review report and decision.

To be completed by the applicant:

Name of applicant:	**Waleed Alsiary**
Student ID no. (if applicable)	**3841367**
Supervisor (if applicable)	**Dr. A. J. Bond and Dr. J.C. Powell**
Project Title:	**Assessment of Environmental Management Systems in the Industrial area in Jeddah, in the Kingdom of Saudi Arabia.**

To be completed by the Ethics Committee:

Reviewer's recommendation (✓):

Accept	✓
Request modifications	
Reject	

Reviewers' checklist	Delete as appropriate	
Risks and inconvenience to participants are minimised and not unreasonable given the research question.	✓	
All relevant ethical issues are acknowledged and understood by the researcher.	✓	
Procedures for informed consent are sufficient and appropriate	✓	

Reviewers' Comments

The comments in the 25th February review have now been addressed satisfactorily in the resubmission.

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Committee's recommendation:

Ethical approval granted.

Signature (Chair of the International Development Ethics Committee)	T.A. Corley
Date	11th April 2012

Ethical Approval Form –November 2011 Page 1

Appendix F:

All statistical relationship tests (significant and insignificant):

ii) Identifying the relationships between the organizations' demographic variables (Ques. 6-9) and general information relating to the organizations' EMS attitudes (Ques. 10, 12 & 13).
(12 tests).

iii) Identifying the relationships between the demographic variables (Ques. 6-9) and the characteristics and efficiency of the EMSs in the organizations (Ques. 14 – 21).
(32 t3sts).

iv) Identifying the relationships among the questions pertaining to the general information of the organizations' EMS attitudes (Ques. 10, 12 & 13).
(9 tests).

v) Identifying the relationships between the general information of the organizations' EMS attitudes (Ques. 10, 12 & 13) and the characteristics and efficiency of the EMSs in the organizations (Ques. 14 – 21).
(24 tests).

ii) Identifying the relationships between the organizations' demographic variables (Ques. 6-9) and general information relating to the organizations' EMS attitudes (Ques. 10, 12 & 13)

- **Type of activity/sector * Do you have an (EMS)**

		Do you have an (EMS)		Total
		Yes	No	
Type of activity/sector	Metals	4	49	53
	Chemical and plastic	9	46	55
	Wood and furnitur	0	9	9
	Textiles and clothing	0	11	11
	Paper and printing	2	10	12
	Food	11	20	31
	Building materials and glass	4	8	12
Total		30	153	183

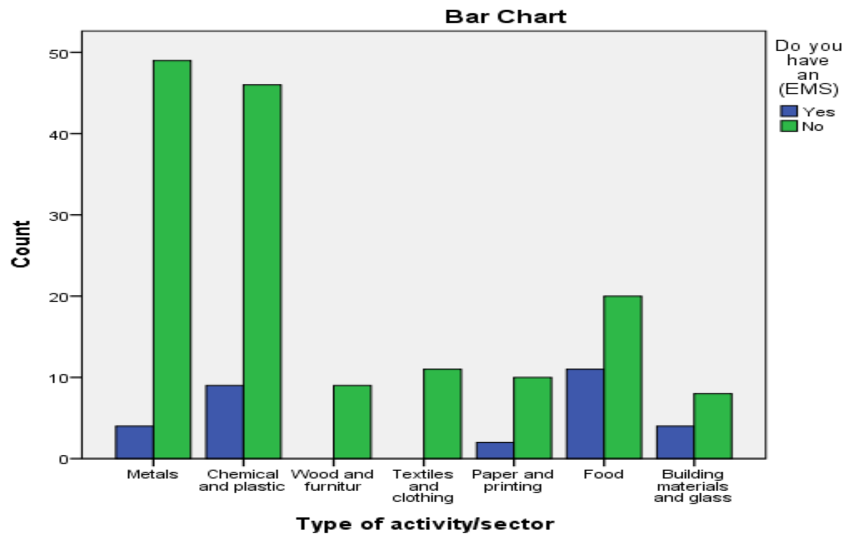
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.704[a]	6	.007
Likelihood Ratio	19.488	6	.003
Linear-by-Linear Association	10.258	1	.001
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.297	.007
N of Valid Cases		183	

The value of Chi-square was found to be 17.707, with corresponding *P*-value 0.007 (which is less than 0.01). This means that there is a highly significant relation between Type of activity/sector and having an EMS.
The value of the contingency coefficient was found to be 0.297.



- **Type of activity/sector * Is your site accredited to ISO14001**

		Is your site accredited to ISO14001			Total
		Yes	No	Don't know	
Type of activity/sector	Metals	2	51	0	53
	Chemical and plastic	8	47	0	55
	Wood and furnitur	0	9	0	9
	Textiles and clothing	0	11	0	11
	Paper and printing	2	10	0	12
	Food	6	24	1	31
	Building materials and glass	2	10	0	12
Total		20	162	1	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.183[a]	12	.289
Likelihood Ratio	15.321	12	.224
Linear-by-Linear Association	2.172	1	.141
N of Valid Cases	183		

The value of Chi-square was found to be 14.183, with corresponding *P*-value 0.289 (which is greater than 0.05). This means that there is no significant relation between Type of activity/sector and site accreditation to ISO14001.

- **Type of activity/sector * Does your site have PME environmental license**

		Does your site have PME environmental license			Total
		Yes	No	Don't know	
Type of activity/sector	Metals	5	43	5	53
	Chemical and plastic	14	39	2	55
	Wood and furnitur	1	8	0	9
	Textiles and clothing	0	11	0	11
	Paper and printing	1	11	0	12
	Food	9	20	2	31
	Building materials and glass	2	10	0	12
Total		32	142	9	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.034[a]	12	.190
Likelihood Ratio	19.546	12	.076
Linear-by-Linear Association	1.758	1	.185
N of Valid Cases	183		

The value of Chi-square was found to be 16.034, with corresponding *P*-value 0.190 (which is greater than 0.05). This means that there is no significant relation between Type of activity/sector and site have PME environmental license.

- **The phase * Do you have an (EMS)**

		Do you have an (EMS)		Total
		Yes	No	
The phase	Phase 1	3	9	12
	Phase 2	4	13	17
	Phase 3	8	37	45
	Phase 4	9	45	54
	Phase 5	6	49	55
Total		30	153	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.553[a]	4	.635
Likelihood Ratio	2.551	4	.635
Linear-by-Linear Association	2.377	1	.123
N of Valid Cases	183		

The value of Chi-square was found to be 2.553, with corresponding *P*-value 0.635 (which is greater than 0.05). This means that there is no significant relation between The phase * Do you have an (EMS).

- **The phase * Is your site accredited to ISO14001**

		Is your site accredited to ISO14001			Total
		Yes	No	Don't know	
The phase	Phase 1	2	10	0	12
	Phase 2	2	14	1	17
	Phase 3	7	38	0	45
	Phase 4	6	48	0	54
	Phase 5	3	52	0	55
Total		20	162	1	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.949[a]	8	.114
Likelihood Ratio	8.125	8	.421
Linear-by-Linear Association	1.243	1	.265
N of Valid Cases	183		

The value of Chi-square was found to be 12.949, with corresponding *P*-value 0.114 (which is greater than 0.05). This means that there is no significant relation between The phase * Is your site accredited to ISO14001.

- **The phase * Does your site have PME environmental license**

		Does your site have PME environmental license			Total
		Yes	No	Don't know	
The phase	Phase 1	5	7	0	12
	Phase 2	3	11	3	17
	Phase 3	13	27	5	45
	Phase 4	6	48	0	54
	Phase 5	5	49	1	55
Total		32	142	9	183

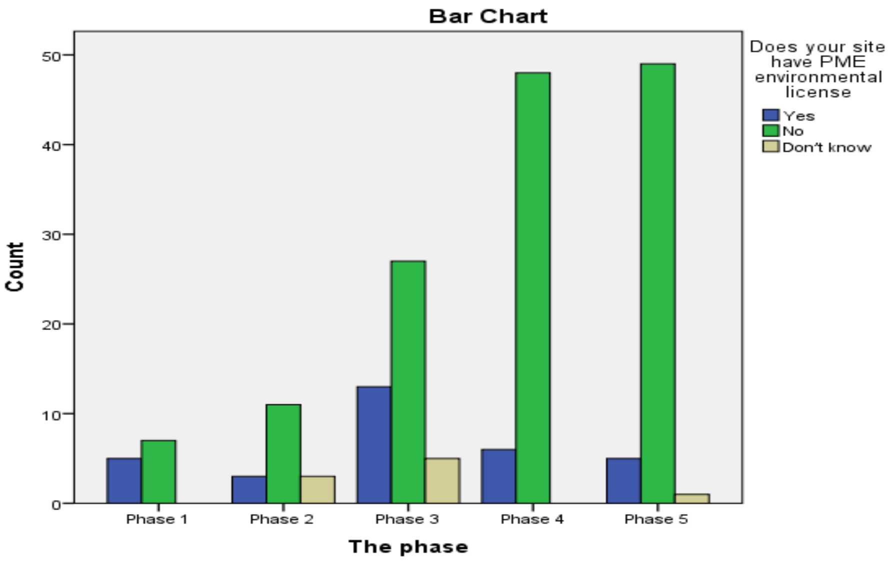
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.819[a]	8	.000
Likelihood Ratio	28.338	8	.000
Linear-by-Linear Association	2.446	1	.118
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.369	.000
N of Valid Cases		183	

The value of Chi-square was found to be 28.819, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between The phase * Does your site have PME environmental license. The value of the contingency coefficient was found to be 0. 369.



- **Number of employees * Do you have an (EMS)**

		Do you have an (EMS)		Total
		Yes	No	
Number of employees	<25 / Micro	1	3	4
	25-60 / Small	1	52	53
	60-99 / Medium	1	39	40
	>99 / Large	27	59	86
Total		30	153	183

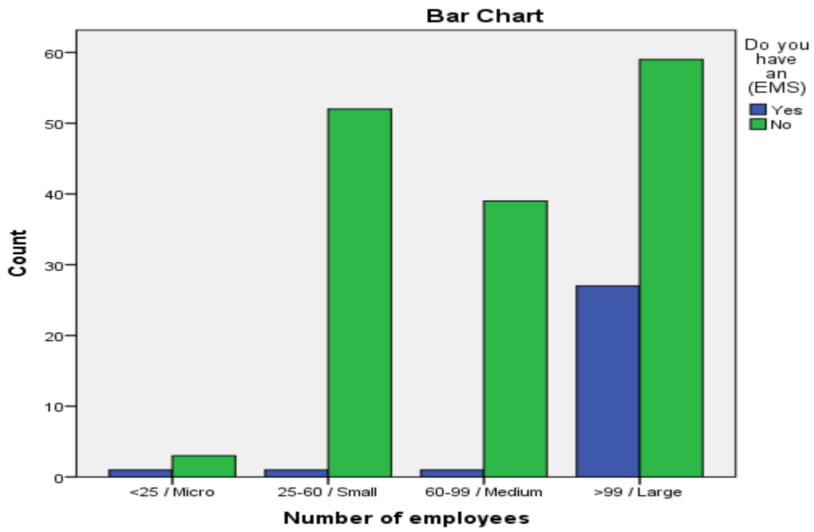
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.109[a]	3	.000
Likelihood Ratio	32.490	3	.000
Linear-by-Linear Association	18.960	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.365	.000
N of Valid Cases		183	

The value of Chi-square was found to be 28.109, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Number of employees * Do you have an (EMS).
The value of the contingency coefficient was found to be 0. 365.



- **Number of employees * Is your site accredited to ISO14001**

		Is your site accredited to ISO14001			Total
		Yes	No	Don't know	
Number of employees	<25 / Micro	0	4	0	4
	25-60 / Small	1	52	0	53
	60-99 / Medium	1	39	0	40
	>99 / Large	18	67	1	86
Total		20	162	1	183

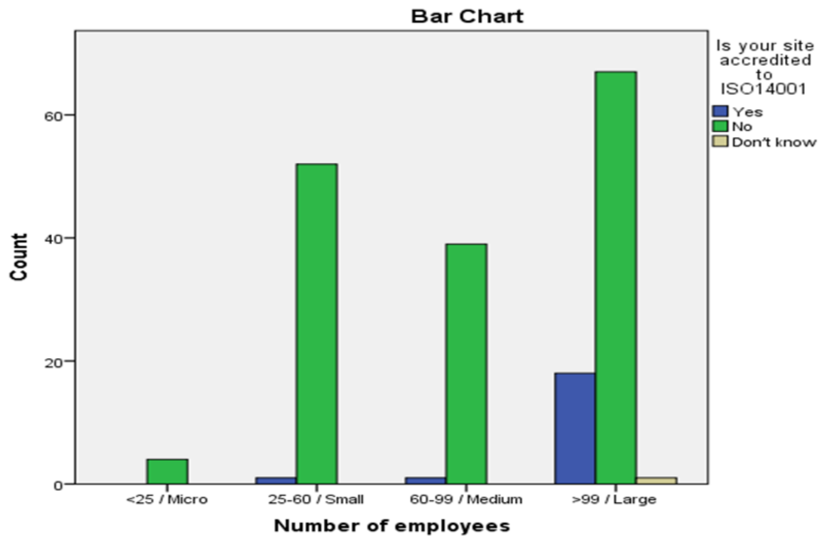
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.071[a]	6	.006
Likelihood Ratio	20.522	6	.002
Linear-by-Linear Association	11.338	1	.001
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.300	.006
N of Valid Cases		183	

The value of Chi-square was found to be 18.071, with corresponding *P*-value 0.006 (which is less than 0.01). This means that there is a highly significant relation between Number of number of employees * Is your site accredited to ISO14001
The value of the contingency coefficient was found to be 0. 300.



- **Number of employees * Does your site have PME environmental license**

		Does your site have PME environmental license			Total
		Yes	No	Don't know	
Number of employees	<25 / Micro	1	3	0	4
	25-60 / Small	4	47	2	53
	60-99 / Medium	3	34	3	40
	>99 / Large	24	58	4	86
Total		32	142	9	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.906[a]	6	.031
Likelihood Ratio	14.653	6	.023
Linear-by-Linear Association	5.209	1	.022
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.266	.031
N of Valid Cases		183	

The value of Chi-square was found to be 13.906, with corresponding *P*-value 0.031 (which is less than 0.05). This means that there is a significant relation between number of Number of employees * Does your site have PME environmental license.

The value of the contingency coefficient was found to be 0.266.

- **Establishment date at the site * Do you have an (EMS)**

		Do you have an (EMS)		Total
		Yes	No	
Establishment date at the site	1970s	2	18	20
	1980s	11	24	35
	1990s	8	42	50
	2000	0	7	7
	2001	2	5	7
	2002	4	13	17
	2003	0	13	13
	2004	1	6	7
	2005	0	8	8
	2006	1	0	1
	2007	0	3	3
	2008	1	7	8
	2009	0	3	3
	2010	0	3	3
	2011	0	1	1
Total		30	153	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.426[a]	14	.117
Likelihood Ratio	24.046	14	.045
Linear-by-Linear Association	2.810	1	.094
N of Valid Cases	183		

The value of Chi-square was found to be 14, with corresponding *P*-value 0.117 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * Do you have an (EMS).

- **Establishment date at the site * Is your site accredited to ISO14001**

		Is your site accredited to ISO14001			Total
		Yes	No	Don't know	
Establishment date at the site	1970s	1	19	0	20
	1980s	8	27	0	35
	1990s	6	44	0	50
	2000	0	7	0	7
	2001	1	6	0	7
	2002	1	15	1	17
	2003	0	13	0	13
	2004	1	6	0	7
	2005	0	8	0	8
	2006	1	0	0	1
	2007	0	3	0	3
	2008	1	7	0	8
	2009	0	3	0	3
	2010	0	3	0	3
	2011	0	1	0	1
Total		20	162	1	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.060[a]	28	.409
Likelihood Ratio	23.601	28	.702
Linear-by-Linear Association	1.642	1	.200
N of Valid Cases	183		

The value of Chi-square was found to be 29.060, with corresponding *P*-value 0.409 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * Is your site accredited to ISO14001.

- **Establishment date at the site * Does your site have PME environmental license**

		Does your site have PME environmental license			Total
		Yes	No	Don't know	
Establishment date at the site	1970s	2	17	1	20
	1980s	14	17	4	35
	1990s	7	40	3	50
	2000	0	7	0	7
	2001	2	5	0	7
	2002	3	14	0	17
	2003	0	13	0	13
	2004	3	4	0	7

	2005	0	8	0	8
	2006	1	0	0	1
	2007	0	3	0	3
	2008	0	7	1	8
	2009	0	3	0	3
	2010	0	3	0	3
	2011	0	1	0	1
Total		32	142	9	183

Chi-Square Tests

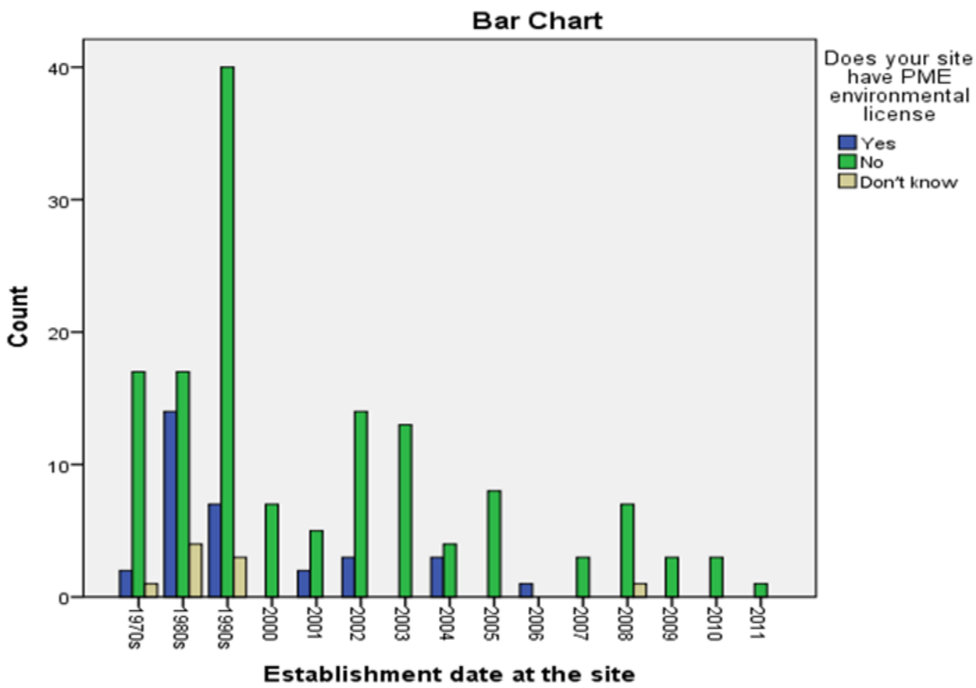
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.428[a]	28	.049
Likelihood Ratio	47.505	28	.012
Linear-by-Linear Association	1.387	1	.239
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.430	.049
N of Valid Cases		183	

The value of Chi-square was found to be 41.428, with corresponding *P*-value 0.049 (which is less than 0.05). This means that there is a significant relation between Establishment date at the site * Does your site have PME environmental license.

The value of the contingency coefficient was found to be 0.430.



iii) Identifying the relationships between the demographic variables (Ques. 6-9) and the characteristics and efficiency of the EMSs in the organizations (Ques. 14 – 21).

- **Type of activity/sector * Our organization has its own environmental policy**

		Our organization has its own environmental policy					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Type of activity/sector	Metals	5	38	4	1	5	53
	Chemical and plastic	2	33	9	5	6	55
	Wood and furniture	0	7	1	1	0	9
	Textiles and clothing	1	9	0	1	0	11
	Paper and printing	1	7	2	0	2	12
	Food	4	14	3	5	5	31
	Building materials and glass	1	9	0	1	1	12
Total		14	117	19	14	19	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.937[a]	24	.583
Likelihood Ratio	27.933	24	.263
Linear-by-Linear Association	.869	1	.351
N of Valid Cases	183		

The value of Chi-square was found to be 21.937, with corresponding *P*-value 0.583 (which is greater than 0.05). This means that there is no significant relation between Type of activity/sector * Our organization has its own environmental policy.

- **Type of activity/sector * Within our budget there is a special item for environmental affairs in the organization**

		Within our budget there is a special item for environmental affairs in the organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Type of activity/sector	Metals	3	20	18	8	4	53
	Chemical and plastic	0	20	12	17	6	55
	Wood and furniture	0	4	2	3	0	9
	Textiles and clothing	0	6	2	3	0	11
	Paper and printing	0	3	7	0	2	12
	Food	2	8	5	11	5	31

	Building materials and glass	0	4	2	6	0	12
Total		5	65	48	48	17	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.293[a]	24	.120
Likelihood Ratio	38.574	24	.030
Linear-by-Linear Association	2.249	1	.134
N of Valid Cases	183		

The value of Chi-square was found to be 32.293, with corresponding *P*-value 0.120 (which is greater than 0.05). This means that there is no significant relation between Type of activity/sector * Within our budget there is a special item for environmental affairs in the organization.

- **Type of activity/sector * The environmental responsibilities and authorities within our organization are fixed and clear**

		The environmental responsibilities and authorities within our organization are fixed and clear					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
	Metals	5	26	12	7	3	53
	Chemical and plastic	0	23	12	16	4	55
	Wood and furnitur	0	4	2	3	0	9
	Textiles and clothing	0	8	2	0	1	11
	Paper and printing	1	7	1	1	2	12
	Food	3	9	3	12	4	31
Type of activity/sector	Building materials and glass	0	8	2	1	1	12
Total		9	85	34	40	15	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.703[a]	24	.135
Likelihood Ratio	38.273	24	.033
Linear-by-Linear Association	.876	1	.349
N of Valid Cases	183		

The value of Chi-square was found to be 32.293, with corresponding *P*-value 0.120 (which is greater than 0.05). This means that there is no significant relation between Type of activity/sector * The environmental responsibilities and authorities within our organization are fixed and clear.

- **Type of activity/sector * There is an environmental record in our organization**

		There is an environmental record in our organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Type of activity/sector	Metals	6	38	2	3	4	53
	Chemical and plastic	1	36	7	6	5	55
	Wood and furnitur	0	7	1	1	0	9
	Textiles and clothing	0	11	0	0	0	11
	Paper and printing	2	8	0	0	2	12
	Food	3	14	2	6	6	31
	Building materials and glass	1	7	1	2	1	12
Total		13	121	13	18	18	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.884[a]	24	.225
Likelihood Ratio	34.814	24	.071
Linear-by-Linear Association	3.163	1	.075
N of Valid Cases	183		

The value of Chi-square was found to be 28.884, with corresponding *P*-value 0.225 (which is greater than 0.05). This means that there is no significant relation between Type of activity/sector * There is an environmental record in our organization.

- **Type of activity/sector * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities**

		Our organization takes into account any potential sources of pollution result from its activities while planning these activities					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Type of activity/sector	Metals	4	13	17	15	4	53
	Chemical and plastic	1	17	14	18	5	55
	Wood and furnitur	0	4	4	0	1	9
	Textiles and clothing	0	7	2	2	0	11
	Paper and printing	0	4	5	1	2	12
	Food	0	7	7	10	7	31
	Building materials and glass	1	3	0	7	1	12
Total		6	55	49	53	20	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.672[a]	24	.091
Likelihood Ratio	39.493	24	.024
Linear-by-Linear Association	2.622	1	.105
N of Valid Cases	183		

The value of Chi-square was found to be 33.672, with corresponding *P*-value 0.091 (which is greater than 0.05). This means that there is no significant relation between Type of activity/sector * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.

- **Type of activity/sector * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment**

		Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Type of activity/sector	Metals	22	25	3	2	1	53
	Chemical and plastic	16	28	6	3	2	55
	Wood and furnitur	1	7	0	0	1	9
	Textiles and clothing	6	5	0	0	0	11
	Paper and printing	2	7	3	0	0	12
	Food	5	15	2	6	3	31
	Building materials and glass	5	5	1	0	1	12
Total		57	92	15	11	8	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.619[a]	24	.074
Likelihood Ratio	34.686	24	.073
Linear-by-Linear Association	5.574	1	.018
N of Valid Cases	183		

The value of Chi-square was found to be 34.619, with corresponding *P*-value 0.074 (which is greater than 0.05). This means that there is no significant relation between Type of activity/sector * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.

- **Type of activity/sector * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness**

		The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Type of activity/sector	Metals	20	26	2	4	1	53
	Chemical and plastic	14	24	7	7	3	55
	Wood and furnitur	1	7	0	0	1	9
	Textiles and clothing	4	6	0	0	1	11
	Paper and printing	1	9	0	0	2	12
	Food	7	10	5	2	7	31
	Building materials and glass	6	4	0	1	1	12
Total		53	86	14	14	16	183

Chi-Square Tests

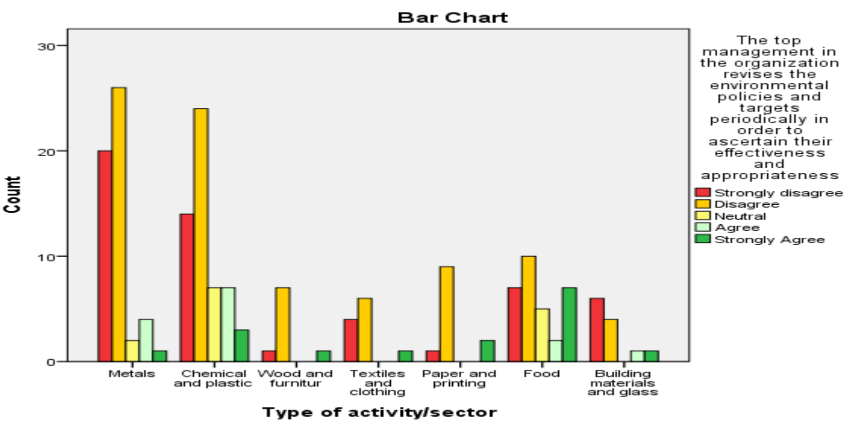
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.697[a]	24	.037
Likelihood Ratio	41.802	24	.014
Linear-by-Linear Association	4.192	1	.041
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.413	.037
N of Valid Cases		183	

The value of Chi-square was found to be 37.697, with corresponding *P*-value 0.037 (which is less than 0.05). This means that there is a significant relation between Type of activity/sector * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.

The value of the contingency coefficient was found to be 0.413.



- **Type of activity/sector * There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs**

		There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs					Total
		Strongly disagree	Disagree	Neutrale	Agree	Strongly Agree	
Type of activity/sector	Metals	23	19	4	5	2	53
	Chemical and plastic	14	21	6	7	7	55
	Wood and furnitur	1	6	0	2	0	9
	Textiles and clothing	4	5	1	0	1	11
	Paper and printing	3	6	1	0	2	12
	Food	6	12	3	2	8	31
	Building materials and glass	4	5	1	1	1	12
Total		55	74	16	17	21	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.095[a]	24	.456
Likelihood Ratio	26.909	24	.309
Linear-by-Linear Association	3.145	1	.076
N of Valid Cases	183		

The value of Chi-square was found to be 24.095, with corresponding *P*-value 0.456 (which is greater than 0.05). This means that there is no significant relation between Type of activity/sector * There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs.

- **The phase * Our organization has its own environmental policy**

		Our organization has its own environmental policy					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
The phase	Phase 1	1	6	3	1	1	12
	Phase 2	0	10	3	2	2	17
	Phase 3	3	31	2	5	4	45
	Phase 4	6	32	5	3	8	54
	Phase 5	4	38	6	3	4	55
Total		14	117	19	14	19	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.638[a]	16	.769
Likelihood Ratio	12.308	16	.723
Linear-by-Linear Association	1.125	1	.289
N of Valid Cases	183		

The value of Chi-square was found to be 11.638, with corresponding *P*-value 0.769 (which is greater than 0.05). This means that there is no significant relation between The phase * Our organization has its own environmental policy.

- **The phase * Within our budget there is a special item for environmental affairs in the organization**

		Within our budget there is a special item for environmental affairs in the organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
	Phase 1	0	5	2	4	1	12
	Phase 2	0	8	2	5	2	17
	Phase 3	2	9	11	14	9	45
	Phase 4	2	18	18	12	4	54
The phase	Phase 5	1	25	15	13	1	55
Total		5	65	48	48	17	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.307[a]	16	.207
Likelihood Ratio	21.993	16	.143
Linear-by-Linear Association	4.018	1	.045
N of Valid Cases	183		

The value of Chi-square was found to be 20.307, with corresponding *P*-value 0.207 (which is greater than 0.05). This means that there is no significant relation between The phase * Within our budget there is a special item for environmental affairs in the organization.

- **The phase * The environmental responsibilities and authorities within our organization are fixed and clear**

		The environmental responsibilities and authorities within our organization are fixed and clear					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
	Phase 1	1	3	4	3	1	12
	Phase 2	0	6	3	5	3	17
	Phase 3	4	17	4	16	4	45
	Phase 4	3	26	10	11	4	54
The phase	Phase 5	1	33	13	5	3	55
Total		9	85	34	40	15	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.650[a]	16	.097
Likelihood Ratio	24.972	16	.070
Linear-by-Linear Association	6.340	1	.012
N of Valid Cases	183		

The value of Chi-square was found to be 23.650, with corresponding *P*-value 0.097 (which is greater than 0.05). This means that there is no significant relation between The phase * The environmental responsibilities and authorities within our organization are fixed and clear.

- **The phase * There is an environmental record in our organization**

		There is an environmental record in our organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
	Phase 1	0	8	1	3	0	12
	Phase 2	0	13	3	0	1	17
	Phase 3	6	22	2	3	12	45
	Phase 4	5	37	3	6	3	54
The phase	Phase 5	2	41	4	6	2	55
Total		13	121	13	18	18	183

Chi-Square Tests

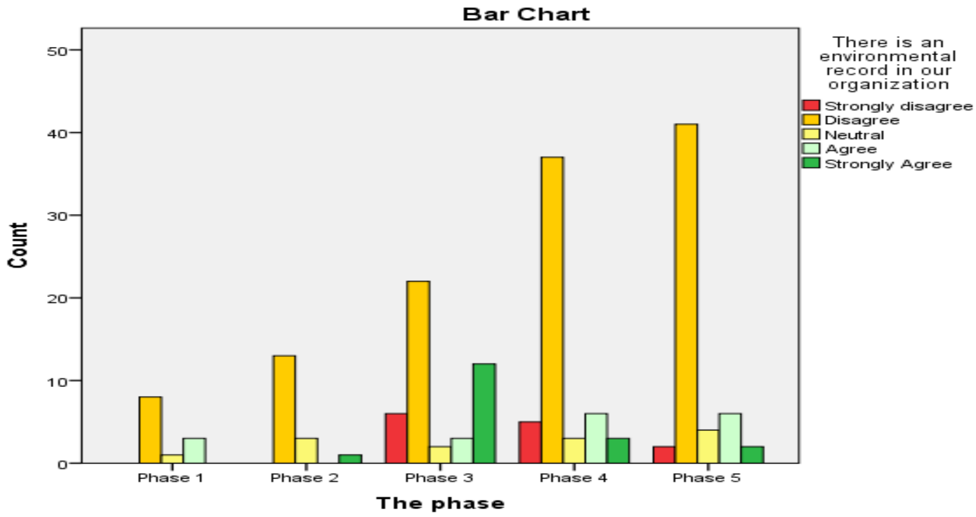
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.711[a]	16	.004
Likelihood Ratio	34.711	16	.004
Linear-by-Linear Association	1.520	1	.218
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.399	.004
N of Valid Cases		183	

The value of Chi-square was found to be 34.711, with corresponding *P*-value 0.004 (which is less than 0.01). This means that there is a highly significant relation between The phase * There is an environmental record in our organization.

The value of the contingency coefficient was found to be 0.399.



- **The phase * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities**

		Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
The phase	Phase 1	1	4	1	5	1	12
	Phase 2	0	9	2	3	3	17
	Phase 3	2	13	7	14	9	45
	Phase 4	2	13	20	14	5	54
	Phase 5	1	16	19	17	2	55
Total		6	55	49	53	20	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.901[a]	16	.116
Likelihood Ratio	23.932	16	.091
Linear-by-Linear Association	.143	1	.705
N of Valid Cases	183		

The value of Chi-square was found to be 22.901, with corresponding *P*-value 0.119 (which is greater than 0.05). This means that there is no significant relation between The phase * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.

- **The phase * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment**

		Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
The phase	Phase 1	3	4	2	3	0	12
	Phase 2	1	9	3	3	1	17
	Phase 3	17	19	6	1	2	45
	Phase 4	24	22	1	2	5	54
	Phase 5	12	38	3	2	0	55
Total		57	92	15	11	8	183

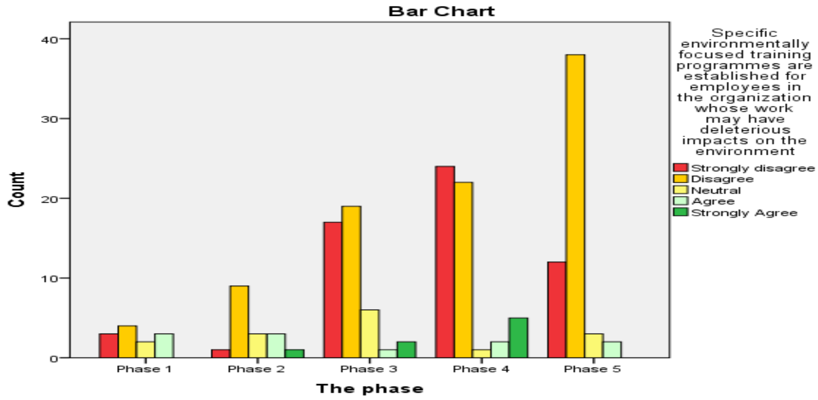
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.580[a]	16	.000
Likelihood Ratio	41.454	16	.000
Linear-by-Linear Association	5.367	1	.021
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.430	.000
N of Valid Cases		183	

The value of Chi-square was found to be 41.580, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between The phase * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment.
The value of the contingency coefficient was found to be 0.430.



- **The phase * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness**

		The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
	Phase 1	3	5	2	1	1	12
	Phase 2	1	10	3	1	2	17
	Phase 3	11	22	4	5	3	45
	Phase 4	22	23	2	3	4	54
The phase	Phase 5	16	26	3	4	6	55
Total		53	86	14	14	16	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.873[a]	16	.608
Likelihood Ratio	14.410	16	.568
Linear-by-Linear Association	.974	1	.324
N of Valid Cases	183		

The value of Chi-square was found to be 13.873, with corresponding *P*-value 0.608 (which is greater than 0.05). This means that there is no significant relation between The phase * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.

- **The phase * There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs**

		There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs					Total
		Strongly disagree	Disagree	Neutrale	Agree	Strongly Agree	
The phase	Phase 1	2	5	2	2	1	12
	Phase 2	1	10	2	3	1	17
	Phase 3	14	15	4	7	5	45
	Phase 4	22	21	3	2	6	54
	Phase 5	16	23	5	3	8	55
Total		55	74	16	17	21	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.424[a]	16	.359
Likelihood Ratio	18.803	16	.279
Linear-by-Linear Association	1.108	1	.292
N of Valid Cases	183		

The value of Chi-square was found to be 17.424, with corresponding *P*-value 0.359 (which is greater than 0.05). This means that there is no significant relation between The phase * There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs.

- **Number of employees * Our organization has its own environmental policy**

		Our organization has its own environmental policy					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Number of employees	<25 / Micro	0	2	2	0	0	4
	25-60 / Small	9	40	1	1	2	53
	60-99 / Medium	2	31	5	1	1	40
	>99 / Large	3	44	11	12	16	86
Total		14	117	19	14	19	183

Chi-Square Tests

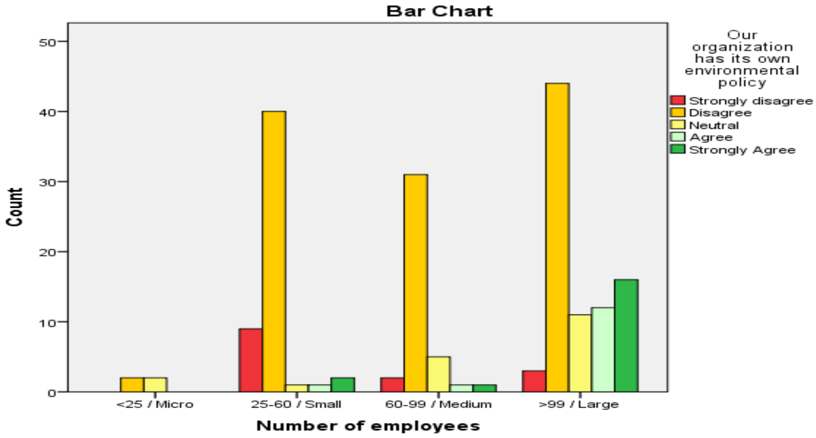
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.706[a]	12	.000
Likelihood Ratio	43.026	12	.000
Linear-by-Linear Association	22.586	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.435	.000
N of Valid Cases		183	

The value of Chi-square was found to be 42.706, with corresponding *P*-value 0.00 (which is less than 0.01). This

means that there is a highly significant relation between Number of employees * Our organization has its own environmental policy.
The value of the contingency coefficient was found to be 0.435.



- **Number of employees * Within our budget there is a special item for environmental affairs in the organization**

		Within our budget there is a special item for environmental affairs in the organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Number of employees	<25 / Micro	0	2	0	2	0	4
	25-60 / Small	3	24	17	5	4	53
	60-99 / Medium	0	12	14	11	3	40
	>99 / Large	2	27	17	30	10	86
Total		5	65	48	48	17	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.844[a]	12	.070
Likelihood Ratio	23.383	12	.025
Linear-by-Linear Association	7.345	1	.007
N of Valid Cases	183		

- **Number of employees * The environmental responsibilities and authorities within our organization are fixed and clear**

		The environmental responsibilities and authorities within our organization are fixed and clear					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Number of employees	<25 / Micro	0	2	1	1	0	4
	25-60 / Small	4	38	5	6	0	53
	60-99 / Medium	1	24	8	6	1	40
	>99 / Large	4	21	20	27	14	86
Total		9	85	34	40	15	183

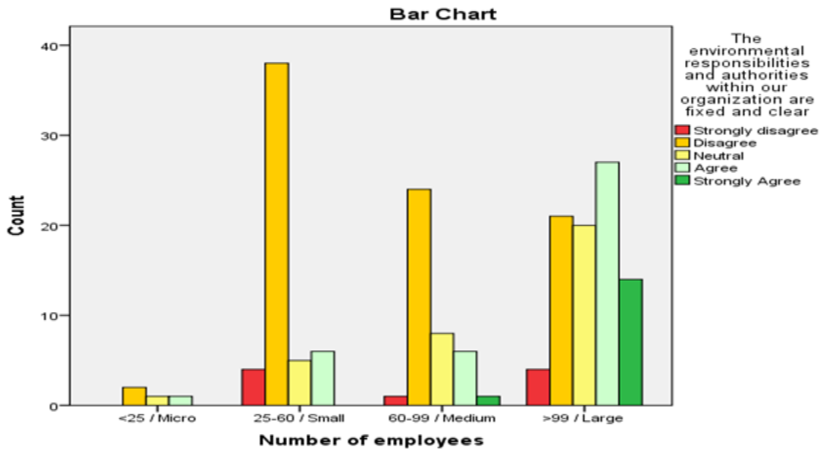
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.072[a]	12	.000
Likelihood Ratio	48.420	12	.000
Linear-by-Linear Association	29.353	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.436	.000
N of Valid Cases		183	

The value of Chi-square was found to be 43.072, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Number of employees * The environmental responsibilities and authorities within our organization are fixed and clear.
The value of the contingency coefficient was found to be 0.436.



- **Number of employees * There is an environmental record in our organization**

		There is an environmental record in our organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Number of employees	<25 / Micro	0	2	1	1	0	4
	25-60 / Small	6	42	2	0	3	53
	60-99 / Medium	2	30	1	5	2	40
	>99 / Large	5	47	9	12	13	86
Total		13	121	13	18	18	183

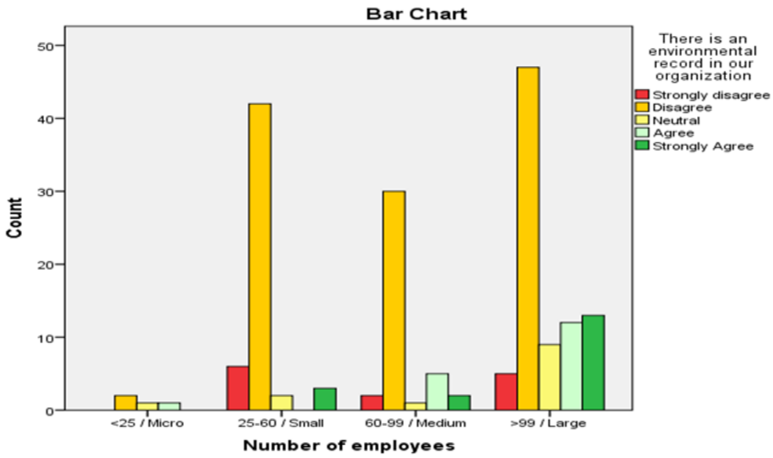
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.620[a]	12	.023
Likelihood Ratio	28.605	12	.005
Linear-by-Linear Association	10.630	1	.001
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.338	.023
N of Valid Cases		183	

The value of Chi-square was found to be 23.620, with corresponding *P*-value 0.023 (which is less than 0.05). This means that there is a significant relation between Number of employees * There is an environmental record in our organization.
The value of the contingency coefficient was found to be 0.338.



- **Number of employees * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities**

		Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Number of employees	<25 / Micro	0	1	0	3	0	4
	25-60 / Small	4	22	18	9	0	53
	60-99 / Medium	1	13	10	14	2	40
	>99 / Large	1	19	21	27	18	86
Total		6	55	49	53	20	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.505[a]	12	.001
Likelihood Ratio	37.571	12	.000
Linear-by-Linear Association	17.721	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.388	.001
N of Valid Cases		183	

The value of Chi-square was found to be 32.505, with corresponding *P*-value 0.001 (which is less than 0.01). This means that there is a highly significant relation between Number of employees * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.
The value of the contingency coefficient was found to be 0.388.

- **Number of employees * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment**

		Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Number of employees	<25 / Micro	0	3	0	1	0	4
	25-60 / Small	29	22	1	0	1	53
	60-99 / Medium	13	24	0	3	0	40
	>99 / Large	15	43	14	7	7	86
Total		57	92	15	11	8	183

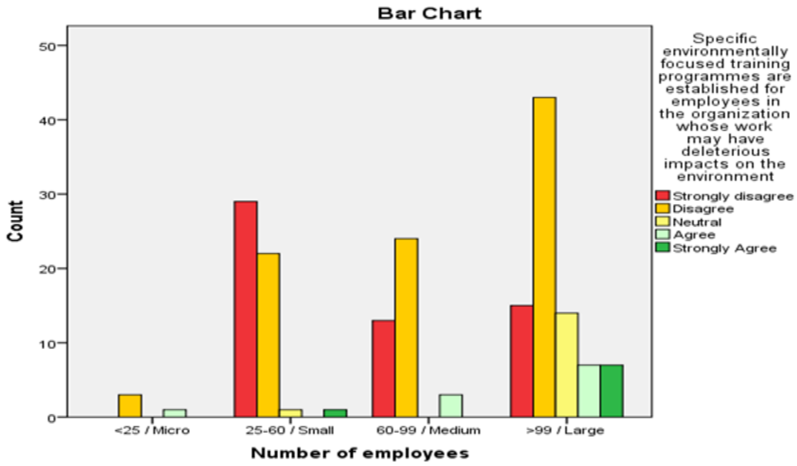
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.840[a]	12	.000
Likelihood Ratio	50.101	12	.000
Linear-by-Linear Association	18.946	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.436	.000
N of Valid Cases		183	

The value of Chi-square was found to be 42.840, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Number of employees * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment.
The value of the contingency coefficient was found to be 0.436.



- **Number of employees * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness**

		The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Number of employees	<25 / Micro	1	2	1	0	0	4
	25-60 / Small	27	22	3	0	1	53
	60-99 / Medium	10	24	3	3	0	40
	>99 / Large	15	38	7	11	15	86
Total		53	86	14	14	16	183

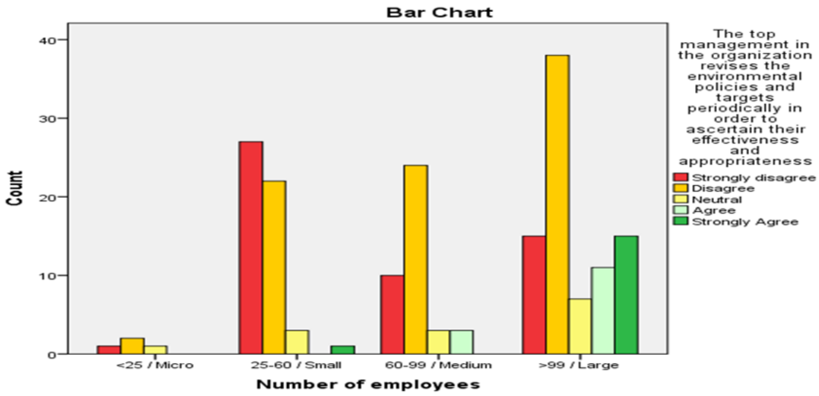
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	38.301[a]	12	.000
Likelihood Ratio	44.027	12	.000
Linear-by-Linear Association	25.986	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.416	.000
N of Valid Cases		183	

The value of Chi-square was found to be 38.301, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Number of employees * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.
The value of the contingency coefficient was found to be 0.416.



- **Number of employees * There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs**

		There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs					Total
		Strongly disagree	Disagree	Neutrale	Agree	Strongly Agree	
Number of employees	<25 / Micro	0	2	1	1	0	4
	25-60 / Small	29	17	3	2	2	53
	60-99 / Medium	12	21	2	4	1	40
	>99 / Large	14	34	10	10	18	86
Total		55	74	16	17	21	183

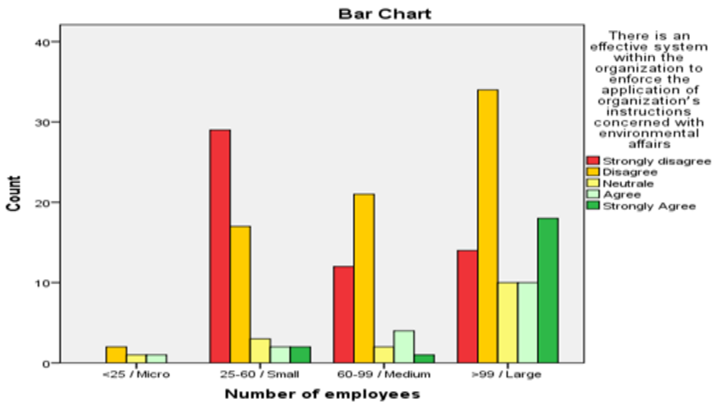
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	39.099[a]	12	.000
Likelihood Ratio	40.498	12	.000
Linear-by-Linear Association	20.145	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.420	.000
N of Valid Cases		183	

The value of Chi-square was found to be 39.099, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Number of employees * There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs.
The value of the contingency coefficient was found to be 0.420.



- **Establishment date at the site * Our organization has its own environmental policy**

		Our organization has its own environmental policy					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Establishment date at the site	1970s	1	14	4	1	0	20
	1980s	3	17	3	4	8	35
	1990s	4	33	4	3	6	50
	2000	1	4	0	1	1	7
	2001	0	5	0	0	2	7
	2002	0	11	2	3	1	17
	2003	0	10	3	0	0	13
	2004	1	3	2	1	0	7
	2005	1	6	0	1	0	8
	2006	0	0	0	0	1	1
	2007	1	1	1	0	0	3
	2008	0	8	0	0	0	8
	2009	0	3	0	0	0	3
	2010	2	1	0	0	0	3
	2011	0	1	0	0	0	1
Total		14	117	19	14	19	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	69.656[a]	56	.104
Likelihood Ratio	67.910	56	.132
Linear-by-Linear Association	5.063	1	.024
N of Valid Cases	183		

The value of Chi-square was found to be 69.656, with corresponding *P*-value 0.104 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * Our organization has its own environmental policy.

- **Establishment date at the site * Within our budget there is a special item for environmental affairs in the organization**

		Within our budget there is a special item for environmental affairs in the organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Establishment date at the site	1970s	0	11	2	7	0	20
	1980s	0	6	11	11	7	35
	1990s	3	16	11	14	6	50
	2000	1	1	2	3	0	7
	2001	0	1	3	2	1	7
	2002	0	13	2	1	1	17
	2003	0	7	3	3	0	13
	2004	1	1	3	1	1	7
	2005	0	3	4	1	0	8
	2006	0	0	1	0	0	1
	2007	0	2	0	1	0	3
	2008	0	2	3	2	1	8
	2009	0	1	1	1	0	3
	2010	0	0	2	1	0	3
	2011	0	1	0	0	0	1
Total		5	65	48	48	17	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	63.072[a]	56	.241
Likelihood Ratio	68.393	56	.124
Linear-by-Linear Association	1.833	1	.176
N of Valid Cases	183		

The value of Chi-square was found to be 63.072, with corresponding *P*-value 0.241 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * Within our budget there is a special item for environmental affairs in the organization.

- **Establishment date at the site * The environmental responsibilities and authorities within our organization are fixed and clear**

		The environmental responsibilities and authorities within our organization are fixed and clear					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Establishment date at the site	1970s	2	8	6	3	1	20
	1980s	0	11	6	11	7	35
	1990s	5	22	9	9	5	50
	2000	1	2	2	2	0	7
	2001	0	2	1	3	1	7
	2002	0	11	1	4	1	17
	2003	0	10	2	1	0	13
	2004	1	1	3	2	0	7
	2005	0	6	1	1	0	8
	2006	0	0	0	1	0	1

2007	0	3	0	0	0	3
2008	0	5	2	1	0	8
2009	0	2	0	1	0	3
2010	0	1	1	1	0	3
2011	0	1	0	0	0	1
Total	9	85	34	40	15	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	53.399[a]	56	.574
Likelihood Ratio	59.887	56	.337
Linear-by-Linear Association	4.033	1	.045
N of Valid Cases	183		

The value of Chi-square was found to be 53.399, with corresponding *P*-value 0.574 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * The environmental responsibilities and authorities within our organization are fixed and clear.

- **Establishment date at the site * There is an environmental record in our organization**

		There is an environmental record in our organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Establishment date at the site	1970s	1	14	2	1	2	20
	1980s	2	20	2	4	7	35
	1990s	5	30	2	6	7	50
	2000	1	5	1	0	0	7
	2001	1	3	2	1	0	7
	2002	0	13	0	3	1	17
	2003	0	12	0	1	0	13
	2004	1	3	0	2	1	7
	2005	0	7	1	0	0	8
	2006	0	0	1	0	0	1
	2007	0	3	0	0	0	3
	2008	0	6	2	0	0	8
	2009	1	2	0	0	0	3
	2010	1	2	0	0	0	3
	2011	0	1	0	0	0	1
Total		13	121	13	18	18	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.991[a]	56	.301
Likelihood Ratio	59.861	56	.337
Linear-by-Linear Association	5.519	1	.019
N of Valid Cases	183		

The value of Chi-square was found to be 60.991, with corresponding *P*-value 0.301 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * There is an environmental record in our organization.

- **Establishment date at the site * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities**

		Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Establishment date at the site	1970s	2	9	2	4	3	20
	1980s	2	8	5	13	7	35
	1990s	0	14	14	16	6	50
	2000	1	2	4	0	0	7
	2001	0	1	3	3	0	7
	2002	0	6	5	4	2	17
	2003	0	6	4	3	0	13
	2004	0	2	1	2	2	7
	2005	0	2	3	3	0	8
	2006	0	0	0	1	0	1
	2007	0	1	2	0	0	3
	2008	0	2	3	3	0	8
	2009	0	0	3	0	0	3
	2010	1	1	0	1	0	3
	2011	0	1	0	0	0	1
Total		6	55	49	53	20	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	62.160[a]	56	.266
Likelihood Ratio	65.456	56	.181
Linear-by-Linear Association	1.420	1	.233
N of Valid Cases	183		

The value of Chi-square was found to be 62.160, with corresponding *P*-value 0.266 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.

- **Establishment date at the site * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment**

		Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Establishment date at the site	1970s	5	10	3	2	0	20
	1980s	11	11	6	3	4	35
	1990s	20	23	3	1	3	50
	2000	2	5	0	0	0	7
	2001	3	1	1	2	0	7
	2002	3	9	2	2	1	17
	2003	5	8	0	0	0	13
	2004	3	3	0	1	0	7

2005	2	6	0	0	0	8
2006	0	1	0	0	0	1
2007	0	3	0	0	0	3
2008	2	6	0	0	0	8
2009	0	3	0	0	0	3
2010	1	2	0	0	0	3
2011	0	1	0	0	0	1
Total	57	92	15	11	8	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	48.096[a]	56	.765
Likelihood Ratio	55.936	56	.477
Linear-by-Linear Association	2.199	1	.138
N of Valid Cases	183		

The value of Chi-square was found to be 48.096, with corresponding *P*-value 0.765 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment.

- **Establishment date at the site * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness**

		The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Establishment date at the site	1970s	5	12	2	1	0	20
	1980s	9	12	3	4	7	35
	1990s	16	23	3	4	4	50
	2000	2	3	1	1	0	7
	2001	3	1	0	1	2	7
	2002	3	10	1	1	2	17
	2003	5	6	2	0	0	13
	2004	3	1	1	2	0	7
	2005	2	5	1	0	0	8
	2006	0	0	0	0	1	1
	2007	0	3	0	0	0	3
	2008	2	6	0	0	0	8
	2009	1	2	0	0	0	3
	2010	2	1	0	0	0	3
	2011	0	1	0	0	0	1
Total		53	86	14	14	16	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	53.748[a]	56	.561
Likelihood Ratio	55.694	56	.486

Linear-by-Linear Association	2.748	1	.097
N of Valid Cases	183		

The value of Chi-square was found to be 53.748, with corresponding *P*-value 0.561 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.

- **Establishment date at the site * There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs**

		There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs					Total
		Strongly disagree	Disagree	Neutrale	Agree	Strongly Agree	
Establishment date at the site	1970s	4	12	1	2	1	20
	1980s	10	8	4	7	6	35
	1990s	15	18	5	5	7	50
	2000	2	3	1	0	1	7
	2001	3	1	0	0	3	7
	2002	4	9	1	1	2	17
	2003	6	4	2	0	1	13
	2004	3	2	0	2	0	7
	2005	2	5	1	0	0	8
	2006	0	0	1	0	0	1
	2007	0	3	0	0	0	3
	2008	3	5	0	0	0	8
	2009	1	2	0	0	0	3
	2010	2	1	0	0	0	3
	2011	0	1	0	0	0	1
Total		55	74	16	17	21	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	58.202[a]	56	.394
Likelihood Ratio	59.508	56	.349
Linear-by-Linear Association	7.038	1	.008
N of Valid Cases	183		

The value of Chi-square was found to be 58.202, with corresponding *P*-value 0.394 (which is greater than 0.05). This means that there is no significant relation between Establishment date at the site * There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs.

iv) Identifying the relationships among the questions pertaining to the general information of the organizations' EMS attitudes (Ques. 10, 12 & 13)

- **Is your site accredited to ISO14001 * Do you have an (EMS)**

		Do you have an (EMS)		Total
		Yes	No	
Is your site accredited to ISO14001	Yes	20	0	20
	No	9	153	162
	Don't know	1	0	1
Total		30	153	183

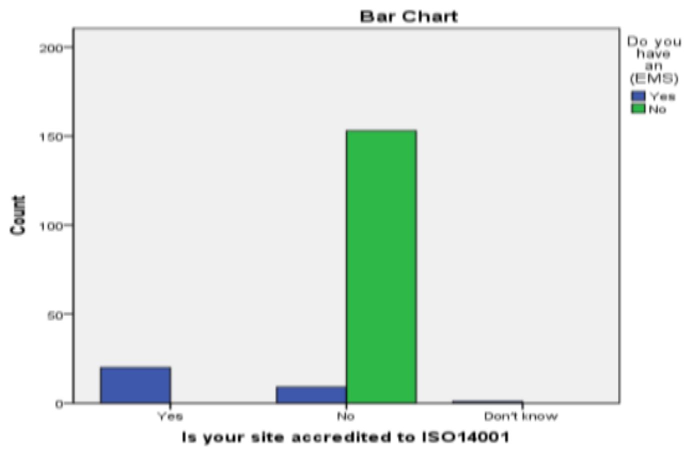
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	120.983[a]	2	.000
Likelihood Ratio	93.769	2	.000
Linear-by-Linear Association	96.232	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.631	.000
N of Valid Cases		183	

The value of Chi-square was found to be 120.983, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Is your site accredited to ISO14001 * Do you have an (EMS). The value of the contingency coefficient was found to be 0.631.



- **Does your site have PME environmental license * Do you have an (EMS)**

		Do you have an (EMS)		Total
		Yes	No	
Does your site have PME environmental license	Yes	18	14	32
	No	9	133	142
	Don't know	3	6	9
Total		30	153	183

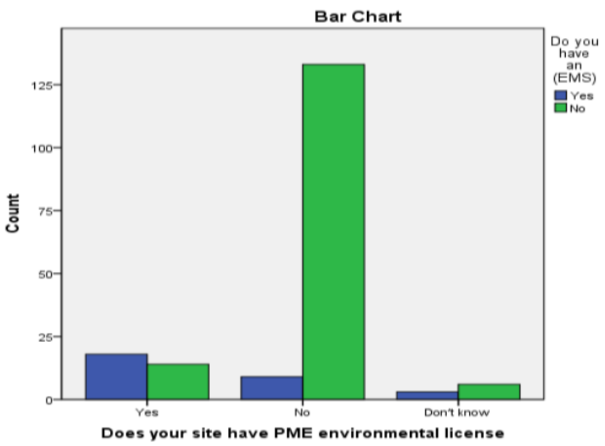
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	49.448[a]	2	.000
Likelihood Ratio	40.897	2	.000
Linear-by-Linear Association	24.010	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.461	.000
N of Valid Cases		183	

The value of Chi-square was found to be 49.448, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * Do you have an (EMS).
The value of the contingency coefficient was found to be 0.461.



- **Does your site have PME environmental license * Is your site accredited to ISO14001**

		Is your site accredited to ISO14001			Total
		Yes	No	Don't know	
Does your site have PME environmental license	Yes	11	20	1	32
	No	7	135	0	142
	Don't know	2	7	0	9
Total		20	162	1	183

Chi-Square Tests

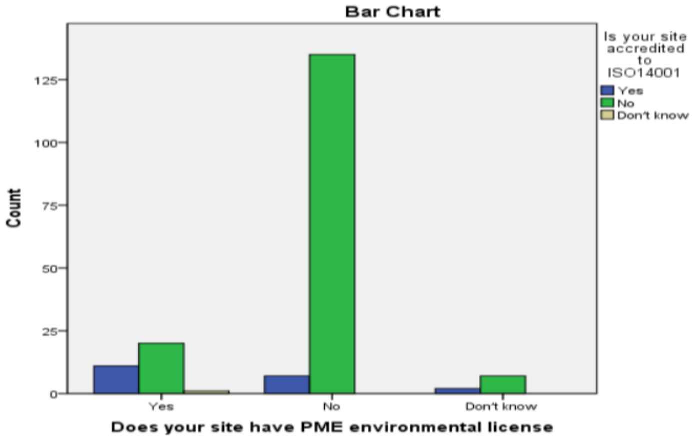
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.794[a]	4	.000
Likelihood Ratio	23.915	4	.000
Linear-by-Linear Association	7.905	1	.005
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.374	.000
N of Valid Cases		183	

The value of Chi-square was found to be 29.794, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * Is your site accredited to ISO14001.

The value of the contingency coefficient was found to be 0.374.



v) Identifying the relationships between the general information of the organizations' EMS attitudes (Ques. 10, 12 & 13) and the characteristics and efficiency of the EMSs in the organizations (Ques. 14 – 21)

- **Do you have an (EMS) * Our organization has its own environmental policy**

		Our organization has its own environmental policy					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Do you have an (EMS)	Yes	2	5	1	8	14	30
	No	12	112	18	6	5	153
Total		14	117	19	14	19	183

Chi-Square Tests

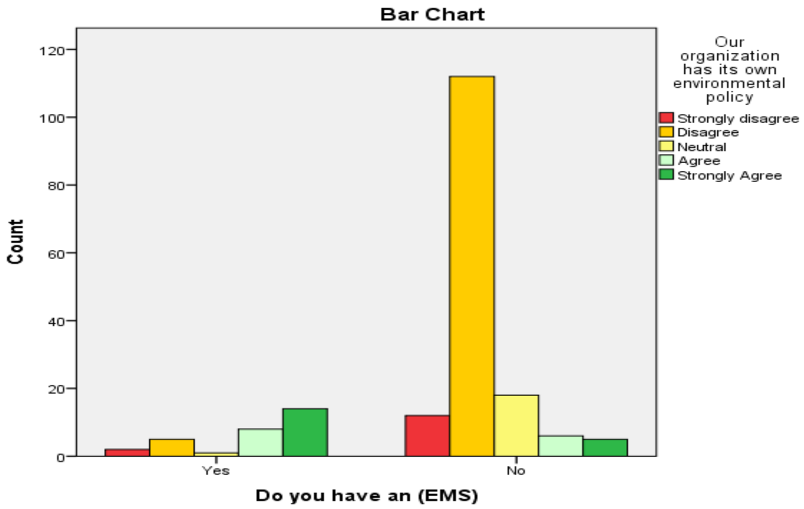
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	76.764[a]	4	.000
Likelihood Ratio	61.635	4	.000
Linear-by-Linear Association	60.028	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.544	.000
N of Valid Cases		183	

The value of Chi-square was found to be 76.764, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Do you have an (EMS) * Our organization has its own environmental policy.

The value of the contingency coefficient was found to be 0.544.



- **Do you have an (EMS) * Within our budget there is a special item for environmental affairs in the organization**

		Within our budget there is a special item for environmental affairs in the organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Do you have an (EMS)	Yes	0	3	5	13	9	30
	No	5	62	43	35	8	153
Total		5	65	48	48	17	183

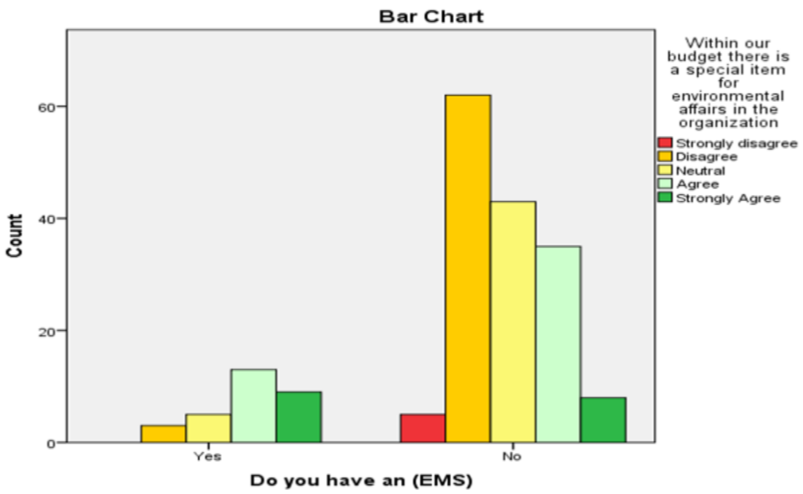
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.380[a]	4	.000
Likelihood Ratio	27.314	4	.000
Linear-by-Linear Association	26.065	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.372	.000
N of Valid Cases		183	

The value of Chi-square was found to be 29.380, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Do you have an (EMS) * Within our budget there is a special item for environmental affairs in the organization.
The value of the contingency coefficient was found to be 0.372.



- **Do you have an (EMS) * The environmental responsibilities and authorities within our organization are fixed and clear**

		The environmental responsibilities and authorities within our organization are fixed and clear					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Do you have an (EMS)	Yes	1	1	2	14	12	30
	No	8	84	32	26	3	153
Total		9	85	34	40	15	183

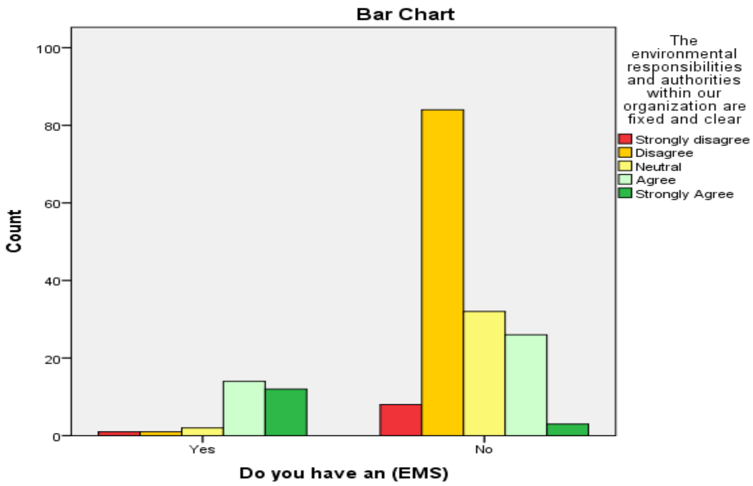
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	71.666[a]	4	.000
Likelihood Ratio	64.113	4	.000
Linear-by-Linear Association	55.099	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.530	.000
N of Valid Cases		183	

The value of Chi-square was found to be 71.666, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Do you have an (EMS) * The environmental responsibilities and authorities within our organization are fixed and clear.
The value of the contingency coefficient was found to be 0.530.



- **Do you have an (EMS) * There is an environmental record in our organization**

		There is an environmental record in our organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Do you have an (EMS)	Yes	1	5	4	9	11	30
	No	12	116	9	9	7	153
Total		13	121	13	18	18	183

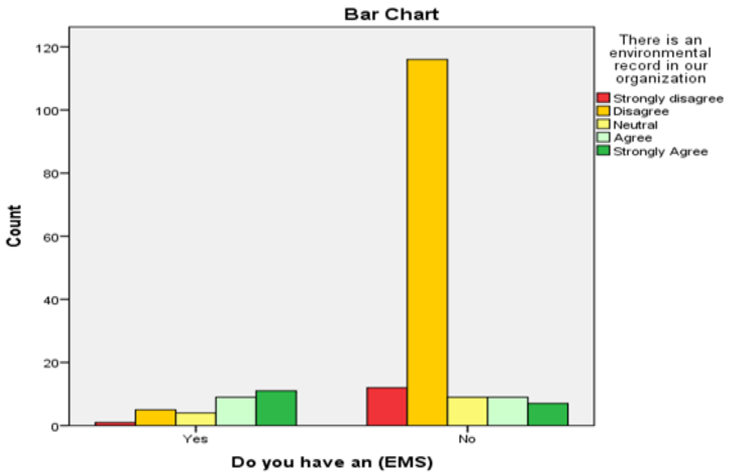
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.044[a]	4	.000
Likelihood Ratio	49.523	4	.000
Linear-by-Linear Association	51.805	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.487	.000
N of Valid Cases		183	

The value of Chi-square was found to be 57.044, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Do you have an (EMS) * There is an environmental record in our organization.
The value of the contingency coefficient was found to be 0.487.



- **Do you have an (EMS) * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities**

		Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Do you have an (EMS)	Yes	1	1	1	13	14	30
	No	5	54	48	40	6	153
Total		6	55	49	53	20	183

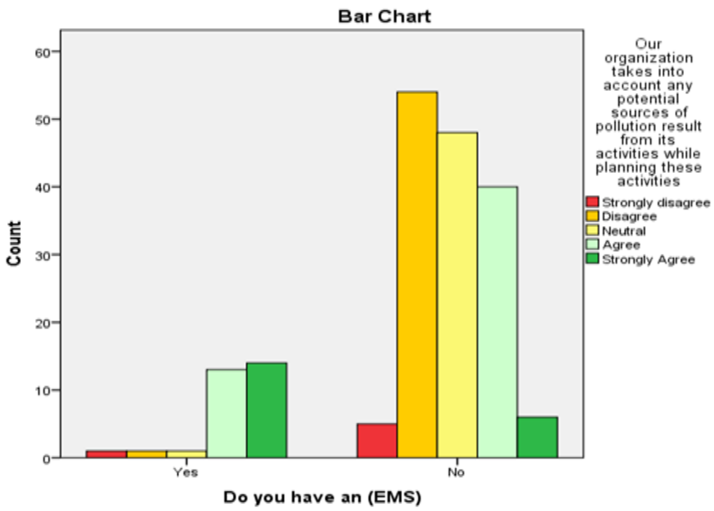
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.382[a]	4	.000
Likelihood Ratio	54.633	4	.000
Linear-by-Linear Association	39.650	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.498	.000
N of Valid Cases		183	

The value of Chi-square was found to be 60.382, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Do you have an (EMS) * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.
The value of the contingency coefficient was found to be 0.498.



- **Do you have an (EMS) * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment**

		Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Do you have an (EMS)	Yes	3	7	8	6	6	30
	No	54	85	7	5	2	153
Total		57	92	15	11	8	183

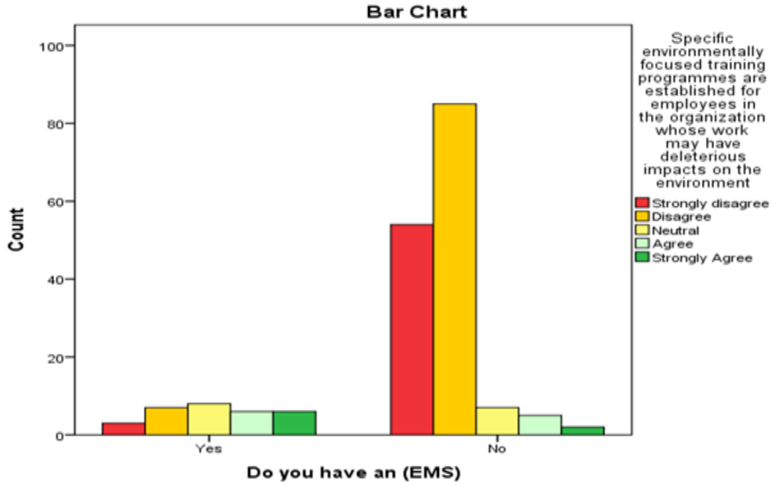
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	56.996[a]	4	.000
Likelihood Ratio	45.381	4	.000
Linear-by-Linear Association	45.547	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.487	.000
N of Valid Cases		183	

The value of Chi-square was found to be 56.996, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Do you have an (EMS) * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.
The value of the contingency coefficient was found to be 0.487.



- **Do you have an (EMS) * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness**

		The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Do you have an (EMS)	Yes	4	4	3	6	13	30
	No	49	82	11	8	3	153
Total		53	86	14	14	16	183

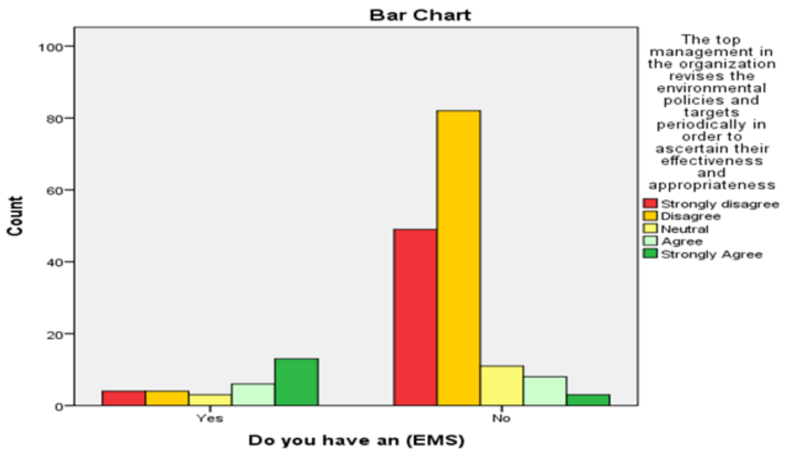
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	68.194[a]	4	.000
Likelihood Ratio	53.456	4	.000
Linear-by-Linear Association	53.970	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.521	.000
N of Valid Cases		183	

The value of Chi-square was found to be 68.194, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Do you have an (EMS) * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.
The value of the contingency coefficient was found to be 0.521.



- **Do you have an (EMS) * There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs**

		There is an effective system within the organization to enforce the application of organization's instructions concerned with environmental affairs					Total
		Strongly disagree	Disagree	Neutrale	Agree	Strongly Agree	
Do you have an (EMS)	Yes	1	4	4	6	15	30
	No	54	70	12	11	6	153
Total		55	74	16	17	21	183

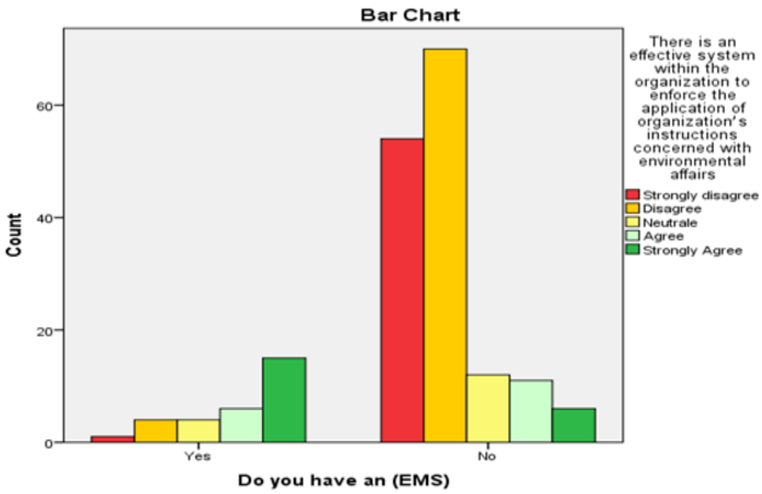
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	66.747[a]	4	.000
Likelihood Ratio	56.971	4	.000
Linear-by-Linear Association	59.748	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.517	.000
N of Valid Cases		183	

The value of Chi-square was found to be 66.747, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Do you have an (EMS) * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.
The value of the contingency coefficient was found to be 0.517.



- **Is your site accredited to ISO14001 * Our organization has its own environmental policy**

		Our organization has its own environmental policy					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Is your site accredited to ISO14001	Yes	1	1	0	6	12	20
	No	13	116	19	7	7	162
	Don't know	0	0	0	1	0	1
Total		14	117	19	14	19	183

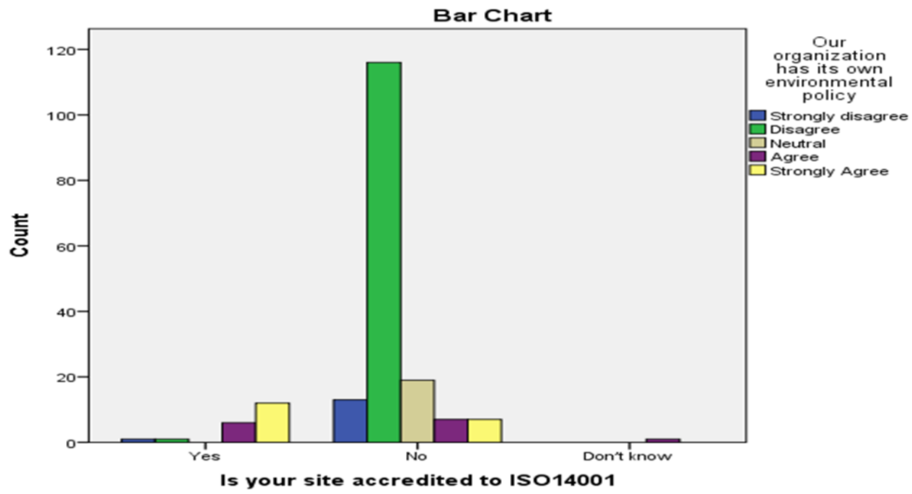
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	95.562[a]	8	.000
Likelihood Ratio	69.583	8	.000
Linear-by-Linear Association	56.367	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.586	.000
N of Valid Cases		183	

The value of Chi-square was found to be 95.562, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Is your site accredited to ISO14001 * Our organization has its own environmental policy.
The value of the contingency coefficient was found to be 0.586.



- **Is your site accredited to ISO14001 * Within our budget there is a special item for environmental affairs in the organization**

		Within our budget there is a special item for environmental affairs in the organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Is your site accredited to ISO14001	Yes	0	0	2	9	9	20
	No	5	64	46	39	8	162
	Don't know	0	1	0	0	0	1
Total		5	65	48	48	17	183

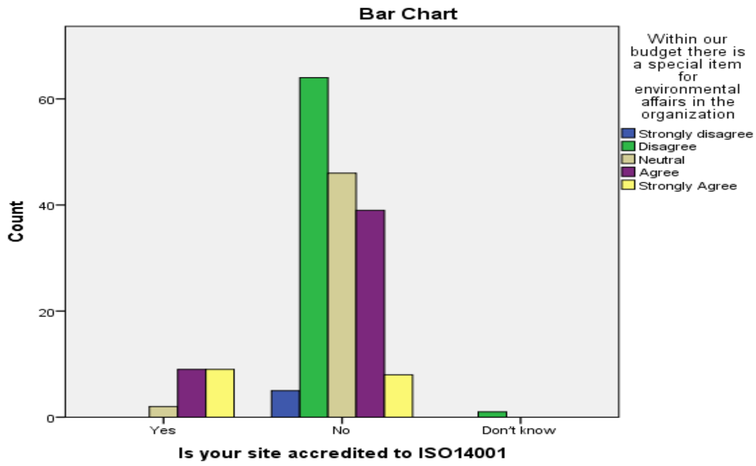
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	46.293[a]	8	.000
Likelihood Ratio	41.665	8	.000
Linear-by-Linear Association	35.445	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.449	.000
N of Valid Cases		183	

The value of Chi-square was found to be 46.293, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Is your site accredited to ISO14001 * Within our budget there is a special item for environmental affairs in the organization.
The value of the contingency coefficient was found to be 0.449.



- **Is your site accredited to ISO14001 * The environmental responsibilities and authorities within our organization are fixed and clear**

		The environmental responsibilities and authorities within our organization are fixed and clear					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Is your site accredited to ISO14001	Yes	0	0	0	8	12	20
	No	9	85	34	31	3	162
	Don't know	0	0	0	1	0	1
Total		9	85	34	40	15	183

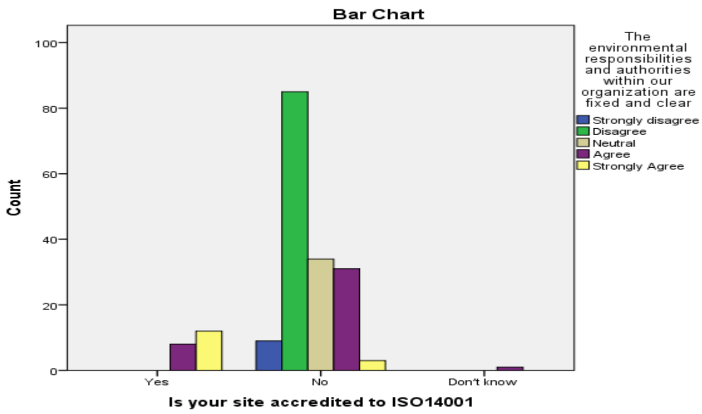
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	96.465[a]	8	.000
Likelihood Ratio	74.517	8	.000
Linear-by-Linear Association	52.715	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.588	.000
N of Valid Cases		183	

The value of Chi-square was found to be 96.465, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Is your site accredited to ISO14001 * The environmental responsibilities and authorities within our organization are fixed and clear.
The value of the contingency coefficient was found to be 0.588.



- **Is your site accredited to ISO14001 * There is an environmental record in our organization**

		There is an environmental record in our organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Is your site accredited to ISO14001	Yes	0	1	3	5	11	20
	No	13	119	10	13	7	162
	Don't know	0	1	0	0	0	1
Total		13	121	13	18	18	183

Chi-Square Tests

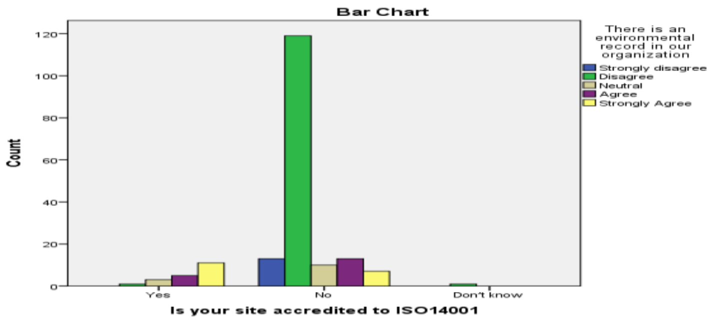
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	68.399[a]	8	.000
Likelihood Ratio	55.939	8	.000
Linear-by-Linear Association	59.573	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.522	.000
N of Valid Cases		183	

The value of Chi-square was found to be 68.399, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Is your site accredited to ISO14001 * There is an environmental record in our organization.

The value of the contingency coefficient was found to be 0.522.



- **Is your site accredited to ISO14001 * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities**

		Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Is your site accredited to ISO14001	Yes	0	1	0	6	13	20
	No	6	54	49	46	7	162
	Don't know	0	0	0	1	0	1
Total		6	55	49	53	20	183

Chi-Square Tests

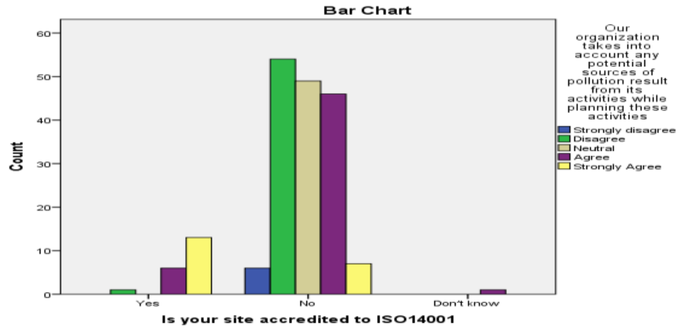
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	74.040[a]	8	.000
Likelihood Ratio	55.452	8	.000
Linear-by-Linear Association	34.224	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.537	.000
N of Valid Cases		183	

The value of Chi-square was found to be 74.040, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Is your site accredited to ISO14001 * Our organization takes

into account any potential sources of pollution resulting from its activities while planning these activities.
The value of the contingency coefficient was found to be 0.537.



- **Is your site accredited to ISO14001 * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment**

		Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Is your site accredited to ISO14001	Yes	0	4	6	4	6	20
	No	57	88	8	7	2	162
	Don't know	0	0	1	0	0	1
Total		57	92	15	11	8	183

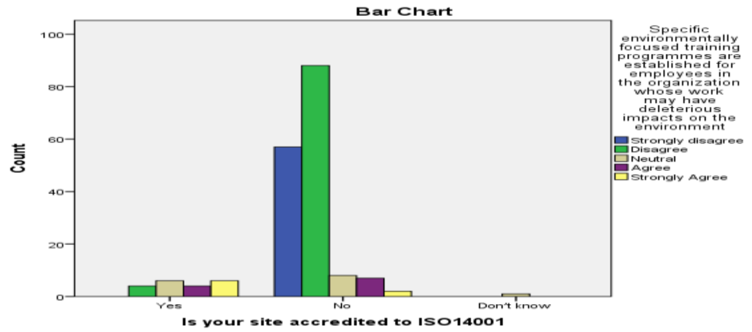
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	77.126[a]	8	.000
Likelihood Ratio	55.667	8	.000
Linear-by-Linear Association	47.615	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.545	.000
N of Valid Cases		183	

The value of Chi-square was found to be 77.126, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Is your site accredited to ISO14001 * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment.
The value of the contingency coefficient was found to be 0.545.



- **Is your site accredited to ISO14001 * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness**

		The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Is your site accredited to ISO14001	Yes	1	1	1	6	11	20
	No	52	85	12	8	5	162
	Don't know	0	0	1	0	0	1
Total		53	86	14	14	16	183

Chi-Square Tests

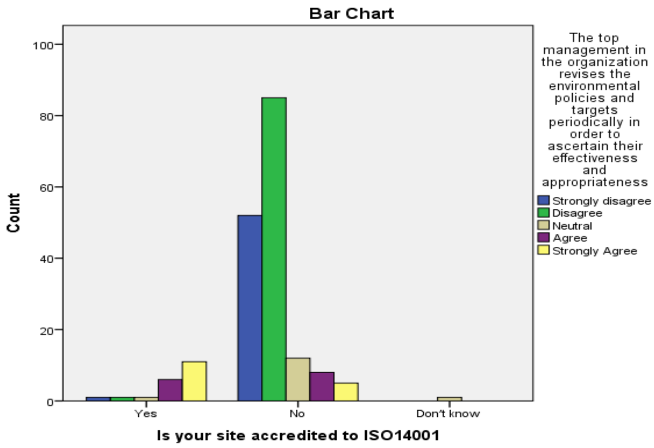
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	94.812[a]	8	.000
Likelihood Ratio	64.391	8	.000
Linear-by-Linear Association	59.440	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.584	.000
N of Valid Cases		183	

The value of Chi-square was found to be 94.812, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Is your site accredited to ISO14001 * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.

The value of the contingency coefficient was found to be 0.584.



- **Is your site accredited to ISO14001 * There is an effective system within the organization to enforce the application of organization’s instructions concerned with environmental affairs**

		There is an effective system within the organization to enforce the application of organization’s instructions concerned with environmental affairs					Total
		Strongly disagree	Disagree	Neutrale	Agree	Strongly Agree	
Is your site accredited to ISO14001	Yes	1	1	1	4	13	20
	No	54	73	14	13	8	162
	Don’t know	0	0	1	0	0	1
Total		55	74	16	17	21	183

Chi-Square Tests

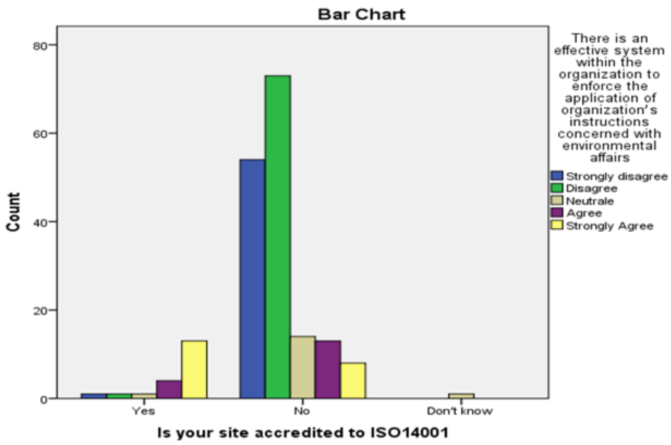
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	81.297[a]	8	.000
Likelihood Ratio	56.581	8	.000
Linear-by-Linear Association	49.376	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.555	.000
N of Valid Cases		183	

The value of Chi-square was found to be 81.297, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Is your site accredited to ISO14001 * There is an effective system within the organization to enforce the application of organization’s instructions concerned with environmental affairs.

The value of the contingency coefficient was found to be 0.555.



- **Does your site have PME environmental license * Our organization has its own environmental policy**

		Our organization has its own environmental policy					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Does your site have PME environmental license	Yes	2	10	5	6	9	32
	No	12	101	13	7	9	142
	Don't know	0	6	1	1	1	9
Total		14	117	19	14	19	183

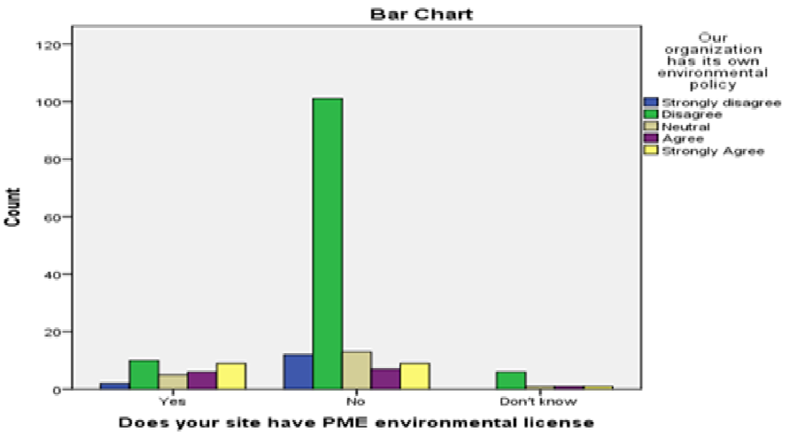
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.066[a]	8	.001
Likelihood Ratio	24.791	8	.002
Linear-by-Linear Association	13.493	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.359	.001
N of Valid Cases		183	

The value of Chi-square was found to be 27.066, with corresponding *P*-value 0.001 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * Our organization has its own environmental policy.
The value of the contingency coefficient was found to be 0.359.



- **Does your site have PME environmental license * Within our budget there is a special item for environmental affairs in the organization**

		Within our budget there is a special item for environmental affairs in the organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Does your site have PME environmental license	Yes	0	5	7	10	10	32
	No	5	59	38	35	5	142
	Don't know	0	1	3	3	2	9
Total		5	65	48	48	17	183

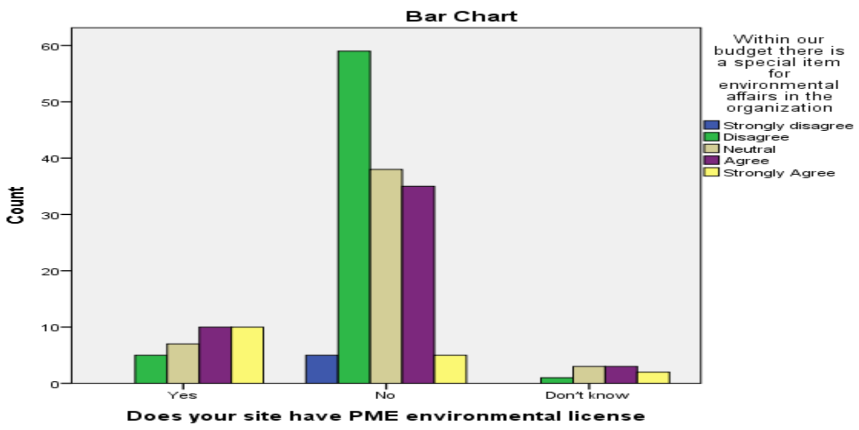
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.328[a]	8	.000
Likelihood Ratio	29.561	8	.000
Linear-by-Linear Association	7.812	1	.005
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.387	.000
N of Valid Cases		183	

The value of Chi-square was found to be 32.328, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * Within our budget there is a special item for environmental affairs in the organization.
The value of the contingency coefficient was found to be 0.387.



- **Does your site have PME environmental license * The environmental responsibilities and authorities within our organization are fixed and clear**

		The environmental responsibilities and authorities within our organization are fixed and clear					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Does your site have PME environmental license	Yes	1	0	5	19	7	32
	No	8	81	28	19	6	142
	Don't know	0	4	1	2	2	9
Total		9	85	34	40	15	183

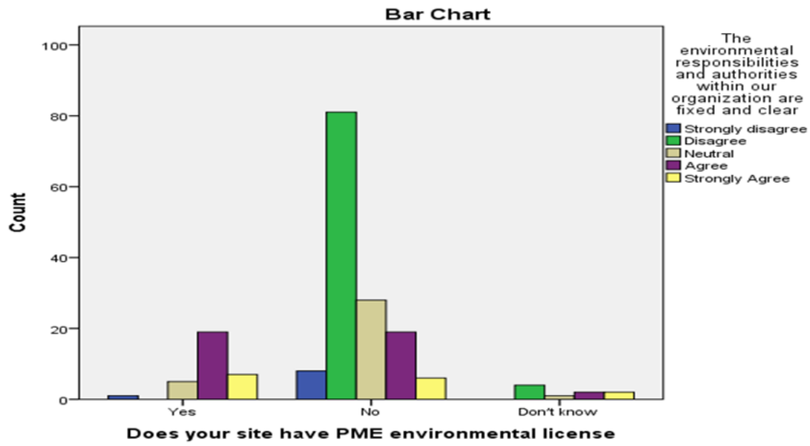
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.094[a]	8	.000
Likelihood Ratio	63.941	8	.000
Linear-by-Linear Association	24.401	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.488	.000
N of Valid Cases		183	

The value of Chi-square was found to be 57.094, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * The environmental responsibilities and authorities within our organization are fixed and clear.
The value of the contingency coefficient was found to be 0.488.



- **Does your site have PME environmental license * There is an environmental record in our organization**

		There is an environmental record in our organization					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Does your site have PME environmental license	Yes	1	7	2	11	11	32
	No	12	110	9	5	6	142
	Don't know	0	4	2	2	1	9
Total		13	121	13	18	18	183

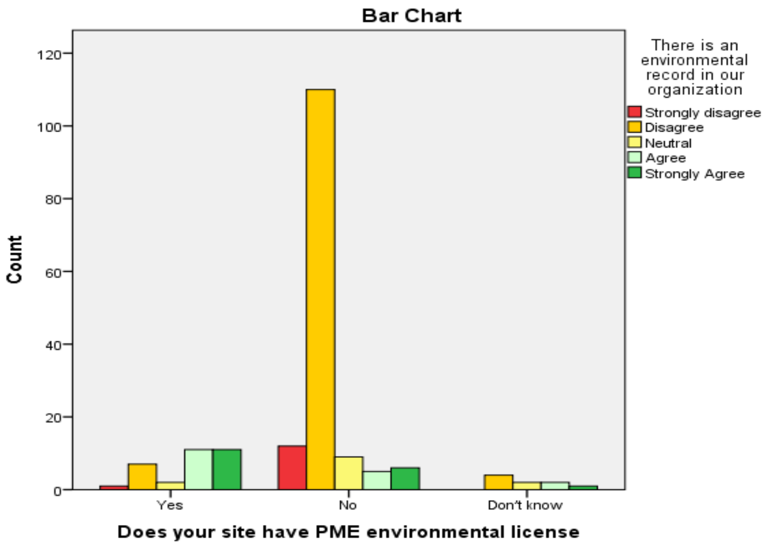
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	68.540[a]	8	.000
Likelihood Ratio	58.842	8	.000
Linear-by-Linear Association	28.195	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.522	.000
N of Valid Cases		183	

The value of Chi-square was found to be 68.540, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * There is an environmental record in our organization.
The value of the contingency coefficient was found to be 0.522.



- **Does your site have PME environmental license * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities**

		Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Does your site have PME environmental license	Yes	0	3	0	18	11	32
	No	6	49	48	32	7	142
	Don't know	0	3	1	3	2	9
Total		6	55	49	53	20	183

Chi-Square Tests

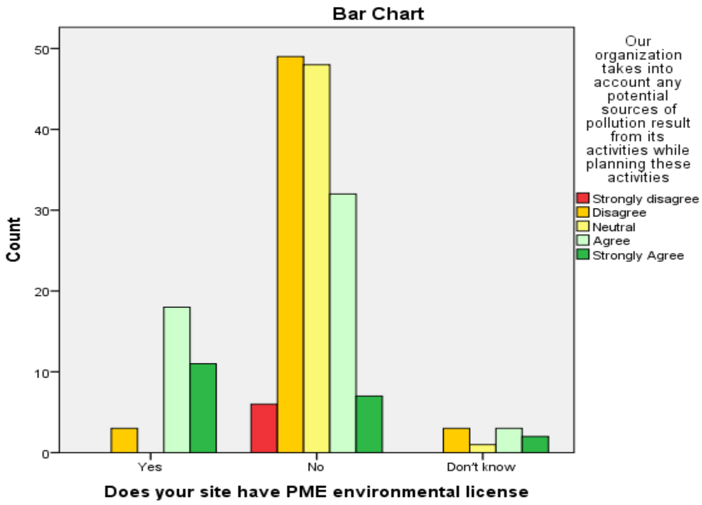
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	51.401[a]	8	.000
Likelihood Ratio	56.413	8	.000
Linear-by-Linear Association	20.267	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.468	.000
N of Valid Cases		183	

The value of Chi-square was found to be 51.401, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * Our organization takes into account any potential sources of pollution resulting from its activities while planning these activities.

The value of the contingency coefficient was found to be 0.468.



- **Does your site have PME environmental license * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment**

		Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Does your site have PME environmental license	Yes	5	11	7	5	4	32
	No	50	77	6	5	4	142
	Don't know	2	4	2	1	0	9
Total		57	92	15	11	8	183

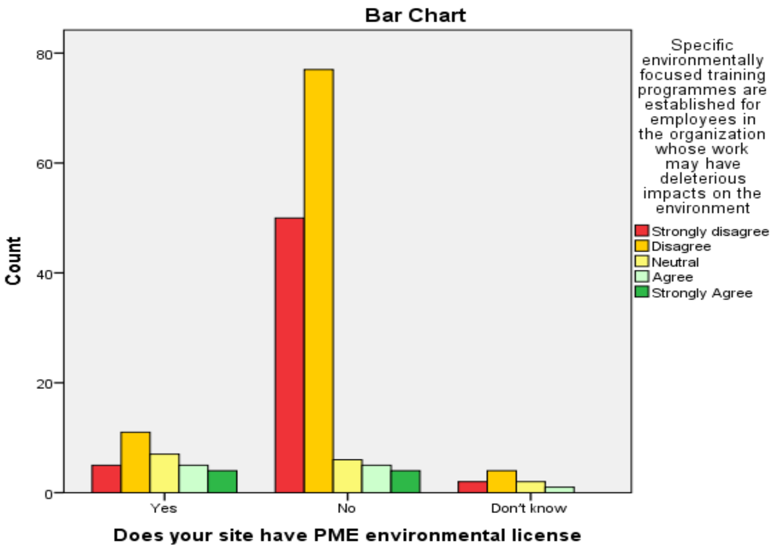
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.555[a]	8	.000
Likelihood Ratio	26.422	8	.001
Linear-by-Linear Association	11.745	1	.001
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.378	.000
N of Valid Cases		183	

The value of Chi-square was found to be 30.555, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * Specific environmentally focused training programmes are established for employees in the organization whose work may have deleterious impacts on the environment.
The value of the contingency coefficient was found to be 0.378.



- **Does your site have PME environmental license * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness**

		The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness					Total
		Strongly disagree	Disagree	Neutral	Agree	Strongly Agree	
Does your site have PME environmental license	Yes	3	11	5	3	10	32
	No	48	72	7	9	6	142
	Don't know	2	3	2	2	0	9
Total		53	86	14	14	16	183

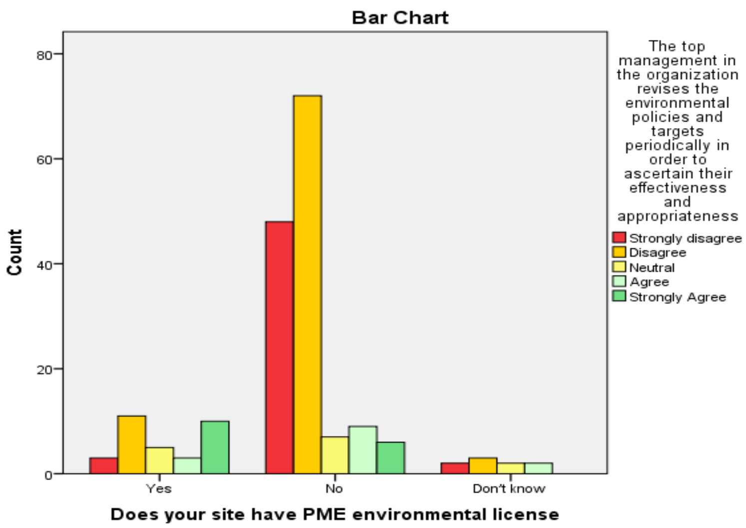
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	39.503[a]	8	.000
Likelihood Ratio	33.113	8	.000
Linear-by-Linear Association	15.852	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.421	.000
N of Valid Cases		183	

The value of Chi-square was found to be 39.503, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.
The value of the contingency coefficient was found to be 0.421.



- **Does your site have PME environmental license * There is an effective system within the organization to enforce the application of organization’s instructions concerned with environmental affairs**

		There is an effective system within the organization to enforce the application of organization’s instructions concerned with environmental affairs					Total
		Strongly disagree	Disagree	Neutrale	Agree	Strongly Agree	
Does your site have PME environmental license	Yes	1	5	5	10	11	32
	No	52	65	9	6	10	142
	Don’t know	2	4	2	1	0	9
Total		55	74	16	17	21	183

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	59.045[a]	8	.000
Likelihood Ratio	55.462	8	.000
Linear-by-Linear Association	35.111	1	.000
N of Valid Cases	183		

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.494	.000
N of Valid Cases		183	

The value of Chi-square was found to be 59.045, with corresponding *P*-value 0.00 (which is less than 0.01). This means that there is a highly significant relation between Does your site have PME environmental license * The top management in the organization revises the environmental policies and targets periodically in order to ascertain their effectiveness and appropriateness.

The value of the contingency coefficient was found to be 0.494.