Antecedents and Consequences of the Complementarities between Green Operations Management Practices: An Empirical Investigation in Oman

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ABSTRACT

Green Operations Management (GOM) is becoming an increasingly important element in the strategic agenda of many enterprises. Its main aim is to enhance the ability of an enterprise to address stakeholder environmental concerns throughout the entire product life cycle (PLC). Earlier studies have recognized GOM as a useful tool to improve competitiveness (Zhang*et al.*, 2008; Sarkis *et al.,* 2010) and business performance (Kassinis and Vafeas, 2006; Jacobs *et al.,* 2010; Zhu *et al.,* 2012)

Over the last few decades, the role of environmental management in achieving sustainable economic development is attracting growing global attention both theoretically and empirically. GOM is particularly important for enhancing the attractiveness of manufacturing companies of less developed countries such as Oman, to be selected as a partner in the global supply chain network of multi-national companies. However, there is a lack of integrative empirical studies to link and simultaneously examine the interrelationships between environmental drivers, practices and performance of manufacturing firms in general and within the context of less developed countries in particular. Through a review of the GOM and strategic environmental management literature, several unexplored areas were identified which are related to:

a) The need for empirical studies to conceptualise various types of environmental practices as complementary to each other. Complementarity of GOM practices refers here to the combined sum of the effects of different sets of GOM practices being greater together than individually.

b) The need for empirical studies to examine the influence of two distinct groups of stakeholders (i.e. market and non-market stakeholders) on the adoption of GOM practices.

c) The need for empirical studies to examine whether the relationship between stakeholder pressures and the adoption of GOM practices is mediated by an organisation's internal capabilities such as the development of environmental cross-functional collaboration (CFC). CFC is here defined as the extent of intra-organisational collaboration, interaction and integration of various core functional areas within the firm on environmentally significant issues (Auh and Menguc, 2005).

d) The need for empirical studies investigating whether this mediated effect of CFC holds across firms regardless of their size, level of pollution intensity and degree of international orientation.

e) The need for empirical studies examining whether environmental performance is considered as a mediator on the relationships between GOM practices and organisational savings and spending, where organisational savings and spending respectively reflect the saving advantages and increase in overall spending resulting from the adoption of GOM practices.

This research is explanatory, deductive in nature, and underpinned mainly by a quantitative research design that was supplemented by document analysis of environmental strategies and performance and some qualitative semi-structured interviews with managers of five Omani manufacturing firms. To achieve the objectives of this research, an integrated conceptual framework was developed and set of hypotheses were proposed. The analysis of the survey data collected from 138 Omani manufacturing firms was conducted using structural equation modelling.

In this research, empirical support was found for most of the research hypotheses, generally revealing that pressures from both market and non-market stakeholders can influence the adoption of GOM practices and that adoption of GOM practices can influence organisational business benefits, spending and environmental performance. However, the relationship between the adoption of GOM practices and organisational business benefits was found to be further mediated by the level of environmental performance. Moreover, by integrating four distinct, yet interrelated sets, of environmental practices into a second order factor/construct called 'collective GOM competency', this research found empirical evidence for the superiority of the second order construct in explaining the relationships between the antecedents and consequences of the adoption of environmental practices. Furthermore, the mediation effect of CFC on the relationship between stakeholder pressures and the adoption of environmental practices was empirically confirmed. This mediation effect of CFC was found to be significantly stronger only for the case of highly internationalised firms compared to their counterparts. Hence, firm characteristics are not always considered as moderators on the relationship between CFC and the adoption of GOM practices. The findings of this study provide new directions for future research and new theoretical and practical insights in GOM practices in manufacturing firms.

PUBLICATIONS

Conference papers:

Al Sheyadi , A.; Muyldermans, L.; Kauppi, K., 2014, " Collaborative competence in environmental practices adoption and its performance effects: A contingency perspective", at *the21st EurOMA Conference, Palermo, Italy, June*

Al Sheyadi, A.; Muyldermans, L.; Kauppi, K., 2014, "A contingent view on effectiveness of cross-functional collaboration for environmental practices adoption", at the 25th *POMS Annual Conference, Atlanta, U.S.A., May*

Al Sheyadi, A., 2014 "Interdependency of Green Supply Chain Management Practices and its Performance Implications" accepted for presentation at *the Midlands Regional Doctoral Colloquium 2014, University of Nottingham, Nottingham, April.*

Al Sheyadi, A.; Muyldermans, L.; Karjalainen, K., 2013, "The mediating role of cross-functional collaboration on the relationship between stakeholder pressures and firm's adoption of green practices", at *the20th EurOMA Conference, Dublin, Ireland, June.*

Al Sheyadi, A.; Muyldermans, L.; Karjalainen, K., 2013, "The complementarity of the environmental practices adoption and its performance implications", at 24th *POMS Annual Conference 2013, Denver, U.S.A., May*.

Al Sheyadi , A.; Muyldermans, L.; Karjalainen, K., 2012, "Stakeholder influences on environmental practices in the Omani manufacturing firms", at *Middle Eastern & North African Studies Conference, Oxford University, Oxford,June*.

Al Sheyadi , A.; Muyldermans, L.; Karjalainen, K., 2012, "Environmental Management in Oman: pressures, practices and performance", at *East Midlands Universities Postgraduate Research Students Conference, University of Nottingham, Nottingham, July*.

DEDICATION

I specially dedicate this thesis to…

My parents for every thing

My wife (S.Alshidi) and my sons (Moatasim and Moataz) for their understanding, continuous support and patience

My beloved brothers and sisters for all their continuous encouragement

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List of abbreviations

AVE— Average Variance Extract

CFA— Confirmatory Factor Analysis

CFC — Cross Functional Collaboration

EFA — Exploratory Factor Analysis

EM — Environmental Management

GOM — Green Operations Management

MI — Modification Indices

OM — Operations Management

OMCI—Omani Ministry of Commerce and Industry

OMECA — Omani Ministry of Environment and Climate Affairs

PLC— Product Life Cycle

RBV — Resource Based View

SPSS — Statistical Package for the Social Sciences

SEM — Structural Equation Modelling

SC — Supply Chain

SCM — Supply Chain Management

CHAPTER 1 INTRODUCTION

> *"…there is no doubt that we are seeing the beginning of a change in societies' attitudes to the environment and industry needs to respond to this".*
>
> Welford and Gouldson (1993, p.2)

As main users of natural resources and as influencers on the natural environment in general, manufacturing firms are responsible to ensure that their operations do not harm the environment or the quality of human life. In the past, many managers considered Environmental Management (EM) as a hindrance to competitiveness and as a main source for increasing overall production cost (Hart, 1995). A large number of theoretical and empirical studies, linking the drivers and adoption of the environmental practices with organisational performance, were conducted recently with the aim to change this managerial attitude and encourage the adoption of more green practices. However, the findings were mixed and sometimes contradict (Zeng *et al.,* 2010a;Dixton-Fowler *et al.,* 2013), highlighting the complexity in linking these three pillars in an EM model. The inconsistencies in the results of previous studies are partially due to the variations in conceptualising drivers, practices and performance and the non-integrative nature of models when studying the relationships between these elements (Claver *et al.,* 2007). Accordingly, this research attempts to solve this inconsistency by developing a single integrated conceptual framework to link and simultaneously examine the relationships between the antecedents and consequences of the adoption of GOM practices within manufacturing firms. This is done by using classifications of EM drivers (i.e. stakeholder pressures in particular), practices and performance proposed by previous studies. It also considers the possible mediating and moderating effects of other factors on these relationships. Developing such an integrated EM model could provide the foundation for building a consensual theoretical model, which may better explain these relationships.

This introductory chapter introduces the current research by providing a brief background about the study, its objectives and key findings. This study was fully funded by the Omani Ministry of Higher Education and aims to gain more insight on the current status of the adoption of EM practices by Omani manufacturing firms. It focuses on understanding the relationships between the antecedents and consequences of EM from an Operations and Supply Chain Management perspective. The individual firm is considered as the unit of analysis. The terms Environmental Management (EM) and Green Operations Management (GOM) are used interchangeably in this research and wherever used are related to the operations and supply chain management activities of the individual firm.

1.1 Research background

Addressing stakeholder environmental requirements has increasingly become an important issue for managers, decision makers and researchers. This was partially encouraged by the growing environmental challenges of various stakeholders asking firms for more environmentally responsible products, services and production processes (Wagner, 2011). It has also been motivated by findings of previous empirical studies suggesting that stakeholders can influence the environmental attitudes of firms (Henrique and Sadorsky, 1999; Delmas and Toffel, 2008).

Stakeholder theory examines how stakeholder pressures can influence organisational behaviour (Freeman, 1984). This theory has been widely used among previous GOM studies to explain why companies engage in environmental activities (Sarkis *et al.,* 2010& 2011).

The relationship between stakeholder pressure and the implementation of environmental practices, which goes beyond the minimum legal requirements (Juan and Enrique, 2007), has been widely discussed in the strategic management and GOM literature. Most of the previous GOM studies found that, in general, stakeholder pressure is positively related to organisational environmental commitments (Delmas and Montiel, 2009; Tate *et al.,* 2010). However, there are still inconsistencies among these studies on the specific stakeholder segment that drives the adoption of GOM practices. Observations of previous studies suggest that not all GOM activities are developed for the sake of achieving a competitive advantage, rather they are required by some groups of stakeholders such as government, society and media (Buysse and Verbeke, 2003;Sarkis*et al.,* 2011). The variations in findings of previous studies on the influence of different stakeholder groups suggest that this issue needs further investigation.

Within stakeholder theory, various groups of stakeholder pressures can be classified as created by either market or non-market forces/stakeholders (Baron, 1995& 2000; Lankoski, 2009; Lawrence 2010). Market stakeholders (i.e. those stakeholders who tend to have a direct economic transaction with the firm, such as customers, suppliers, employees and shareholders) tend to have more control over organisations' resources compared to non-market stakeholders (Baron, 2000; Sharma and Henriques, 2005). On the other hand, non-market stakeholders such as the government, NGOs, media and the local community tend to have more capacity to change the public opinion for or against certain environmental practices (Freeman,1984; Rowley, 1997; Roome and Wijen, 2006; Sarkis *et al.,* 2010). Non-market stakeholders are key to encourage more environmental management (Rivera-Camino, 2004; Wu and Pagell, 2011). These arguments imply that pressures of both market and non-market stakeholders are positively related with the proactivity level of the firm. However, whether equal attention is given to address the demands of both market and non-market stakeholders or whether one particular segment of stakeholders plays a main role in the establishment of GOM practices needs further investigation. Such investigation in this area is required to obtain a better understanding of how firms prioritize their stakeholders to achieve both environmental and economic objectives at the same time.

Companies may be willing to better meet or exceed the environmental expectations of stakeholders and communicate their environmental efforts and performance back to them. However, achieving this objective may be hard if some critical organisational capabilities are not in place (Rueda-Manzanares *et al.,* 2008;Sarkis *et al.,* 2010). A capability refers here to the firm's ability to assemble, integrate, mobilise and deploy environmentally oriented valuable resources to achieve its objectives (Russo and Fouts, 1997). Such enabling capabilities may include the level of an environmentally oriented cross-functional collaboration (CFC) among core functional areas within the firm. CFC explains the extent of collaboration, communication and the amount of productive interaction among various core functional areas within the firm (Troy *et al.,* 2008).

The adoption of GOM practices normally involves various functional areas and a single department within the firm may lack the full knowledge of the exact requirements of each stakeholder group(Hart,1995; Handfield *et al.,* 1997). For example, the marketing and customer relations departments tend to have more information about the environmental expectations of customers as these departments are directly interacting with customers, while supply chain and procurements departments may have more knowledge about suppliers' environmental expectations, whilst strategic or finance departments may have better understanding about the environmental demands of shareholders. A key advantage of GOM innovations and efforts lay in their abilities to promote and sell green products, services, processes and other innovative ideas (Cronin *et al.,* 2011). However, lack of full knowledge about the requirements of various stakeholders may limit the ability to create more coherent, effective and efficient environmental programs and ultimately limit the ability to reap the benefits of GOM practices. CFC helps in making quick decisions and responding faster to the market and non-market requirements (Heckscher and Adler, 2006; Fiedler, 2010; Cuijpers *et al.,* 2011). As most of the GOM practices are integrative and socially complex (Sarkis *et al.,* 2010), the development of an internal CFC capability may also improve the ability of the firm to successfully adopt these green practices.

The strategic role of the intra-organizational collaboration in fostering and maintaining organisational competitiveness and business performance has been well recognised by strategic (Auh and Menguc, 2005), supply chain (Flynn *et al.,* 2010; Wong *et al.,* 2011) and new product development (Troy *et al.,* 2008) management researchers. The GOM literature has also suggested that the development of CFC is required for achieving effective environmental supplier management (Carter and Jennings, 2002; Carter, 2005), enhancing the firm's business and operations performance (Wagner, 2007) and successfully developing effective environmental programs (Hart, 1995;Melnyk *et al.,* 2003; Wagner, 2011). However, most of this research is still unconnected, largely theoretical and without systematic empirical explanation or justification. In particular, the extent to which CFC mediates the relationships between stakeholder pressures and the adoption of GOM practices has not been empirically examined yet. In this research the development of CFC is believed to be an essential mediating capability that could enable the firm to better understand requirements of stakeholders and effectively translate these requirements into action.

Furthermore, previous studies which have used the contingency perspective have suggested that the ability of internal organisational resources and capabilities to lead to positive outcomes may be moderated by firm contingencies including company characteristics (Buysse and Verbeke, 2003; Wagner, 2011; Dixton-Fowler *et al.,* 2013). These observations raise the question of whether the mediating role of CFC differs based on firm characteristics. Keeping the possible mediating role of CFC in mind, this research also argues that the benefits obtained from the development of CFC for effective adoption of GOM practices is context dependent. For example, firms with high visible environmental impacts such as those with high pollution intensity could benefit more from the development of CFC than those firms with less pollution intensity. Examining the possible conditional mediating effect of CFC on the relationship between drivers and practices of EM may be needed in order to have a different understanding of the causal relationships between these variables.

The Resource Based View (RBV) of the firm explains how organisation's valuable, rare, inimitable and non-substitutable resources and capabilities can be a source of competitive advantage (Barney, 1991). RBV has been extended to include natural resources and capabilities (Hart, 1995). When considering environmental management such capabilities may include developing an integrated GOM system (Helfat and Peteraf, 2003) that consider the collective, rather than the individual isolated, adoption of various sets of routine-based environmental practices in reducing the environmental impacts throughout the entire product lifecycle. Previous studies have conceptualised the adoption of various sets of environmental practices as competitive, rather than complementary, to each other and resulted in inconclusive findings. Complementarity exists when a resource is more valuable in the presence of another resource than when it is considered alone (Milgrom and Roberts, 1995; Mishra and Shah, 2009). Complementarity Theory (CT) has been validated in the management (Milgram & Robert, 1995), HRM (Cassiman & Vegelers, 2006), IT (Melville *et al.,* 2004; Zhu, 2004) and SCM (Mishra & Shah, 2009) literature. Yet, there is a paucity of theoretical and empirical investigation of the complementarity and interdependency of various GOM practices and their performance implications.

In fact, as the interest in EM drivers, practices and performance started to grow among practitioners and researchers, the earlier GOM studies emphasised on specific, deconstructive dimensions of Operations and Supply Chain Management (SCM) (Sarkis, 2012) such as purchasing practices (Carter, 2005), logistics practices (Vachon and Klassen, 2006; Zhu *et al.,* 2008a) and reverse logistics practices (Van Hock and Erasmus, 2000; Sarkis *et al.*, 2010; Ye *et al.,* 2013). Some recent studies have argued for the importance of conceptualising the interdependencies between various green practices (Wagner, 2011; Zhu *et al.*,2008c, 2012& 2013). By integrating and using both the RBV and Complementarity theory as explanatory theories, this research also posits that the complementary and simultaneous adoption of various environmental practices is more valuable and can lead to a long lasting competitive advantage. The integration of RBV and Complementarity theory is expected to extend the theory and practice of GOM and provide new insights. The complementarity of various environmental practices is operationalised in this research by integrating four different yet interrelated sets of environmental practices into a second order construct called ‘collective GOM competency’.

Further, when considering the performance implications of environmental commitments, companies are increasingly adopting various green practices assuming that their environmental efforts will bring good business outcomes. However, empirical findings of previous GOM studies provided mixed findings on these relationships (Zeng *et al.,* 2010a), suggesting that performance implications of adopting GOM practices need to be further assessed and systematically investigated.

This research argues that the relationship between collective adoption of GOM practices and the ability to achieve positive economic performance is further mediated by the level of environmental performance. Better environmental performance may provide more potential to increase the positive economic outcomes of environmental efforts. This belief is motivated by arguments of some studies suggesting that GOM may not directly lead to economic benefits for all companies, and that other factors could influence this relation (Dixton-Fowler *et al.,* 2013; Zhu *et al.,* 2013). However, much of the previous studies have not given enough attention to examining the possible mediating effect of environmental performance on the association between EM practices and economic performance. Investigating the possible mediating role of environmental performance on this relationship may help to refine the relationship between environmental resources/capabilities and performance.

The context of the Omani manufacturing sector has been selected for the application of this research for several reasons. During the last decade the Omani government, like other Gulf Corporate Council (GCC) oil exporting countries, realised the importance of diversifying their income to minimize the reliance on oil and gas resources (DGI, 2010a; OCC, 2010a). In Oman, great attention has been given by the Omani government to develop the manufacturing sector for improving the country's GDP. Accordingly, the contribution of this sector in Oman's GDP has been increasing year on year at an annual rate of 9.3 % over the last five years (DGI, 2010a, 2010b; OCC, 2010a). This rapid growth confirms that the sector is growing at a rate that qualifies as one of the most important elements of the national income in the coming decades. However, these manufacturing firms have also consumed a large amount of resources and resulted in environmental pollution and challenges (DGESD, 2011). These growing environmental problems have encouraged the Omani government, represented by the Ministry of Environment and Climate affairs and the Ministry of Regional Municipalities, to spend more effort and resources for motivating the adoption of more green practices and to reduce the environmental impacts. Further, trade agreements with foreign countries (e.g., Oman-USA free trade agreement) have imposed more pressure on manufacturing firms to improve their environmental performance in order to match international standards and enhance competitiveness. Nevertheless, the impact of these pressures to encourage more green practices in Omani firms and the implications of these practices on their performance are still unknown.

In fact, the GCC countries are considered among the world’s largest oil exporting states (Momani, 2008). On the other hand, the six GCC countries (Kingdom of Saudi Arabia, United Arab Emirate, Oman, Qatar, Kuwait and Bahrain) fall in the top 25 countries of carbon dioxide emission per capita and are perceived as the main actors blocking international climate change negotiations (Reiche, 2010). Recently, these governments have started to give more attention to the development of sustainable economies where environmental sustainability is an essential dimension(Launary, 2006; Raouf, 2008; DGESD, 2011). Despite the increasing importance of environmental concerns around the world and the environmental problems the GCC countries are facing such as the growing pollution levels and growing water scarcity (Raouf, 2008; Reiche, 2010), to the researcher's best knowledge, no effort has been made as yet to empirically investigate the environmental practices of the manufacturing sectors in the GCC countries in general and in the Omani context in particular. The literature on GOM has been mainly focused on developed countries and relatively less attention was given to developing counties (Zeng *et al.,* 2010a; Min and Kim, 2012;Govindan *et al.,* 2014). Several studies argued that findings of studies conducted in developed counties should not be directly transferred to developing counties (Bruton and Lau, 2008). Drivers of GOM, environmental challenges and environmental expectations may vary from one country to another (Rao and Holt, 2005;Zhu *et al.,* 2005 & 2007). By studying drivers, practices and performance of GOM in Oman, this research will contribute significantly to the existing knowledge about this region and will provide more realistic and practical implications for managers and decision makers in the Sultanate of Oman and other similar contexts. Further justification for using environmental management in the Sultanate of Oman as the research context is provided in the next section.

1.2 Research context

This section introduces the context of the study, which includes the current status of the Omani manufacturing industries and environmental management in Oman.

1.2.1 The Sultanate of Oman: An overview

The Sultanate of Oman is an Arab state in Southwest Asia, on the South East coast of the Arabian Peninsula. It is bordered by Saudi Arabia to the West, the United Arab Emirates (UAE) to the Northwest and Yemen to the Southwest(see Figure 1.1). Limited rainfall, a hot climate and drought cause the problem of scarcity in water supply, which is perceived as one of the greatest environmental problems in Oman (DGESD, 2011). According to the 2013 census, the total population of Oman was 3.83 million and of those, 1.68million (44%) were non-Omanis (CIA, 2014). Omani citizens, like other GCC citizens, enjoy good living standards, but the future is uncertain with Oman's limited oil reserves.

Figure 1.1: Location of Oman (https://maps.google.co.uk/maps?q=oman)

The strategic location of the country, which makes it unique among its neighbouring GCC nations and the huge economic reforms undertaken by the Omani government during the last four decades, have promoted the establishment of many types of industries which resulted in improving the economic development of the country (DGES, 2010). In fact, in November 2010, the United Nations Development Programme (UNDP) listed Oman as the most improved nations over the last 40 years from 135 countries worldwide (UNDP, 2010). Moreover, according to international indicators, Oman is one of the most stable and developed countries in the region (OCC, 2010a; UNDP, 2010). The Omani economy has been totally transformed through a series of development plans aim at improve financial and economic stability, globalise the Omani economy, improve the contribution of the private sector in the country development and diversify the sources of national income and economic base (DGES, 2010; OCC, 2010b).

In addition, Oman is a member of many regional and international trade associations (e.g. GCC, ASIAN, Indian Ocean Rim Association for Regional Cooperation (IORARC) and the World Trade Organization (WTO)) and has signed different international trade agreements such as the free-trade agreement with the United States, which took effect on 1 January 2009 (OCC, 2010a). At the same time, Oman has joined many international environmental agreements such as the UN Framework Agreement on climate change in 1992, the Kyoto Protocol on Climate Change in 2004, the Vienna Agreement on the Protection of Ozone, and the Montreal Protocol 1998 (DGEA, 2011), which necessitate the development of several environmental strategies in order to improve the country's overall environmental performance.

1.2.2 Environmental management in Oman

The growing environmental problems (e.g. climate changes and water scarcity) and the growing national, regional and international environmental concerns have encouraged the Omani government to establish two ministries (Ministry of Environment and Climate Affairs and Ministry of Regional Municipalities) to take care of the environmental issues. Also, it imposed strict environmental regulations on Omani manufacturing enterprises in order to improve the overall environmental performance of the country (DGESD, 2011). Accordingly, the Sultanate, represented by the Ministry of Environment and Climate Affairs, has gained a good regional and international reputation and was awarded a certificate of merit during the 20th anniversary of Montreal Protocol for its efforts on protecting the natural environment (DGESD, 2011).

In fact, trade and environmental agreements that Oman has joined have opened many opportunities for Omani manufacturing companies, but they have also imposed different challenges for companies. These challenges include the growing environmental pressures from the local community and various local and international customers, shareholders, government agencies, competitors, NGOs and the media demanding them to improve the level of their environmental performance in order to match or sometimes exceed the international standards. Despite the growing importance of environmental sustainability in Oman and other neighbouring GCC counties, to the knowledge of the author, issues related drivers, practices and performance of environmental management among the manufacturing firms operating in this region have not been empirically investigated. This research is considered as the first empirical study to thoroughly investigate these issues in this region. As this PhD research aims to develop an integrated model of environmental management and applying it to the Omani manufacturing firms, it is necessary to have a good understanding of the manufacturing sector in Oman in general and the status of manufacturing firms with more than 19 full-time employees in particular (main unit of analysis for this research).

1.2.3 The manufacturing sector in Oman

Like in other GCC countries, the Omani manufacturing sector is considered as a cornerstone of the long-term economic development aiming to diversify the sources of national income and reduce dependence on oil and gas (DGES, 2010). In fact, Oman has a lot of mineral resources such as chromites, zinc, dolomite, iron, limestone, silicon, gold, copper, gypsum and cobalt. The availability of these resources leads to the emergence of several industries around these resources as part of the national development process (DGI, 2010a, 2010b). Moreover, the five years strategic development plans helped to create the conditions for an attractive investment climate, which encouraged the establishment of more new manufacturing enterprises (DGES, 2010; OCC, 2010a). As a result of great attention given by the Omani government to the Omani manufacturing section, this sector has shown the capability in helping to meet Oman's social and economic development needs and generate larger added value for national resources by transferring them into manufactured goods (DGI, 2010a).

The manufacturing firms with more than 19 full-time employees represent more than 20% of the total manufacturing firms in Oman (DGI, 2010a, OCC, 2010b). They are distributed among different industrial activities such as foods & beverages; garments; paper & paper products; refined oil & liquefied natural gas products; chemical; plastic products; non-metallic mineral products; basic metals; fabricated metal products; manufacturing of machines and equipment; manufacturing of electronic applications and electronic machines; furniture , wood and wood products; textiles manufacturing, leather and saddles; manufacturing of medical & optical equipment and machinery; manufacturing of vehicles and trailers; manufacturing of other transportation tools and recycling industry (see table 1.1) (DGI, 2010a, 2010b). According to the Omani Ministry of Commerce and Industry (OMCI) reports, there are around 574 manufacturing firms in Oman with more than 19 full-time employees (DGI, 2010a). The contribution of these firms to the country's GDP has increased at an annual rate of 9.3 % over the last five years and the growth rate of the workforce in these firms increased by 12 % in 2010, compared to 2008 (DGI, 2010a). Also, it is expected that these percentages will increase in the coming years as a result of the growing number of industrial estates established over the last 5 years and numerous trade reforms, facilities and incentives provided by the Omani government to the local and international investors (DGES, 2010, OCC, 2010a).

Table 1.1: Number of manufacturing firms with >19 employees (Source: DGI, 2010a)

No.	**Industrial activity**	**2010**
1	Food and beverage industry	110
2	Garments Industry	4
3	Wood and wood product industry except for furniture	12
4	Paper and paper products industry	14
5	Publishing activities, printing, photocopying (including printing press activities)	32
6	Refined oil and liquefied natural gas	16
7	Chemical industry (including dyes, insecticides, pharmaceutical products, detergents, fertilisers, perfumes and cosmetic)	49
8	Plastic products industry	48
9	Non-metallic mineral products (including cement and its primary products, marble and ceramics products)	154
10	Basic metals (including iron pipes industry and the activities related to metal fission	15
11	Fabricated metal products	53
12	Manufacturing of machines and equipment	13
13	Manufacturing of electric appliances and electrical machines	16
14	Furniture Industry	24
15	Office and computer equipment	4
16	Medical equipment and optical fibers	3
17	Weaving textiles, thread, cloth and textiles industry	3
18	Leather industry	3
19	Recycling waste and scraps	1
Total		574

1.3 Research objectives

Considering the theoretical gaps briefly mentioned above (*more details of these gaps are provided in Section 2.8)* this research aims to contribute to the Operations Management and Strategic Environmental Management literature in general and to the GOM literature in particular. It also aims to assist managers in making strategic decisions when investing in the development of various environmental practices that can better respond to environmental requirements of various stakeholders and improve the economic and environmental performance simultaneously. This research mainly intends to develop an integrated conceptual model to link and simultaneously examine the interrelationships between stakeholder pressures, environmental practices and performance of Omani firms operating in multiple manufacturing sectors. The main question of this research is:

What are the relationships between stakeholder pressures, the adoption of environmental practices and performance of manufacturing firms?

The main research question was further split into five sub-objectives (see Chapter 4 for a detailed discussion):

1- To empirically test the superiority of the complementarity model of GOM practices in explaining the relationship between stakeholder pressures, GOM practices and performance of the firm, and to examine the influence of the collective adoption of GOM practices on improving organizational performance.
2- To empirically examine the effects of two groups of stakeholders (market and non-market stakeholders) on the adoption of GOM practices by firms.
3- To empirically examine the direct effects of collective GOM practices on environmental performance, business benefits and spending, and its indirect, mediated, effects on organizational business benefits and spending via environmental performance.
4- To empirically investigate the mediating effect of environmentally oriented cross-functional collaboration on the relationship between stakeholder pressures and the adoption of GOM practices.

5- To empirically investigate the moderating effects of three firms specific characteristics (pollution intensity, size and international orientation) on the relationship between CFC and the development of GOM practices.

To achieve these objectives, an integrated conceptual framework was developed based on an extensive review of the literature. The proposed EM conceptual model incorporated three main elements: drivers, practices and performance of EM. These elements are considered as the main pillars for building this model. In terms of the environmental management drivers, this research focuses on examining the influence of stakeholder pressures on the adoption of GOM practices. Stakeholder pressures are considered as the main driver for environmental commitments (Sarkis *et al.,* 2010). Stakeholders were classified into market and non-market stakeholders based on the ability of each stakeholder to add value to company operations. This research also aims to test the superiority of the complementarity of various GOM practices. This was done by integrating four distinct yet interrelated sets of environmental practices into a second order factor. The stakeholder pressure factors were linked to the second order GOM factor and the latter was linked to performance. The performance included environmental performance and economic performance, where the latter was further divided into two dimensions, business benefits and spending. To test the possible mediation effect of environmental performance on the relationship between GOM practices and economic performance, environmental performance was also linked to organisational business benefits and spending. To examine the influence of internal organisational capabilities and resources on their ability to effectively respond to stakeholder environmental demands, CFC was conceptualized as a mediator (or enabler) on the relationship between stakeholder pressures and the adoption of GOM practices. Finally, the moderating effect of firm size, pollution intensity and international orientation on the relationship between CFC and GOM practices was also considered in the developed model to investigate whether the effectiveness of CFC on the adoption of GOM practices varies based on these firm characteristics.

1.4 Research methodology: an overview

Based on a critical review of the literature (Chapter 2), a conceptual model was proposed. A questionnaire survey was administered to managers of Omani manufacturing firms. The data obtained from the survey was analysed in four main stages: 1. Data cleaning, 2. Descriptive statistics, 3. Assessment of the measurement model (i.e. reliability and validity testing), and 4. Assessment of the structural model. The descriptive analyses were conducted using SPSS version 20.0, and the inferential analyses were performed using confirmatory factor analysis by the mean of Structural Equation Modelling(SEM) using AMOS 20.0.

Additional information was collected through semi-structured interviews with senior managers from five Omani manufacturing companies and from the websites of these companies. It is worth noting that, in this research, the objectivist paradigm and the quantitative research methods are considered as the main methodological approaches. The additional qualitative work (i.e. document analysis and semi-structured interviews) were used to contextualise and further explain the findings of the quantitative data analysis.

1.5 Research key findings

The findings of the empirical analysis suggest that conceptualising various types of environmental practices as a complement is important in achieving a clear understanding of the relationship between EM drivers, practices and performance. In addition, the influence of market forces in general and market stakeholders in particular on the adoption of GOM practices was strongly supported, while the influence of non-market stakeholders was marginally supported. These findings highlight the importance of developing an integrative environmental system, which may better explain the environmental requirements of both segments of stakeholders. In turn, this may enable the firm to achieve more effective stakeholder management. In fact, the results from the case studies showed that non-market forces have encouraged the participating firms to develop short-term pollution control practices and that managers’ perception of the source of the environmental pressures play a key role in the process of adopting more GOM practices. It was also found that

CFC is a mediator on the relationship between stakeholder pressure and the adoption of GOM practices. All participants of the case companies have also strongly emphasized the strategic role of CFC as an important enabler in progressing the environmental efforts of their firms. This implies that the willingness and ability to effectively translate stakeholder environmental demands into action will improve if CFC is in place. Results of the mediation tests also showed that the effectiveness of CFC was higher for more visible firms (i.e. large size, highly polluting and highly internationalised). However, further analysis through the moderation tests revealed that the effectiveness of CFC was significantly stronger for the highly internationalised firms. That is, obtaining more benefits from the development of CFC will be easier for highly internationalized firms, which are willing to capitalise on their environmental efforts. During the interviews with managers of five companies, it was also observed that highly internationalised firms are more active in terms of CFC and that they are more willing to increase their investment in developing CFC than other firms. Hence, the role of firm characteristics as a moderator on the relationship between CFC and adoption of GOM practices was only partially supported. Finally, the research illustrated that the collective adoption of GOM practices has a stronger impact on organisational business benefits than on spending, revealing that it pays to be green. Good economic advantages exist for manufacturing firms that develop an integrative environmental management programs. However, results also show that the influence of the collective adoption of environmental practices on business benefits is going through environmental performance. For managers, this result indicates the importance of achieving greater levels of environmental performance as a prerequisite for achieving higher levels of savings and other business benefits from the adoption of GOM practices.

1.6 Structure of the thesis

The focus in the current chapter (**Chapter 1**) was to introduce the research context, objectives, methodology, and key findings. The literature review of the three main dimensions of the firms' EM model; stakeholder pressures, environmental practices and environmental and economic performance are discussed in detail in **Chapter 2**. The literature on other factors, mediators and moderators, which may affect the relationship between the three dimensions of the EM model, is also highlighted in **Chapter 2**. This is followed by a discussion of some critical gaps in the literature.

Chapter 3 presents the background of this research which begins by illustrating the research objectives and questions. Based on the existing literature, a conceptual model of EM was developed and the fundamental hypotheses and propositions of this research were formulated.

Chapter 4 explains the methodological background of this research. This chapter starts with a description of the adopted research philosophy followed by a justification for using a questionnaire-based survey as the main methodology for data collection. Next, the survey development and data collection process are highlighted. An overview of the main techniques used for data analysis (i.e. SEM) is also provided at the end of this chapter.

The results of the quantitative data analysis are covered in **Chapter 5**. This chapter provides the results of the four main stages of the quantitative data analysis and a detailed explanation of the methods used in each one of these stages. The final results of hypothesis and proposition testing are also presented in this chapter.

In order to enhance the literature and inform the findings of the quantitative data analysis, a further qualitative study including five case studies in Omani manufacturing firms was conducted. **Chapter 6** provides the aims and methods for the qualitative work. It also presents findings of the empirical case studies in relation to findings of the quantitative work.

Chapter 7 provides a detailed interpretation of the final findings of the research as they relate to research questions, objectives, hypotheses and proposition testing.

Chapter 8is the concluding chapter and presents the theoretical and practical implications of the research. The limitations of the research and directions for future research are also outlined in this chapter.

CHAPTER 2 LITERATURE REVIEW

Research in the area of environmental management has obtained increasing attention over the last few decades, aiming to achieve a sustainable use of natural resources and control of hazards (Vachon, 2007;Sarkis, 2012; Dixton-Fowler *et al.,* 2013). Many aspects of EM have been discussed in the literature such as antecedents including drivers and enablers for adopting various EM practices (Delmas and Toffel, 2008; Montiel and Husted, 2010;Sarkis *et al.,* 2010; Gimenez and Tachizawa, 2012; Driessen *et al.,* 2013) and consequences of implementing these practices including environmental and economic outcomes (Klassen and Whybark, 1999; Lopez-Gamero *et al.,* 2009; Jacob *et al.,* 2010; Zeng *et al.,* 2010a; Zhu *et al*., 2012). The literature in this area ranges from empirical studies to studies that focus on modelling enterprise EM behaviours. The range of EM activities includes recycling, eco-design, reverse logistics, environmental technologies, environmental management systems, remanufacturing, product stewardship and environmentally collaborative supply chains (Sarkis *et al.,* 2011; Wu *et al*., 2012). This research focuses on investigating antecedents and consequences of EM in the manufacturing firms. The next sections discuss in detail the existing literature on various EM drivers, practices and performance implications. It is worth noting that, this research follows suggestions of previous studies (e.g. Lee and Klassen, 2008; Sarkis *et al.,* 2010, and Gimenez and Tachizawa, 2012) by distinguishing between drivers and enablers of adopting environmental practices. While a driver is defined as a factor that motivates, initiates and sometime forces an enterprise to implement environmental practices, an enabler refers to a factor that assists an enterprise in effectively achieving and implementing these practices (Gimenez and Tachizawa, 2012).

2.1 Environmental management drivers

The literature has provided some explanations as to why firms should or must engage in environmentally sustainable activities. In addition to the potential improvement in environmental performance, there may be similar results in economic performance (Bowen *et al.,* 2001a; Zeng *et al.,* 2010a). Moreover, some studies have arguedthat different firms might have different behaviors in dealing with the environmental concerns (Sharma and Henriques, 2005).This might happen because of the lack of effective driving forces to encourage or discourage the adoption of different EM options (Del Brioand Junquera, 2003; Walker *et al.,* 2008). Zeng *et al.* (2003) and Govindan, *et al.* (2014) claim that the lack of government incentives, high initial capital cost and lack of environmental information and technologies can result in having insufficient adoption of advance environmental practices.

A good number of studies can be found in management and GOM literature that used the stakeholder theory to understand how individual stakeholders influence the internal and external environmental operations of an individual firm. In general, these studies consider stakeholder pressures as a main driver for the adoption of green practices (Sarkis *et al.,* 2010). The current research also considers stakeholder pressures as a main driver for enhancing the environmental commitment of the firm. However, this research is interested in gaining a more detailed understanding on the extent to which stakeholder characteristics or the source of stakeholder pressures (i.e. from market or non-market stakeholders) can influence firms' decisions to develop more green practices.

2.1.1 Stakeholder theory

Stakeholder theory has been used as a theoretical instrument to explain the goals of strategic choices and to describe how managers incorporate the legitimate requirements of various stakeholders when making strategic decisions (Donaldson and Preston, 1995). It suggests that different stakeholder pressures significantly encourage the firm to implement various environmental practices, aiming to develop environmentally sound products and production processes (Delmas and Toffel, 2008). Stakeholder theory explains why firms tend to adopt various green practices in order to meet their stakeholders' environmental requirements. Stakeholders have been traditionally defined as "any group or individual who can affect or is affected by the achievement of the organisational objectives" (Freeman, 1984, p. 46). Externalities often lead stakeholders to increase pressures on organisations to reduce or eliminate negative impacts and increase the positive ones (Sarkis *et al.,* 2010). The Resource Dependence Theory (RDT) provides further theoretical explanation of how stakeholders influence organisational behaviours. RDT suggests that firms cannot be fully self-sufficient, rather they are dependent on resources provided by other internal and external parties such as stakeholders to achieve a long-term survival (Ulrich and Barney, 1984). Such resource dependence has empowered the stakeholders and encouraged or sometimes forced firms to consider the environmental concerns in their decision-making processes and adopt more green practices to legitimise their operations (Kassinis and Vafeas, 2006). An organization can gain benefits by reducing or closing the gaps in its relations with its stakeholders (Ahuja, 2000). Firms need to carefully manage their relationships with these parties to ensure sustainable development (Freeman, 1984; Delmas and Toffel, 2008).

The strategic management literature argues that firms exist to satisfy a wide array of stakeholders through strategic corporate norms and attitudes that aim to create value for stakeholders (Delmas, 2001). A focus on stakeholder value is one of the main reasons for the adoption of environmental practices (Mitchell et al., 1997). In short, **stakeholder management** emphasises the importance of linking stakeholder environmental requirements with organisational products, production processes and strategies in a way that could enable the firm to achieve maximum levels of effectiveness and efficiency, and ultimately improve its business performance (Buysse and Verbeke, 2003). However, findings of previous strategic environmental management studies have provided mixed results on how pressures and values of various segments of stakeholders can influence environmental decisions and commitments. For example, one group of studies (e.g. Henriques and Sadorsky, 1999; Sharma and Henriques, 2005; Wu and Pagell, 2011) believed that not all stakeholders are equally important to the firm and that the firm will establish priorities among stakeholder demands. These studies argued that manager decisions to invest in developing certain environmental programs would be in response to the demand of those stakeholders that they believe are important to the firm. This may suggest that the characteristics of specific groups of stakeholders can affect their ability to influence enterprise environmental strategies (Mitchell *et al.,* 1997; Post *et al.,* 2002; Kassinis and Vafeas, 2006). On the other hand, findings by another group of studies (e.g., Clarkson, 1995; Murillo-Luna *et. al.,* 2008; Darnall *et al.,* 2010; Sarkis *et al.,* 2010) suggest that pressure from all stakeholders is important to encourage the adoption of environmental practices. Nevertheless, in general findings of previous studies suggest that stakeholder pressure is considered a main driver for the development of environmental activities and programs (Sarkis *et al.,* 2010).

Green stakeholders, or those with the ability to affect the firm's environmental efforts and strategies, have been classified and named differently by previous EM studies depending on the specific phenomenon under investigation (see Table2.1 for examples of existing classifications of stakeholders). However, within stakeholder theory, stakeholder pressures can be generally classified as created by either market stakeholders or non-market stakeholders (Baron*,* 1995& 2000; Stevens *et al.* 2005; Lankoski, 2009; Lawrence, 2010). Market stakeholders are those involved with direct, economic transactions with the organization such as workers (employees and managers), shareholders, suppliers, competitors and customers (Baron*,* 1995& 2000; Rivera-Camino, 2007). These stakeholders have the ability to shape the market context that manufacturing firms are exposed to (Rivera-Camino, 2007) and they are more directly involved in the product, production processes and other activities of the manufacturing firm than non-market stakeholders. However, for some firms their success depends heavily on their effective relationships with non-market stakeholders, and not just on the characteristics of their products, services or production processes (Baron, 1995). The non-market stakeholders are those stakeholders who do not involve with any direct, or economic transactions with the organisation such as the government, society, media and NGOs (e.g. environmental associations), but they are mainly concerned about the well-being of the society (Henriques and Sadorsky, 1999; Stevens *et al.* 2005). When compared to market stakeholders, this segment of stakeholders tends to have no or minimum control over the organisation's resources (Sharma and Henriques, 2005; Steven *et al.,* 2005) but has more capacity to change public opinions for or against certain environmental practices (Freeman, 1984; Delmas, 2001; Delmas and Toffel, 2008).

Table 2.1: Classifications of environmental stakeholder pressures by previous studies

Study	Classifications
Baron,(1995); Baron, (2000);Logsdon& Kristi (1997); Cummings and Doh, (2000);Stevens et al. (2005); Lankoski (2009) and Lawrence (2010)	-Market stakeholders -Non-market stakeholders
Zhu & Sarkis, (2004); Zhu et al, (2008); Wu *et al.,* (2012)	-Regulatory stakeholders -Market stakeholders -Competitive stakeholders
Henriques and Sadorsky (1999)	-Regulatory stakeholders -Organisational stakeholders -Community stakeholders
Buysse and Verbeke (2003)	-External primary stakeholders -Secondary stakeholders -Internal primary stakeholders -Regulatory stakeholders
Kassinis &Vafeas (2006)	-Regulatory stakeholders -Community Stakeholders
Matos & Jeremy (2007), Wagner (2011)	-Agent stakeholders (Primary) -Environment stakeholders (Secondary)
Murillo-Luna *et al.,* (2008)	-Regulatory stakeholders -Corporate governances stakeholders -Internal economic stakeholders -External economic stakeholders -Social external stakeholder
Menguc, *et al.,* (2010)	-Internal stakeholders -External stakeholders
Darnall *et al.,* (2010)	-Primary stakeholders -Secondary stakeholders -Environmental regulators (government)
Sarkis*et al*., (2010)	-Stakeholders as a single construct
Kirchoff*et al.,*(2011)	-Voluntary (Primary) -Secondary (Industry & Political)

Government agencies and regulatory bodies are the most obvious non-market stakeholders when it comes to environmental concerns and they play a significant role in guiding EM (Delmas and Toffel, 2004; Chen *et al.,* 2006). The literature provided inconclusive findings on the role of the legislative requirements in encouraging firms to adopt more innovative green practices (Schoenherr *et al.,* 2012). For example, Porter and Van Der Linde (1995) and Dean and Brown (1995), among others, found a positive relationship between regulative requirements and the firm's environmental innovation capabilities and performance. On the other hand, Nash and Ehrenfeld (1997) found that regulatory pressure only encourages firms to adopt pollution control and end-of -pipe solutions, rather than implementing more innovative pollution prevention practices. Firms will implement various environmental practices in order to comply with the regulatory requirements and, ultimately, avoid any environmental fines, penalties and violation costs (Johansson and Winroth, 2010). Failure to comply with the legislative environmental requirements can make companies vulnerable to different action lawsuits and can affect their reputation and relations with customers(Karpoff *et al.,* 2005; Sarkis*et al.,* 2010). Firms can go beyond compliance by adopting voluntary pollution prevention practices such as practices related to eco-design and the establishment of formal Environmental Management Systems (EMSs). Adopting these voluntary practices was found to be critical in enabling the firm to form collaborative relationships with government bodies (Baker, 2007), improve its reputation (Henriques and Sadorsky, 1999) and allow it to gain maximum support from the government (e.g., obtaining critical environmental information and gaining technical and managerial environmental assistance) (Karpoff *et al*., 2005).

Other non-market stakeholders come from the local community and NGOs such as environmental and social protection associations and media (Baron, 2000; Cummings and Doh, 2000; Stevens *et al*. 2005; Kassinis and Vafeas, 2006). The increased environmental problems caused by manufacturing firms and reported in the mass media have resulted in increased social awareness of the consequences of environmental damages, and has promoted more pressures from various social stakeholders on the behaviours and operations of organisations (Claver *et al*., 2007). Furthermore, Barkemeyer, *et al*., (2010) argued that the media initially influenced the debates around the environmental issues, aiming to increase the public awareness about the companies' environmental problems. The media can influence environmental behaviours by publishing environmental initiatives or environmental violations, which ultimately can result in either gaining public support for the firm's activities or facing the risk of the public protest against its operations (Barkemeyer *et al.,* 2010). The nature and intensity of the local community opinion about the corporate environmental performance have also been recognized as crucial drivers for the development of environmental regulations in most of the developed countries (Delmas and Toffel, 2004). As such, failure to meet the requirements of each of the social stakeholder groups could lead to long lasting economic risks, because these stakeholders have a strong ability to change public opinion for or against environmental approaches (Roome and Wijen, 2006). The above arguments show that non-market stakeholders can have critical influence on the firm's decisions to implement various environmental practices and thus firms will adopt various environmental activities and will devote enough resources to respond to these requirements.

Hart (1995) argued that proactive firms tend to adopt more proactive, rather than reactive or defensive, environmental strategies which go beyond the minimum social and legal requirements imposed mainly by non-market stakeholders. Their environmental programs focus on addressing the concerns of a wider range of market stakeholders (Schot and Fischer, 1993). Customers, suppliers, employees, shareholders and competitors are considered as among the main groups of market stakeholders who can significantly affect firm environmental behaviours (Baron, 1995& 2000). For example, increasingly more strict environmental criteria are used by industrial customers when selecting their supply chain partners in order to eliminate the environmental and economic risks and liabilities associated with the production and/or consumption of the final product (Handfield *et al.,* 1997; Walton *et al.*, 1998). Supplier adoption of certain green practices such as the acquisition of a certified EMS (e.g., ISO 14001) and eco-design initiatives (e.g., providing materials or components that are designed for the environment) became mandatory by most of the industrial customers (Zhu and Sarkis, 2004; Vachon, 2007). This is to ensure that the materials or components purchased are able to meet the environmental standards. The growing evidence linking the environmental disasters, product consumption and their consequences on human health encouraged many consumers to ask for more environmentally responsible products and services. These changes in consumer demands have forced many firms to modify part or all of the products and services they offer to meet customer expectations (Chitra, 2007). In addition, critical suppliers may force customers to implement EM in order to maintain the reputation of the firm and improve the environmental performance of the whole supply chain (Geffen and Rothenberg, 2000). Firms can adopt control-command mechanisms or get directly involved collaboratively to improve the environmental activities of supply chain members (Vachon, 2007). These environmental pressures of supply chain stakeholders aim to reduce or eliminate the potential environmental impacts associated with the activities of the entire supply chain, which may improve the reputation of the company and enhance its competitiveness (Vachon and Klassen, 2006).

Bankers and shareholders are also important market stakeholders because they provide access to financial resources required for the firm's development. Firms need to respond to their environmental requirements in order to maximising the value of their investments (Roome and Wijen, 2006). These stakeholders demand the firm to implement more green practices to reduce the economic risks associated with the environmental liabilities and to guarantee that their investment will not be at risk due to bad environmental reputation associated with environmental violations (Patten, 2002). Firms can improve shareholder value, increase financial performance and protect investment against environmental violation costs by adopting more advance environmental activities (Rueda-Manzanares*et al.,* 2008; Jacobs *et al,* 2010). Furthermore, commitment of firm employees such as the owners, managers and workers has been found to be significantly related to the firms' ability to develop successful environmental projects (Sharma, 2000; Zhu *et al.,* 2008a) and improving its environmental performance over time (Hanna *et al*, 2000). The personal beliefs and values of the top and middle level managers about the importance of environmental management can widely influence the attitudes and environmental commitments of other workers(Bowen *et al.,* 2001a). Workers often are considered as the initiators of environmental initiatives, and enhancing their environmental commitment is critical in the process of adopting more innovative green practices (Hanna *et al.,* 2000;Sarkis *et al.,* 2010). Attracting the most talented and committed employees requires the firm to develop more green practices as these workers tend to prefer to work with firms that are more concerned about the environmental issues (Reinhardt, 1999). As market stakeholders such as shareholders, employees, suppliers and customers are essential elements of the value chain, they play a critical role in the implementation of various environmental practices (Communing and Doh, 2000). Therefore, firms need to adopt various environmental practices to address the environmental concerns of this group of stakeholders.

In addition to stakeholder pressures, previous studies have identified other important drivers that promote the adoption of environmental practices. These drivers include the firm's desire to enter new markets, improve its reputation, improve its environmental obligation for employee health (Egri and Herman, 2000; Romme and Wijen, 2006) and market competitors (Hart, 1995; Shrivastava, 1995a; Hofer *et al.,* 2012). Firms that implement environmentally sustainable practices can gain more market share and competitive advantages (Sharma and Vredenburg, 1998; Montiel and Husted, 2010).

Based on the above discussion, it is clear that firms are facing a lot of pressure from various groups of stakeholders demanding more environmentally responsible products and processes. This can encourage a better understanding of the current and potential stakeholder concerns, the possible solutions and the capabilities required to implement these solutions. Despite this growing attention on examining the influence of stakeholder pressures on organizational environmental efforts by previous studies, some studies still argue that the linkage between EM divers and the development of different environmental practices has not been empirically investigated thoroughly (e.g. Delmas and Toffel, 2008; Zhang *et al.,* 2008; Sarkis *et al.,* 2010 & 2011; Schoenherr *et al.,* 2012).This reveals that further research in these areas can be justified. For instance, the above review of the literature reveals that previous studies have not provided a clear answer into whether firms tend to give equal attention to satisfy the requirements of both market and non-market stakeholders when making their environmental decisions or whether they focus mainly on satisfying the requirements of one particular group of stakeholders and ignore the demands of other groups. These areas will be further investigated in this research.

2.2 Resource based view and environmental management

The resource-based view (RBV) of the firm (Barney, 1986, 1991) has been widely recognized as a good normative and instrumental model to explain the competitive advantages associated with the firm's development and deployment of valuable resources and capabilities that cannot be easily obtained or copied by competitors (Lewis *et al.,* 2010). According to Helfat and Peteraf (2003), a resource refers to any input or asset (tangible or intangible) that a firm can use during the production process (e.g., capital, human resources, technology, production materials and equipment). Capability, on the other hand, refers to the ability to use a collection of routines (or repeated activities) and undertake an integrated set of tasks in order to achieve a specific objective through an effective utilization of the resources (Helfat and Peteraf, 2003). While routine or practice explains the way how things are done, capability is defined as a collection of distinct yet interrelated set of routines (Amit and Schoemaker, 1993; Teece *et al.,* 1997). Recently the routine based approach to capability has been extended to the dynamic based approach of capability, which focuses on a firm's ability to integrate, build and re-configurate its competences to match rapidly changing environments (Helfat and Peteraf, 2003; Peng *et al*., 2008). Thus, with RBV both the routine based and dynamic based approaches of capability are considered as good sources of enhancing firm competitiveness (Peng *et al*., 2008).

Several GOM studies have used the RBV to explain sustainable competitive advantage as a consequence of the firm's ability to develop valuable environmental capabilities such as stakeholder integration and continuous environmental innovation associated with the development of advanced environmental programs (Hart, 1995; Sharma and Verdenburg, 1998). The positive link between environmental programs and organisational performance has been widely recognized by previous RBV studies (e.g., Russo and Fouts, 1997; Sharma and Verdenburg, 1998). For instance, findings by Christman (2000) illustrate that the availability of firm specific and complementary process capabilities could enable the firm to achieve a cost competitive advantage when it decides to implement 'best environmental practices'. These competencies reflect a unique set of valuable, rare, non-substitutable and inimitable resources that can be used either individually or in combination (Barney, 1991). When considering the natural environment, Hart (1995) argues that a combination of structural and infrastructural investment is needed in order to effectively respond to stakeholder's environmental pressure and improve the firm's environmental capabilities and competitiveness.

2.3 Selection and adoption of environmental practices

Environmental Management (EM) practices consider what the company does to address stakeholder environmental concerns and these include management systems, production equipment, methods and procedures, product designs and product delivery mechanisms that conserve energy and natural resources, minimise environmental impacts of human activities and protect the natural environment (Shrivastava, 1995b; Klassen and Whybark, 1999; Zhu and Sarkis, 2004). Due to the continuous, multi-directional and vast expansion of literature related to environmental management, previous researchers have proposed numerous classifications of EM practices (Zhu *et al.,* 2007; Sarkis, 2012). Some of these classifications are summarised in Table 2.2. The selection of a specific classification depends largely on the purpose of the research (Klassen and Whybark, 1999; Zhu and Sarkis, 2004; Sarkis, 2012).

Considering the objectives and the context of this research, EM practices are classified in this research into four main categories as suggested by Zhu and Sarkis (2004 & 2008) and Sarkis *et al.,* (2010) based on their broader management orientation. These categories include: 1) manufacturing for the environment and design for disassembly (*or eco-deign*), 2) total quality environmental management (*or source reduction and investment recovery*), 3) technology and process assessment (*or Environmental Management Systems-EMSs*), and 4) *alliance* with supply chain members, which focuses on external EM initiatives with supply chain members. The EM and operations strategy literature gives the theoretical basis for this classification (Zhu & Sarkis, 2004 & 2008). These four types of environmental practices represent some of the main environmental activities a firm may use when facing environmental concerns. Also, they are considered as part of the pollution prevention strategies which tend to have significant effect on performance (Sarkis *et al.*, 2010; Wu *et al.,* 2012; Zhu *et al.,* 2012). Below is a detailed explanation about these different sets of environmental practices.

Table 2.2: Classifications (elements) of GOM practices in the literature

Study	Classifications (or elements of GOM)
Klassen and Whybark, (1999) and Rusinko (2007)	Pollution prevention and pollution control
Bowen *et al.,* (2001a & 2001b)	Strategic purchasing and supply, product-based green supply, corporate environmental proactivity, greening the supply process
Buysse and Verbeke (2003)	The end-of-pipe, pollution prevention, product stewardship, sustainable development
Melnyk *et al.,* (2003)	Life cycle assessment, environmental management systems (EMSs)
Rao and Holt (2005)	Greening the inbound function, greening production, greening the outbound function
Zhu and Sarkis (2004 & 2008), Zhu *et al,* (2005)	Eco-Design, investment recovery, EMSs, collaboration with customers and suppliers
Sarkis *et al*., (2010)	Eco-Design, source reduction, EMSs
Delmas and Toffel (2008)	Environmental management systems, government-initiated voluntary environmental programs
Sharma & Henriques (2005) and Sharma (2000)	Pollution control, eco-efficiency, recirculation, eco-design, EMSs
Gonzalez-Benito J. and Gonzalez-Benito O. (2005)	Planning and organizational, Operational (product related), Operational (process related) and Communicational
Vachon and Klassen (2006) and Vachon (2007)	Environmental collaboration, environmental monitoring
Shang *et al.,* (2010)	Green manufacturing and packaging, environmental participation, green marketing, green suppliers, green stock, and green eco-design
Wu *et al.,* (2012)	Green purchasing, cooperation with customers, eco-design and investment recovery
Zhu *et al.,* (2012 & 2013)	External and internal

2.3.1 Internal and external environmental practices

There are many environmental practices a firm can use when considering how to reduce environmental emissions and improve the overall environmental performance(see Melnyk *et al.,* (2003) for a list of some of the more generally used environmental practices). While some of these practices are used to improve the internal activities of the firm and focus on pollution reduction by providing more ecological solutions (e.g., waste separation and recycling), others are used internally for pollution prevention (e.g., process and product redesign). Moreover, the third type of practices focuses on the management and evaluation of EM practices such as the adoption of EMSs. These EMSs focus on the formal procedures and databases which combine the process and methods of training employees, monitoring performance, summarising, analyzing and reporting information related to environmental performance to different stakeholders (Melnyk*et al.,* 2003; Sroufe, 2003). The fourth type of the environmental practices is used to extend EM outside the firm's internal operations. These focus on the environmental alliance between firms and their external supply chain members. These types of environmental practices are complex and require more resources and effort as they focus on developing relationships beyond the firm boundaries (Bowen *et al*., 2001a, 2001b, Vachon, 2007; Vachon and Klassen, 2008). However, they can result in higher environmental and economic performance if planned and managed properly (Vachon and Klassen, 2006; Vachon, 2007).The importance of these four sets of environmental practices, on complementary base, for responding to various stakeholders pressures and for improving environmental and economic performance is one of the main concerns of this PhD research. Although the author acknowledges that there are other practices that a firm might use to become greener, this research focuses on these four sets of environmental practices. Various other studies also considered these to be among the most prominent environmental solutions for manufacturing firms (Zhu and Sarkis, 2004; Sarkis *et al*., 2010; Wu *et al*., 2012). The next sections provide a detailed discussion of these factors, their possible interrelationships and their impacts on environmental and economic performance.

2.3.1.1 Internally focused environmental practices

Internally focused environmental practices involve those activities that fall under the full control of the firm and focus mainly on reducing the environmental problems within the internal operations of the firm (Zhu *et al*., 2012). For the purpose of this research, internal environmental practices are classified to three main types: eco-design, source reduction and EMSs. These sets of practices and how important they are in greening the internal activities of a firm are discussed below.

2.3.1.1.1 Eco-design and source reduction practices

Increasing penalties associated with harming the natural environment and affecting the quality of human life escalated with the pressures from international institutions and market requirements have encouraged many companies to adopt more advanced pollution prevention practices (Hart, 1995) such as those related to eco-design and source reduction (Sarkis *et al*., 2010).Unlike the pollution control practices, which are characterized by 'end-of-pipe' solutions (Hart, 1995; Russo and Fouts, 1997), pollution prevention practices focus on reducing or eliminating pollution from the source (Klassen and Whybark, 1999). This can be achieved by changing the existing physical product or process (e.g. product redesign, in-process recycling, process modification and material substitution) (Hart, 1995). By making fundamental changes to the existing product or process, these practices can provide many benefits and different ways to improve the level of environmental performance, thus providing greater chances for innovation (Russo and Fouts, 1997; Christmann, 2000). Several researchers argued that pollution prevention practices can offer greater competitive advantage because the adoption of these initiatives relies on tacit organisational and knowledge-based capabilities and resources (Hart, 1995; Dean and Brown, 1995; Russo and Fouts, 1997).

Eco-design and source reduction practices are considered as effective pollution prevention strategies that modify the design of products or production processes in such a way that waste is eliminated or reduced (Tukker *et al.*, 2001; Kurk and Eagan, 2008). **Eco-design practices** refer to the long-term strategies of designing a product or production processes to have minimal impacts on the natural environment (Zhu *et al.,* 2008b). These practices focus mainly on manufacturing for the environment and design for disassembly (Zhu and Sarkis, 2004). **Source-reduction practices**, on the other hand, are related to total quality management and refer to the operational-level environmental activities that aim to reduce the amount of pollution from the source; sometimes before it is even generated (Sarkis *et al.,* 2010). Operational activities for source reduction include activities related to input substitution, reducing the amount of materials used during the production or distribution processes, operational changes and improvements, and inventory management (Sarkis and Rasheed, 1995). The goal of eco-design and source reduction practices is to achieve a more efficient utilization of resources by evaluating how business is conducted, what materials/components are purchased and how these materials/components are used (Gupta, 1995). A growing number of firms have realized that adopting these practices enable them to outperform their competitors by exceeding, not just matching, environmental regulations (Sharma and Vredenburg, 1998; Zhu and Sarkis, 2004; Zhang *et al.,* 2008). The reduction of waste implies that lesser raw materials are used or that materials are used more efficiently (Gupta, 1995). This may suggest that eco-design and source reduction initiatives are not just good for the environment but also economically beneficial.

2.3.1.1.2 Environmental management systems

Due to the growing pressures for EM from various stakeholders, both managers and researchers have recognized the importance of internal systems employed to organise, manage and evaluate environmental practices (Delmas, 2001; Del Brio and Junquera, 2003; Sroufe, 2003).**EMSs** can be generally defined as "the formal system and database which integrates procedures and processes for the training of personnel, monitoring, summarizing, and reporting of specialized environmental performance information to internal and external stakeholders of the firm" to increase stakeholder involvement in managing firm operations (Melnyk *et al.,*2003, p.332). Previous studies agree that an effective EMS is used to assist firms in managing, organising, measuring and improving the environmental issues of its operations (Melnyk *et al.,* 2003; Darnall and Edwards, 2006). The implementation of EMSs includes setting environmental policy, establishing goals, implementing the goals, monitoring goals achievement and undertaking management review (Sroufe, 2003; Darnall and Edwards, 2006). In order to guide managers during these stages, ISO 14001 and other environmental certificates were introduced (Tibor and Feldman, 1996; Delmas, 2001; Sroufe, 2003). Consequently, many firms have moved towards implementing certified EM practices (Del Brioand Junquera, 2003). Melnyk *et al.*, (2003) evaluated the effects of having formal but uncertified compared to formal and certified systems and they argued that the presence of certified EMS can lead to significant improvement of performance.

EMSs assistfirms in being more compliant with voluntary and mandatory environmental responsibilities (Darneall and Edwards, 2006) and in achieving waste reduction goals (Sayre, 1996; Sroufe, 2003) by encouraging better environmental planning from the stage of raw materials acquisition to the stage of product distribution (e.g. Sayre, 1996; Tibor & Feldman, 1996). The implementation of these systems can also foster the development of inter and intra-organizational collaboration about information and resources to facilitate other environmental initiatives within and across firms (Sroufe, 2003). In short, the development of these systems could provide the company with unique capabilities, resources and other benefits that can lead to competitive advantages (Delmas, 2001; Melnyke *et al.,* 2003; Sroufe, 2003).

From the discussion above it can be seen that the presence of EMS requires a set of formal environmental policies, strategies, goals and administrative process for improving the level of environmental performance. However, one should keep in mind that the emphasis in adopting an EMS is on the process rather than on achieving a certain level of environmental performance (Sroufe, 2003; Darnall and Edwards, 2006). Also, the quality and adoption of these systems might not be recognized by those outside the firm but the firm can communicate the existence of these systems by certifying them (Delmas, 2001; Melnyke *et al.,* 2003). Implementing an EMS can be considered as a process to help firms in achieving their own environmental objectives (Sroufe, 2003).

2.3.1.2 Externally focused environmental practices

Identifying and managing environmental impacts throughout the supply chain (SC) is receiving a lot of attention in operations management research (Chiou *et al*., 2011; Caniels *et al*., 2013). The absence of a clear and consensus definition of external EM in the literature does not facilitate its investigation (Vachon and Klassen, 2006; Matos and Jeremy, 2007). However, in general, external environmental management can be seen as integrating environmental concerns into the inter-organisational practices of supply chain management (Geffen and Rothenberg, 2000; Vachon and Klassen, 2006; Linton *et al.,* 2007; Vachon, 2007). In this research the term '**external environmental management**' will be used to compose all environmental activities and initiatives adopted by the firm concerning the elimination, reduction or prevention of any kind of pollution associated with activities of its external supply chain parties.

The literature suggests that there are two main interrelated approaches of external environmental practices a firm can adopt to green the activities of its supply chain members. The first approach is called 'supply chain environmental collaboration' (SCEC), where the firm integrates its environmental activities with other external SC members and commits some of its own resources to improve the level of environmental performance outside its internal operations (Vachon, 2007). It concentrates on the inter-firm interaction and cooperation and includes various EM activities such as conducting joint planning sessions and knowledge-sharing activities related to EM, mutual willingness to learn about each other's operations, reducing wastes related to logistics activities and product or process modifications (Vachon and Klassen, 2006; Linton *et al.,* 2007; Matos and Jeremy, 2007). SCEC gives more attention to the processes and practices that help to achieve more environmentally sound products or operations and less attention to the immediate effects of the suppliers' environmental activities such as the compliance with existing environmental regulations (Walton *et al*., 1998). It also requires a firm to devote specific resources for cooperative activities that tackle environmental concerns in the supply chain. These types of practice allow for more risks, rewards, technology and information sharing and, thus, encourage SC members to work collaboratively to improve the environmental and social performance (Klassen and Clay, 1999; Kotabe, *et al.,* 2003).

The second approach is called supply chain environmental monitoring (SCEM), where the firm adopts command and control approaches, and puts no or a minimum level of commitment of its resources to improve the level of environmental performance outside its operations (Vachon and Klassen, 2006; Vachon, 2007). SCEM is based on collecting and maintaining documentations about the environmental practices of suppliers (Zhu and Sarkis, 2004) or customers (Vachon *et al.* 2001). It can be accomplished by requesting external supply chain partners to comply with different environmental regulations such as hazardous materials labelling (Walton *et al.,* 1998). Many companies implement monitoring practices just to avoid economic liabilities or environmental risks associated with suppliers' non-compliance to environmental regulations rather than to gain a competitive advantage (Min and Galle, 2001; Bowen *et al*., 2001a).

In contrast to SCEC, SCEM gives less attention to long-term outcomes of working collaboratively with suppliers to achieve more environmentally sound product or operation (Sharma and Vredenburg, 1998; Vachon and Klassen, 2006). SCEM might be viewed more easily implemented than SCEC because it requires less resources and efforts (Bowen *et al,* 2001a, 2001b), and thus adopting this approach could be more preferred especially by firms that might have less visible environmental impacts. Nevertheless, the adoption of both

SCEC and SCEM practices have started to receive greater attention as firms have become linked to the environmental activities of their suppliers in their customers' minds and in front of other stakeholders (Wokutch, 2001; Carter and Jennings, 2002; Zhu and Sarkis, 2004; Zhu *et al*., 2005). Previous studies considered these two approaches as highly integrated external environmental approaches (Vachon and Klassen, 2006) and thus in this research both of these practices will be grouped as one practice called ‘External EM practices’.

The literature shows that there are various internally and externally focused EM practices for firms to adopt in order to respond to stakeholder pressures. These green activities are important to enhance the firm’s environmental capabilities. This may also suggest that firms need to select and adopt the right combination of both internal and external environmental practices in order to effectively match the external pressures with the internal resources and capabilities (Sharma and Henriques, 2005) and to achieve good levels of environmental and economic performance (Klassen and Whybark, 1999b; Zhu *et al.,* 2012).

2.4 Elements of GOM: Substitution or complement

Increasing attention has been given in the literature to investigate how organisations address environmental issues in their supply chain (Vachon and Klassen, 2006; Sarkis, 2012). This has been traditionally described as Green Operations/Supply Chain Management (GOM). Despite the abundant literature on GOM, there is still a lack of consensus in the definition of GOM and its elements (Sarkis, 2012) (see Zhu and Sarkis, 2004; Sarkis, 2012, for a list of definitions and terminologies used for GOM). The definitions and elements used to describe GOM vary among previous studies depending on the objectives of the researcher and the specific issues under investigation (Sarkis, 2012). Nevertheless, most of the existing definitions of GOM suggest that organisations are responsible for the environmental performance of both their internal operations and of their external supply chain members. To avoid confusion caused by a lack of generally accepted definition of GOM, this research defines **GOM** as the incorporation of environmentally friendly thinking and efforts into every aspect of operations and SCM activities including product design and development, material sourcing, internal management systems, manufacturing process, packaging, storage, retrieval, transportation and disposal, as well as post sales services including end-of-product life management (Srivastava, 2007; Min and Kim, 2012). This and other definitions used in the literature suggest that each element of GOM is important to develop an effective GOM program to enable the firm to effectively achieve both business and environmental objectives. Most of the existing studies, however, linked different elements of GOM to organisational performance assuming that there is substitutability, rather than complementarity, among these elements. This may be obvious from the recent works by Zhu *et al.,* (2008c, 2012& 2013) emphasising the need to conceptualize the interdependency among various elements of GOM and to investigate its performance implications.

Companies differ in their concentration of GOM efforts, some give more attention to greening their internal activities, others focus on greening their external supply chain activities. Integrating the environmental issues throughout internal and external supply chain practices and strategies is considered a good way to differentiate the firm from its competitors (Rao and Holt, 2005; Zhu *et al*., 2008b, Wu *et al.,* 2012) and improve its performance (Carter and Rogers, 2008). What is less clear from the literature is whether the adoption of a specific set of GOM practices is more beneficial to the firm or whether the collective (or complementary) adoption of different internally and externally focused GOM practices would result in greater improvement in performance. Basing the rationale on the theory of complementarity, this research aims to examine the extent to which a simultaneous and a collective, rather than an individual-isolated, adoption of various sets of GOM practices can influence the organisational performance. The next section discusses the literature on the theory of complementarity and its importance in studying the relationships between EM drivers, activities and performance.

2.4.1 Complementarities of GOM practices

Traditionally, firms tended to focus on developing specific GOM aspects, in which they have sufficient knowledge and experience (Shrivastava, 1995a). This may occur in order to avoid the set up cost for shifting from one aspect to another. It may also happen because of the lack of sufficient resources and capabilities to effectively develop other aspects of GOM. In recent years, more firms follow a more integrated approach to GOM considering both internal and external initiatives (Bacallan, 2000). Most of the time stakeholders do not differentiate between a company and its supply chain partners when an environmental catastrophe occurs (Rao and Holt, 2005). There is a growing interest among researchers to examine the relationships between the internal and external elements of GOM (Zhu *et al.,* 2013). At the heart of these studies are the views of the dependency (complementarity) or independency (competitiveness/substitutability) among the internal and external GOM aspects and their performance implications. Traditionally research in GOM has separately investigated internal and external elements of GOM (Zhu *et al.,* 2012), assuming that there is substitutability between these elements. A number of recent studies have argued for the importance of coordinating internal and external GOM efforts (e.g. Lee and Klassen, 2008; Yang *et al*., 2010; De Giovanni, 2012; Zhu *et al.,* 2012& 2013). Yet, the possible interrelationships between various GOM practices varies (e.g. contingent relationship (Wong *et al.,* 2012), sequential/mediated relationship (Zhu *et al.,* 2012& 2013), or independent relationships (Sarkis, 2003; Zhu *et al*., 2007; Wu *et al.,* 2008)) and thus there is no consensus in the results of these studies. For example, Wong *et al.,* (2012) examined the moderating influence of the environmental management capability of suppliers on the effectiveness of internal green operations including process and product stewardship. They found that in general the success of internal green operations is contingent on the environmental capabilities of suppliers. Moreover, using the coordination theory, which suggest that coordination and integration of supply chain activities will lead to better performance (Malone and Crowston 1994), Zhu *et al.* (2012) have argued for the importance of coordinating internal and external GOM aspects and have examined the role of the sequential, or the mediated, adoption of different elements of GOM on performance. Yet, there has been no effort made to empirically examine the role of complementarity of various internal and external GOM practices on performance. This gap will be addressed in this research.

Complementarity is one of the fundamental conceptual theories in this research. In particular, this research uses the perspective of the complementarity theory to test the relationships between GOM practices. The notion of complementarity of organisational activities flourishes in the management literature and highlights the superior value/outcome from resource combinations (Milgrom and Robert, 1995; Cassiman and Veugelers, 2006; Mishra and Shah, 2009). The super-modular optimisation theory, introduced by Milgrom and Robert (1990; 516), states that a set of resources and capabilities can be called complementary (or substitute) when increasing the use of one or more variables raises (or reduces) the marginal return of other variables. Complementarity occurs when the value of one resource increases in the presence of other related resource, rather when used on its own (Milgrom and Robert, 1995; Mishra and Shah, 2009).That is, it occurs when the total value added resulted from combining two or more interrelated factors in a production system exceeds the value that would be generated by using these factors in isolation (Ennen and Richter, 2010). The idea of complementarities among organisational activities has been empirically validated in the context of Human Resource Management (Laursen and Foss, 2003; Cassiman and Veugelers, 2006), Information Technology (Melville *et al.*, 2004; Zhu, 2004) and Supply Chain Management (Mishra and Shah, 2009). In the context of e-procurement, (Kauppi*et al.,* 2010) have also illustrated that the complementarity of skills and tools are needed to succeed with e-procurement. Combining both external and internal resources and capabilities enables the firm to establish a sustainable competitive advantage (Lewis *et al.,* 2010).In fact, the idea that organisation need to operationally and strategically integrate and coordinate various types of GOM resources and strategies, and consider these as complementary to each other has also been recognised by some of the strategic GOM studies, but as yet not been investigated empirically. For example, Klassen and Whybark, (1999; 604) believe that "strategic choices must include structural, infrastructural, and integration areas and that any assessment of environmental management should consider similar theoretical areas". One of the critical contributions of Hart (1995) is his conceptual argument that simultaneous investment in the development of several linked resources is needed in order to allow the firm to become greener (Buysse and Verbeke, 2003). This explains that resource complementarity in the development of various environmental practice domains is particularly important for the firm to enhance its environmental capabilities.

Firms are increasingly responding to environmental stakeholder concerns by implementing new internal environmental changes to green their internal process (Zhu *et al.,* 2005) and by expanding the selection of suppliers who can provide the firm with less harmful materials (Vachon and Klassen, 2006). The recent literature (Vachon, 2007) provides insights on the potential of developing environmentally oriented coordinated supply chain relationships for enhancing the level of environmental performance. It has been found that addressing environmental concerns throughout all stages of PLC may add more value to the firm, offer new chances for enhancing market competitiveness (Hansmann and Kroger,2001), reduce economic risks and increase profitability (Zhu and Sarkis, 2004). Shah *et al.,* (2008) argue that the inter and intra-organisational relationships between supply chain actors are fundamental to coordinate and integrate the GOM activities. Previous studies suggest that there is a need to focus on the totality of the supply chain including both the internal and external GOM aspects. However, to the author's knowledge, as yet no effort has been done to empirically validate the notion of the complementarities of GOM activities and its ability to better explain economic and environmental performance.

In this research, the EM process of firms is modelled as a collective competency that highlights the adoption of various EM practices. The argument here is that the firm's ability to simultaneously develop and deploy various environmental practices in response to stakeholder pressures is a critical competitive advantage that allows good environmental and economic performance. Accordingly, in this research, the collective investment in the development and simultaneous deployment of various types of internal and external EM practices is termed as 'Collective GOM competency'. Collective GOM competency comprises four sets of EM practices: EMSs, Eco-Design practices, Source Reduction practices and External EM practices.

2.5 Environmental management and firm performance

The relationship between organisational environmental commitments and its environmental and economic performance implications has been studied extensively, both theoretically (e.g., Hart, 1995) and empirically (e.g., Klassen and Whybark, 1999; Bowen *et al*., 2001a; Montiel and Husted, 2010). However, there is still an on-going debate (Seuring and Muller 2008) regarding the adoption of EM practices on one hand and the improvement of environmental and economic performance on the other hand (Russo and Fouts, 1997; Carter and Dale, 2008; Menguc *et al.,* 2010). As argued by Hoffman and Bazerman (2005, p. 16): *"The key to resolving this debate is the recognition that environmental behaviours are sometimes profit-compatible and sometimes not"*.

Although the majority of recent studies have argued that good environmental performance results in improved financial performance (Dixton-Fowler *et al.,* 2013), empirical research has provided mixed or even conflicting findings (see Table 2.3.), highlighting the complexity in linking the two (Patten, 2002; Corbett and Klassen, 2006; Iraldo *et al.,*2009; Lopez-Gamero*et al.,* 2009; Zeng *et al.,* 2010a). For example, Vachon and Klassen (2008) have noted that environmental initiatives such as supply chain alliance for environmental management are associated with positive operational performance. Also, Chiou *et al.,* (2011) found that green innovations can enhance the market competitiveness of the firm. Similarly, Wong *et al.* (2012) demonstrated that the adoption of GOM initiatives positively relate to economic performance. On the other hand, Walley and Whitehead (1994) have argued that examples where environmental initiatives can improve organizational performance are rare. In addition, Matos and Jeremy (2007) have claimed that the benefits from EM efforts have been elusive and Bowen *et al.,* (2001) highlighted that positive economic performance of EM is not being obtained in short term. Moreover, Zhu *et al.* (2007) and Vanessa *et al.,* (2010) have found that adopting GOM practices can have little impact on economic and operational performance. At the same time, another group of studies argued that environmentally responsible activities of profit oriented firms can directly increase the business benefits and, at the same time, can increase the overall cost of production and spending, and thus hurt the profitability of the firm (Zhu and Sarkis, 2004).

The conflicting findings of previous EM studies show the complexity of studying the relationship between environmental and economic performance (Molina-Azorin *et al.,* 2009a). These mixed results may also suggest that these factors might be indirectly related to each other through a third mediating or moderating factor (Dixton-Flower, *et al.*, 2013). The above arguments suggest that further investigation is needed.

Table 2.3: Mixed results of previous empirical studies

Study	Findings of the study
Hart (1995) and Russo & Fouts (1997)	Strong **positive** relationship between firm's adoption of various source reduction practices and its ability to achieve good financial performance.
Hamilton (1995)	**Positive** relationship between firm's adoption of EMSs and its ability to improve its stock price.
Konar and Cohen (2001)	**Negative** relationship between firm's adoption of EMSs and source reduction practices and its ability to improve its stock price.
King and Lenox (2002)	**No** significant relationship between firm's adoption of source reduction practices and its ability to improve its financial performance.
Wagner (2005)	**Negative** relationship between firm's adoption of pollution control (or end of pipe) environmental practices and its ability to improve its financial performance. **No** significant relationship between firm's adoption of pollution prevention (or source reduction) environmental practices and its ability to improve its financial performance.
Link and Naveh (2006), Iraldo *et al.,* (2009)	**No** significant relationship between firm's adoption of EMSs and its ability to improve its financial performance.
Sarkis and Dijkshoorn (2007)	**No** significant relationship between firm's adoption of waste management practices and its ability to improve its financial performance.
Molina-Azorin *et al*., (2009b)	**Positive** relationship between firm's adoption of eco-design and economic performance.

Despite the growing literature on performance implications of EM, it lacks a specific theoretical model that explains how organisational environmental efforts can result in positive economic outcomes (King and Lenox, 2001; Iraldo *et al.,* 2009). The relationships between GOM, environmental and economic performance are still unclear. Not only for companies operating in developing countries like Oman but also, to some extent, for companies operating in developed countries like Europe and US. This is clear from the absence of a well-accepted theoretical and empirical justification of whether it pays to be green (Lopez-Gamero *et al*., 2009; Zeng *et al.,* 2010a; Dixton-Fowler *et al.* 2013). The diversity of GOM practices used in previous empirical studies and adopted by different companies in different industries (Elsayed and Paton, 2005; Elsayed, 2006; Claver *et al.,* 2007), and how the relationships between GOM and environmental and economic performance were conceptualized in these studies might be significant reasons behind the mixed findings of previous GOM studies. Accordingly, using the perspective of the complementarity theory, this research aims to develop and provide an alternative conceptual model to assess the performance implications of adopting GOM practices. The developed model considers the adoption of GOM practices from a complementarity-holistic, rather than a competitive-bivariate, perspective. It also argues that the direct positive economic benefits resulting from the collective and simultaneous adoption of various GOM practices will exceed its negative economic outcomes. In addition to the direct impacts of collective adoption of GOM practices on economic performance, the model assumes that this relationship is further mediated by the level of environmental performance. Taken together, the developed model is expected to contribute to the theoretical development of processes and performance of GOM implementation. More discussion supporting the preceding arguments of this research on the possible direct and indirect links between GOM adoption and firm environmental and economic performance is provided in the next sections.

The discussion to this point focused on the importance of various stakeholder pressures, various GOM practices and performance of the firm. However, a comprehensive EM model needs to integrate all these factors together (Wagner, 2011) and, at the same time, examine other moderating and mediating factors that may impact on these relationships (Sarkis*et al.,* 2010; Dixton-Fowler *et al.,* 2013; Ye *et al.,* 2013; Schrettle *et al.*, 2014). Among the potential factors,one mediating factor (environmentally oriented CFC), and three moderating factors related to firm characteristics ((i) pollution intensity, (ii) size, and (iii) international orientation) have been identified as essential in this research. These factors are some of the most important ones, which are likely to mediate or moderate the relationships between EM drivers, practices and performance. The literature regarding the influence of these mediating and moderating factors on the effectiveness of organizational environmental efforts is presented next. The word **effectiveness** refers here to the quality of environmental practices and their ability to achieve what they are intended to achieve.

2.6 Linking drivers and practices of GOM: Mediation of organizational internal capabilities

The growing environmental concerns of various stakeholders have driven many firms to devote substantial resources, time and effort to EM. When designing environmental activities, firms sometimes fail to equally satisfy the requirements of all stakeholders (Neu *et al.,* 1998; Buysse and Verbeke, 2003). This may occur because firms lack the required internal capabilities that enable them to achieve successful stakeholder management and to effectively adopt GOM practices (Sarkis *et al.,* 2010). The development of these capabilities is important for enabling the firm to make better decisions regarding the type of GOM practices to be adopted, the moment when these practices should be adopted, and to facilitate the process of incorporating the environmental issues when the firm decides to do so (Claver *et al.,* 2007). The capabilities that have been highlighted in the literature include: the ability of integrating stakeholders; training and involving all employees in the process of green innovations; having a shared vision about the environmental management; top management support; internal integration of EM strategies with other general management strategies and decentralizing control techniques (Hart, 1995; Christman, 2000; Zhu *et al.,* 2008a; Sarkis *et al.,* 2010; Wagner, 2011; Ye *et al.,*2013). This research considers the level of environmentally oriented Cross-Functional Collaboration(CFC) as a critical capability that may enable more effective stakeholder management and successful adoption of GOM programs.

2.6.1 Cross-functional collaboration as a critical environmental capability

As highlighted in Section 2.2, the RBV of the firm suggests that close competitors differ in their competitive positions based on the importance and durability of their resources and capabilities (Barney, 1986). When considering environmental management, dynamic capabilities which enable the firm to continuously adjust resource allocations based on environmental changes (Helfat and Peteraf, 2003), including environmental programs for resource acquisition, resource reconfiguration and integration of operational resources and activities (Aragon-Correa and Sharma, 2003, Sarkis *et al.,* 2010).

In this research, it is believed that the strategic value of various environmental initiatives will depend on a firm's ability to develop an environmentally oriented CFC (the inter-departmental collaboration) between the core functional areas of the firm. The development of firm specific and 'knowledge based' capabilities can be a source of long lasting competitive advantage (Aragon-Correa and Sharma, 2003). Because of the lack of a generally accepted definition of CFC in the literature, environmentally oriented **cross-functional collaboration** is defined here as the degree of intra-organizational collaboration, interaction and integration of core functional areas (design, R&D, purchasing, operations, production, quality, marketing, logistics, accounting, information technology, strategic management, public relations and customer service) on environmental management (Auh and Menguc, 2005). This definition may include environmentally oriented operational and strategic collaboration to resolve conflicts, enhance mutual trust, common environmental goals, risk sharing, information and resource sharing, sharing of environmental planning, teamwork and efficient communication, and other collaborative efforts between different departments (Handfield *et al*., 1997; Tan and Voderembes, 2006). CFC requires continuous interaction and collective effort across functional areas to reduce the environmental impacts associated with products and processes. Although the development of CFC may be challenging, it is likely to improve stakeholder management and enhance the environmental capability of the firm.

Inter-departmental collaboration enables the firm to effectively manage and deal with task inter-dependency (Thompson, 1967; Auh and Menguc, 2005). It also aims to eliminate the traditional organizational structure that is based on the specialisation, centralisation and departmentalisation, which focuses on grouping activities into separate departments, and encourages a more flexible, organic, informal and decentralised structure (Burns and Stalker, 1961; Heckscher and Adler, 2006: Fiedler, 2010). This informal and flexible organization structure is more suitable for innovation, entrepreneurial behaviour and quick decision-making (Allen et al., 2007; Cuijpers *et al.,* 2011), such as the adoption of GOM practices. In supply chain management, the development of inter and intra organizational collaboration capabilities is considered a good source of competitive advantage (Flynn *et al.,* 2010). Firms tend to develop this capability to achieve efficient and effective flows of information, products, money and services, which enable them to deliver optimum value to their internal and external customers in the shortest time and at the lowest possible cost (Flynn *et al.,* 2010; Wong *et al.,* 2011). However, in SCM, internal collaboration is considered the foundation upon which external collaboration can be achieved (Wong *et al.,* 2011). The same argument is also applied to the adoption of environmental practices. Environmental initiatives rarely occur in a specific department and generally incorporate other departments within and across firms (Hart, 1995; Handfield *et al*., 1997). Hence, proper adoption of environmental practices may require more internal collaboration and coordination among various functions of the firm (Carter, 2005). Lack of coordination may lead to conflicting ecological or operational objectives, which in turn incurs more coordination costs and imposes ineffective utilization of organizational resources (Wagner, 2011).

Complex organizations intending to adopt complex processes such as GOM, should balance the pressures for differentiated products or processes in response to environmental pressures, with the negative implications of developing these specialised products or processes on limited organizational resources. These negative implications can result from inter-departmental conflicts and inconsistency of goals among these departments (Lawrence and Lorsch, 1967; Sarkis *et al*., 2010). Although inter-departmental differences and conflicts and their related negative implications might be overcome by integrating environmental decisions across various departments (Wagner, 2007& 2011), the establishment of successful projects may require a long-term inter-departmental collaboration (Adler, 1995). The inter-departmental collaboration depends on the deployment of human resources and emphasizes the synchronisation of activities of different parties involved in the execution of a specific task (Hauptman and Hirji, 1999). While integration focuses mainly on what the environmental programs or projects entails, the collaboration emphasizes how environmental projects should be successfully undertaken (Born and Margerum, 1993). Successful inter-departmental collaboration may provide the foundation to successfully undertake intensive and complex tasks such as the adoption of GOM practices. These arguments imply that integration and collaboration are different and even "are not mutually substitutable", though they tend to address similar issues (Hauptman and Hirji, 1999; 180). Unlike integration which focuses on the intersection of common goals (Wagner, 2011), collaboration focuses on a collective, deep determination to achieve an identical objective which most of the time requires stronger power of project, rather than departmental leadership (Clark, 1992). Functionally fragmented efforts, due to the lack of inter-departmental collaboration, (Born and Sonzogni, 1995) and restriction in information and resources flow across organisation core functional areas make GOM unfeasible (Ravi and Shanker, 2005; Govindan *et al*., 2014). By establishing an environment of continuous communication and coordination between different departments, collaboration may allow for more flexible and mutual adjustment of resources required for the effective adoption of complex products and production processes. Although the literature has suggested that CFC can play an important role in successfully implementing environmental initiatives, the possible mediating role of CFC on the relationship between the drivers and process of EM has not been investigated.

2.6.2 Contingency perspective on the effectiveness of CFC for GOM

Although the above discussion suggests that achieving CFC is often considered an important capability in effective GOM (Darnall *et al*., 2008; Zhu *et al.,* 2008a), it is still not very clear how organisational internal capabilities, such as CFC, can lead to good outcomes. Some studies found that CFC can enhance the firm's ability to successfully implement GOM initiatives (Zhu *et al.,* 2008a; Gonzalez-Torre *et al.,* 2010), whilst others maintained that more inter-departmental coordination and collaboration may complicate the decision making process (Sethi, 2000), reduce employee satisfaction (Karlsson and Ahlstrom, 1996) and increase overall costs (Iraldo *et al*., 2009). These studies suggest that there are no specific practices that can be called 'best', but that the most important element is the fit between the adopted practices and the context. A misfit will negatively influence the effectiveness of organizational programs and its associated performance outcomes. Therefore, based on these arguments and with the support of the contingency theory (Fiedler, 1964), one can argue that the effectiveness of organizational environmental capabilities (such as the development of CFC) depends on the environment in which these capabilities are adopted. Also, an adequate level of fit between firm conditions and the developed capability should positively affect the effectiveness of environmental initiatives. This research attempts to provide more clarity into when CFC is going to result in a more effective adoption of GOM practices by empirically examining the moderating impacts of three potential moderators related to firm characteristics (size, pollution intensity and international orientation). In other words, this research posits that though CFC is an important capability that can play a significant role in effective GOM practices adoption, the combination of CFC with other variables may be of greater (or lesser) importance. Examining the moderating effects of firm characteristics on the CFC— GOM practices adoption can provide a new insight into situations where the effectiveness of CFC is maximised.

The RBV of the firm identifies the resources and capabilities that enable the firm to achieve a better outcome and a competitive advantage (Barney, 1986, 1991). In the context of this research, this may include the level of CFC within the firm. Despite the many contributions of the RBV theory, it could not provide an explanation of the firm's heterogeneity due to contextual factors (Ginsberg, 1994). In other words, the RBV does not consider the influence of contextual factors on the organisation's ability to maximise or maintain the effectiveness of its sustainable difference. Some studies argued that contingencies can have important influences on the firm's heterogeneity (Wagner, 2007; Flynne *et al.,* 2010; Wong *et al,* 2011), and thus, they should be considered when studying the organisational environmental strategies and competitive advantages (Christmann 2000; Bowen *et al.,* 2001b; Sharma and Starik 2002; Wagner, 2011). The contingency theory has been widely used in the strategic management literature and it argues that "*there is no one best way of organizing and that an organizational style that is effective in some situations may not be successful in others*" (Fiedler, 1964, p. 150). This theory emphasizes the role of organisational contextual factors and it suggests that for organizations to avoid any loss of performance they need to match their internal features and strategies with the requirements of the external environment (Lawrence and Lorsch, 1967; Donaldson, 2001). Using the contingency perspective, this research argues that the effectiveness of the CFC for GOM depends on the context of implementing it.

Although the literature identified several advantages of CFC (Zhu *et al.,* 2008a; Fiedler, 2010), some disadvantages of CFC were also reported in previous studies. For example, Sethi (2000) found that the involvement of multiple functions can increase the complexity of the decision making processes. Oslon *et al.,* (1995) also argued that decentralised decision-making approaches and informal communication among employees of different departments in the inter-departmental collaboration in some cases are less efficient and more time consuming when compared to more centralized approaches of management. Moreover, inter-departmental collaboration often requires employees to be responsible for more than one task and work continuously with employees with different perspectives, goals, values and backgrounds, which ultimately may lead to conflicts in personnel assignment, technical and resource issues, increase in workload and reduce employee satisfaction (Karlsson and Ahlstrom, 1996). These and other disadvantages of CFC reveal that developing this coordination capability may increase the overall operational cost (Iraldo *et al*., 2009), increase the work complexity (Sethi, 2000) and reduce the chances of effective adoption of complex practices such as those related to GOM. This implies that the benefits of CFC may vary depending on the specific condition (or characteristics) of the firm. This can happen because there might be more visible environmental implications from operations in some firms compared to others (Brammer and Millington, 2006), which in turn could influence the ability of a firm to take full advantage of its internal environmental resources and capabilities. For instance, operations of larger firms tend to be more visible to a wider range of stakeholders and thus they are more likely to be under continuous public scrutiny (Brammer and Millington, 2006). The growing pressure on large firms can drive these firms to be more concerned and willing to enhance their environmental capabilities (Henriques and Sadorsky, 1999; Min and Galle, 2001) by developing critical capabilities such as CFC. Also, small firms may be more flexible and more able to accept changes and to respond to environmental challenges than their larger counterparts (Chen and Hambrick 1995). The CFC may be needed to a greater extent by larger firms to meet their environmental commitments and to achieve more flexible and effective implementation of GOM practices. In addition, national contexts can have strong influences on commitments and resources devoted to the development of environmental practices (Sharma and Vredenburg 1998). Environmental expectations and challenges in some countries are stronger than in others (Zhu *et al*. 2007). This may raise questions regarding the generalisability of the effectiveness of internal capabilities such as CFC in improving environmental abilities when the firm is operating in stricter countries (or in more than one country) compared to firms operating in less strict countries (or just focusing on the domestic market). Indeed, the above arguments imply that the relationships between CFC and GOM is more complicated in that CFC can positively impact the implementation of environmental initiatives, but its combination with other firm contextual factors may further enhance (or diminish) the success of effective adoption of GOM practices. This suggests that there is a need to investigate the contingency effects of organisation conditions (e.g., characteristics) under which the effectiveness of the CFC can be maximised.

Despite the increasing recognition of the importance of the organizational internal capabilities in the development of environmental initiatives (Russo M, Fouts, 1997; Zhu *et al.,* 2008a; Sarkis *et al.,* 2010), the above arguments reveal that our understanding of the true influence of CFC and other internal capabilities on effective GOM remains unclear. This research intends to provide insight in this area by determining the conditions under which CFC can be more effective. This will be done by testing the possible moderating effect of three specific firm characteristics (pollution intensity, size and international orientation) on the relationship between CFC and GOM practices. It is important to note that the three firm characteristics used in this research are by no means exclusive and the author acknowledges that other characteristics of a firm might also have a moderating influence on the effectiveness of the CFC. However, these three characteristics have been widely considered as among the most important moderating variables when studying GOM practices (Buysse and Verbeke, 2003; Zhu *et al.,* 2007; Dixton-Fowler *et al.,* 2013).

2.7 Summary of the literature review

Based on the discussion in sections 2.1 – 2.6**,** the literature shows that recent years have seen growing interest in studying the degree to which various stakeholders contribute to enterprise environmental initiatives and performance (Sharma and Henriques, 2005; Sarkis *et al.,* 2010). The literature suggests that pressures of different groups of stakeholders do impose significant influence on enterprise environmental practices through direct and indirect actions for or against certain environmental practices(Tilt, 1994; Baron, 1995; Henriques and Sadorsky, 1999; Delmas, 2001). In order to effectively respond to pressure from stakeholders, firms are increasingly adopting various internally and externally focused GOM practices to reduce their environmental impacts throughout the entire PLC (Zhu *et al.,* 2012& 2013). However, adopting these practices does not always result in satisfactory environmental and economic solutions (Zeng *et al.,* 2010a). Due to the mixed findings of previous empirical studies on the relationship between EM driver, practices and performance of GOM some recent studies suggested that the relationships between these factors are not straightforward, and that other factors might mediate (Rueda-Manzanares *et al*., 2008; Sarkis *et al.,* 2010; Wagner, 2011) or moderate (Wagner, 2011; Dixton-Fowler *et al.,* 2013) these relationships, which need to be further investigated. These arguments imply that in order to have a better understanding of the relationships between antecedents and consequences of adopting GOM practices, the development of an integrated model that links and simultaneously examines the relationships between these factors is needed. Rarely, empirical studies attempt to include drivers, enablers, practices and performance of EM in a single study and this research uses such an approach. The literature review shows that some interesting questions remain unanswered and that there are some critical gaps. The following section discusses some of these gaps, which the current research intends to fill.

2.8 Research gaps in the literature and their significance

Despite the rich literature on all the above-discussed topics related to antecedents and consequences of adopting GOM practices, there are still some gaps in the existing literature. The gaps highlighted in this section are those that this research intends to fill. A detailed discussion of these gaps was provided in sections 2.1, 2.4, 2.5 and 2.6.

Research Gap 1:*The lack of empirical studies to conceptualise the complementarities of environmental practices when studying the relationships between antecedents and consequences of GOM practices*

As highlighted in section 2.4, the arguments of recent GOM studies (e.g. Zhu *et al.,*2008c, 2012 & 2013) suggest that both internally and externally focused GOM practices are important for the firm to develop an effective environmental program. This may imply that to arrive at a clearer understanding of the possible relationship between antecedents and consequences of GOM practices, various internal and external sets of green practices should be used.

The collaboration and integration of firm resources and capabilities is a key for innovation (Yeung *et al.,* 2007) and for achieving superior performance (Zhu *et al*., 2012). When considering the increasing complexity and interdependency of GOM research and practice (Zhu and Sarkis, 2004), some researchers have even argued that firms cannot keep isolating their relevant GOM efforts and depend solely on either internal or external aspects of GOM (Sarkis, 2003; Zhu and Sarkis, 2004; Zhu *et al.,* 2013). Firms might need to collaborate and integrate various GOM activities, and consider these as complements to each other to reap the full benefits of their implementation.

So far, in addition to the traditional independency view of different elements of GOM (Zhu *et al.,* 2007), only the moderation (Wong et al., 2012) and mediation models (e.g., Zhu *et al.,* 2012& 2013) of interdependency of GOM elements are used in GOM research. This suggests that a bivariate perspective of the interdependency of these elements is dominant in the existing GOM studies. Yet, no research has attempted to study this interdependency aspect from a holistic perspective, considering various GOM elements as complements.

The complex and multi-disciplinary nature of GOM studies may have caused this paucity of empirical insights and knowledge about the implications of the collective and complementary adoption of GOM practices, thus providing inconclusive results on the antecedents, processes and consequences of GOM. Examining the complementary adoption of various GOM practices and its relations with the antecedents and performance outcomes can help to integrate the findings on GOM and provide better theoretical and managerial insights on how the complexity of various GOM practices could be dealt with when implementing them. Therefore, this research aims to extend the existing contributions on interdependency of GOM practices and investigate whether conceptualising the complementary adoption of various GOM practices provides a better understanding of the relationships between driver, practices and performance of GOM, and whether this may have greater effects on organisational performance compared to the isolated, competitive, adoption of each set of GOM.

Research Gap 2:*The lack of empirical studies to examine the influence of both market and non-market stakeholder pressures on the adoption of GOM practices*

As pointed out in section 2.1.1, various market and non-market stakeholder groups impose significant influence on environmental management. Accordingly, firms have realized the importance of responding to pressures from various stakeholders to improve their competitive position (Freeman, 1992). However, firms should also manage the various perspectives and conflicting interests of these stakeholders with their internal scarce resources (Rueda-Manzanares *et al.*, 2008), and at the same time be able to be more competitive (Hart, 1995). This suggests that it is important for the firm to identify, understand and meet the demands of its influential stakeholders (Delmas, 2001) to develop an effective environmental program.

Some studies argued that not all stakeholders and their concerns are important to the firm and that firms tend to prioritise stakeholder environmental requirements (Mitchell*et al.,* 1997; Post *et al*., 2002; Wu and Pagell, 2011). For managers, developing environmentally responsible products and production processes is important to satisfy their critical stakeholders. Characteristics of specific groups of stakeholders were considered as a critical factor to determine the stakeholder ability to influence firm's environmental strategies (Kassinis and Vafeas, 2006; Cronin *et al.,* 2012). For example, from a performance standpoint, relationships with market stakeholders were found to create strong value to the firm (Rivera-Camino, 2007). However, non-market stakeholders who include the legal, political and social organisations manage the interaction processes between firms and their public or their market stakeholders (Baron, 2000). Thus, they have more capacity to change the public opinion for or against firm environmental practices (Freeman, 1984; Rowley, 1997). When considering the adoption of GOM practices, these arguments raise the question of whether firms will give equal attention to the concerns of market and non-market stakeholders. This issue has not been answered thoroughly by previous GOM studies. In this regard, Schoenherr *et al.*, (2012) recently argued that there is a need to investigate the role of stakeholder concerns such as government regulations on organisational environmental initiatives. Examining the influence of market and non-market influences on environmental commitments can help to explain how managers prioritise stakeholders concerns when making decisions about various GOM practices. This study aims to empirically investigate whether manufacturing firms will devote more resources to respond to pressures of market stakeholders or pressures of non-market stakeholders, or whether equal attention will be given to meet the requirements of both stakeholders groups.

Research Gap 3:*The lack of empirical studies to examine both the direct and indirect impacts of collective GOM practices on organisational environmental and economic performance*

As discussed in section 2.5, firms can adopt numerous environmental practices but adopting these practices may not always result in good economic performance (Bowen *et al.,* 2001a; Matos and Jeremy, 2007; Zhu *et al.,* 2007). Indeed, the amount of resources and commitments allocated to the development of these practices by different firms might be a good reason behind performance variations (Menlyk *et al.,* 2003; Elsayed, 2006). For instance, firms adopting only internal GOM practices may differ in their resources and capabilities from those adopting both internal and external GOM practices, which can influence the level of performance a firm can achieve. Using the perspective of the complementarity theory, this research argues that this resource allocation for simultaneous development and deployment of various green practices will influence the firm's ability to achieve good economic outcomes, an issue that has yet to be investigated.

This research aims to empirically investigate the *direct* effect of the simultaneous-complementary adoption of various GOM practices on organisational environmental and economic performance. The economic performance is conceptualised by two distinct constructs (business benefits and spending) to assess both the positive and negative economic performance implications of the collective adoption of GOM practices. Although the literature has acknowledged that there are both positive and negative economic implications of GOM practices (Zhu and Sarkis, 2004 & 2007; Gonzalez-Benito and Gonzalez-Benito, 2005; Ambec and Lanoie, 2008), many of the existing studies have conceptualised the economic performance as a single construct. Indeed, the way in which economic performance was measured may have partially caused the mixed findings by previous studies (Gonzalez-Benito and Gonzalez-Benito, 2005; Dixton-Fowler *et al.* 2013). Zhu and Sarkis (2004) emphasised the importance of differentiating between the positive and negative economic outcomes of GOM practices to evaluate whether the positive (negative) outcomes exceed the negative (positive) outcomes, and then to provide managers with a clearer picture of whether it really pays to be green or not. Following Zhu and Sarkis (2004) suggestions, in this research the positive and negative impacts of GOM practices are assessed using two different constructs: '**business benefits**' and '**spending'**. The **business benefits** refer to the possible strategic and operational business benefits gained through the adoption of GOM practices (e.g. enhancing the reputation and image of the firm, opportunities to enter new markets, cost avoidance, reduction of overall resource usage and cost of production). The **spending** refers to the negative impact of GOM by increasing the levels of spending (including increase of overall investment, increase of training cost, increase of operational cost, and increase of costs for purchasing environmentally friendly materials). This research intends to extend the literature by considering the direct influence of the collective-complementary adoption of GOM practices, rather than the individual-isolated adoption used by (e.g.Zhu and Sarkis, 2004).

Apart from the assessment of the *direct* performance impacts of collective GOM competency, this research also aims to test if the collective GOM competency is *indirectly* related to the economic performance via the environmental performance. Many researchers believe that greening different phases of operations and SCM leads to positive environmental performance (Rao and Holt, 2005; Zhu *et al.,* 2012), implying that GOM initiatives should directly influence the economic performance (Zhu and Sarkis, 2007; Ye *et al.*, 2013), regardless of whether this influence is positive or negative. However, whether collective implementation of various green initiatives is indirectly related to the economic performance through the level of the environmental performance is yet to be investigated.

The possible correlation between corporate environmental efforts, environmental performance and economic performance has been a major issue of GOM studies (Russon and Fouts, 1997; Murphy, 2002;Menguc *et al.,* 2010), but a clear conclusion is still missing in the literature (Zeng *et al*., 2010a). This suggests that the relationship between these factors is more complex and not as straightforward, highlighting the need to examine the possible mediated or moderated (rather than direct) relationships between these factors (Wagner, 2011; Dixton-Fowler *et al*., 2013). Accordingly, this research examines if the relationship between collective GOM competency and economic performance is mediated by environmental performance. Such a study is important to identify the nature of the causal relationships that exist between GOM efforts and environmental and economic performance of the firm. Doing so may also provide an explanation as to why some firms implement advanced GOM practices and achieve satisfactory levels of environmental and economic performance while others do not.

Research Gap 4:*The lack of empirical studies to examine the mediating role of the CFC on EM drivers and practices*

The literature shows that the adoption of green initiatives driven by the pressures of various market and non-market forces does not lead per se to the development of effective environmental programs (Reinhardt, 1998; Claver *et al.,* 2007). To build effective and more competitive environmental programs, the RBV of the firm suggests that development of specific internal enabling capabilities is needed (Sarkis *et al.*, 2010). These capabilities help to achieve a balance between the growing, and sometime conflicting, stakeholder pressures for environmentally responsible operations and the organisational scarce resources (Rueda-Manzanares *et al.,* 2008;). In the context of this research, the internal environmentally oriented capabilities include CFC.

As discussed in section 2.6.1, CFC can improve operational and business capabilities of the firm and enable a sustainable competitive advantage. It can also allow the firm to accept changes easily, encourage the use of employee innovations and make quick actions (Carter and Jennings, 2002; Heckscher and Adler, 2006;Fiedler, 2010). CFC is important because when environmental problems increase; stakeholders are interested to know which department of the organization has caused the problem, but are also interested to know whether the firm has fulfilled its environmental obligations or not. Inter-departmental collaboration opens multiple channels for receiving requirements from various stakeholders and at the same time enables the firm to respond in a more cohesive way and as a completely integrated unit.

Some recent studies (e.g., Rueda-Manzanares *et al.,* 2008;Sarkis *et al.*, 2010) argued that the relationship between stakeholder pressures and the adoption of GOM practices is more likely to be mediated by some critical organisational capabilities. Previous GOM studies have not considered the possible mediating role of CFC on this relationship. In particular, the literature on the role of CFC for effective environmental management lacks a specific framework that explains the nature of the causal relationship GOM practices. Hence, this research aims to contribute to the literature by investigating this relationship.

Research Gap 5:*The lack of empirical studies to examine the moderation role of firm characteristics on the effectiveness of cross-functional collaboration for adopting GOM practices*

Inter-departmental collaboration has been suggested as a key enabler for successful adoption of GOM practices (Claver *et al.,* 2007; Zhu *et al.,* 2008a). As discussed in section 2.6.2, a close review of the literature reveals some degree of difference in terms of how firms perceive the strategic values of CFC, how much they are willing to develop CFC, and ultimately how CFC leads to effective adoption of GOM practices. This suggests that contingencies can play a significant role in determining the extent to which a firm can benefit from its voluntary efforts to improve its environmental capabilities (Wang *et al.,* 2008), and thus more contextual studies are needed when examining the relationship between CFC and GOM practices. The existence of these differences may also raise an important question regarding which firms (e.g. large vs. small, international vs. domestic, and highly vs. less polluting) are more positively affected by the CFC. This research aims to provide more clarity on this matter. Particularly, it examines the conditions under which CFC may be more effective for adopting GOM practices by determining specific firm characteristics (pollution intensity, size, and international orientation) that might moderate the relationship between CFC and GOM practices.

Chapter 3 RESEARCH CONCEPTUAL FRAMEWORK

This chapter aims to provide a detailed explanation of the conceptual framework of the current research. It begins by summarising the research questions and objectives (Section 3.1). Then, the conceptual framework (Section 3.2) and the fundamental hypotheses (Section 3.3) of this research are discussed.

3.1 Research questions and objectives

This research intends to extend our knowledge and provide new insights in the area of antecedents and consequences of GOM practices by filling the previously discussed theoretical gaps in the literature (see Section 2.8). This is achieved by developing and empirically testing an integrated conceptual model that simultaneously links and tests the relationships between EM drivers, practices and performance. It also incorporates other mediating and moderating factors that are likely to influence the relationship between these factors. However, prior to developing the conceptual framework, the research questions and objectives are summarised as follows.

Main research question: ***What are the relationships between drivers, practices and performance of green operations management within the Omani manufacturing sector?***

Sub-questions:

1- Does the complementarity model of adopting GOM practices better explain the links between drivers, practices and performance of GOM compared to the individual adoption of GOM practices model?, and does the collective competency of various GOM practices have a greater effect on organisational performance compared to the individual competencies?

2- To what extent do market stakeholder pressures influence the firm to adopt various GOM practices compared to non-market stakeholder pressures?

3- What are the direct and indirect relationships between GOM practices and environmental performance, business benefits and spending of the firm?
4- Does CFC mediate the relationship between stakeholder pressures and the adoption of GOM practices?
5- Do firm characteristics (i.e. pollution intensity, size and international orientation) moderate the relationship between CFC and GOM practices?

In order to provide empirical answers to these research questions, the objectives of this research are as follows.

Main objective: Develop a single integrated conceptual model that simultaneously links and examines the relationship between stakeholder pressures, environmentally oriented CFC, the complementarity of various (internally and externally focused) GOM practices and environmental and economic performance.

Sub-objectives:

1- To empirically test the superiority of the complementarity model of GOM practices in explaining the relationship between stakeholder pressures, GOM practices and performance of the firm, and to examine the influence of the collective adoption of GOM practices on improving organisational performance.
2- To empirically examine the effects of two groups of stakeholders (market and non-market stakeholders) on the adoption of GOM practices by firms.
3- To empirically examine the direct effects of collective GOM practices on environmental performance, business benefits and spending, and its indirect, mediated, effects on organizational business benefits and spending via environmental performance.
4- To empirically investigate the mediating effect of environmentally oriented cross-functional collaboration on the relationship between stakeholder pressures and the adoption of GOM practices.

5- To empirically investigate the moderating effects of three firm specific characteristics (pollution intensity, size and international orientation) on the relationship between CFC and the development of GOM practices.

In summary, this study responds to the call from various previous researchers for the need to build a single integrated EM model. More importantly, this integration can assist managers in making sound decisions regarding pollution reduction strategies of their companies, and allow them to bring new insight into the strategic role of matching external forces and internal resources and capabilities when making strategic choices. Further, learning about the status of drivers, practices and performance of EM for the GCC manufacturing firms in general and in Oman in particular will add to the knowledge as no empirical study as yet has been conducted to investigate these issues in this region.

3.2 Research conceptual framework:

The integrated conceptual framework (Figure 3.1) developed for this research was based on understanding the current literature on EM drivers, enablers, practices and performance of manufacturing firms. The framework shows that stakeholder influences the adoption of GOM practices, which in turn affects organisational performance. The framework allows investigating the complementarity of GOM practices and the possible conditional mediation role of CFC. The market-oriented perspective of linking these factors in the developed framework is rooted in the RBV of the firm. The RBV explains how the market competitiveness can be influenced by addressing stakeholder requirements and incorporating their environmental concerns into products, services and production processes (Hart, 1995). Improvement of business performance is a result of internal factors (such as the development of GOM capabilities (Sarkis *et al*., 2010)) and external factors including management of stakeholder environmental concerns (Delmas and Toffel, 2008).

In the proposed framework, stakeholder pressures and organisational internal enabling capabilities are the main antecedents of GOM practices. The stakeholder influence is related to stakeholder theory, which explains environmental commitment by the firm in response to both market and non-market stakeholders (Baron 1995, 2000). The GOM literature suggests that pressures of market stakeholders are critical drivers for the adoption of GOM practices (Walker *et al*., 2008; Sarkis *et al.,* 2010). In addition, the role of non-market stakeholders as important driving forces for increasing organisational GOM efforts have also been recognized by previous studies (Hamilton, 1995; Zhu *et al.,* 2005; Genovese *et al.,* 2013).

The second main antecedent of GOM practices is the availability of organisational internal complementary capabilities (or enablers). These refer to the potential environmental capabilities of the firm that could facilitate the adoption of GOM practices in response to various environmental concerns when the firm decides to do so (Sarkis *et al.,* 2010). These facilitating capabilities enable the firm to better understand and effectively incorporate stakeholder environmental requirements within environmental strategies (Rueda-Manzanares *et al.,* 2008). These capabilities may include the level of CFC in the firm (Carter and Jennings, 2002;Melnyk *et al*., 2003; Zhu *et al.,* 2008a). In addition, GOM contingency studies suggest that the firm's willingness to develop GOM programs (Buysse and Verbeke, 2003; Schrettle *et al.,* 2014) and its ability to reap the full benefits of its internal resources and capabilities (Dixton-Fowler *et al.,* 2013) may vary depending on internal contextual factors such as firm size, pollution intensity and international orientation. Accordingly, in this research, the CFC is considered as a mediator for the relationship between drivers and practices of GOM. The benefits of CFC development for effective GOM is proposed to be contingent on three firm specific characteristics (size, pollution intensity and international).

The adoption of GOM practices influences organisational performance. In the GOM literature, a lot of attention has been given for examining the direct effect of GOM practices on environmental and economic performance. Although the literature has shown that GOM positively related to environmental performance, the empirical findings regarding the relationship between GOM practices and economic performance were mixed (Rao and Holt, 2005; Lopez-Gamero *et al.,* 2009; Zeng *et al.,* 2010a). It may be the way in which economic performance was conceptualised in these studies that caused these mixed results (Zhu and Sarkis, 2004). In recent years, several studies have argued for the importance of conceptualising the economic implications of GOM practices as two distinct constructs, such as influence on revenue and spending/cost (Wu *et al*., 2014) or positive economic performance and negative economic performance (Zhu and Sarkis, 2004) to reflect the positive and negative economic outcomes of implementing GOM practices. This approach is also used in this research. Accordingly, in this research the term 'business benefits' is used to reflect the business benefits gained through GOM practices. Furthermore, the term 'spending' is used to reflect negative business outcomes resulting from GOM practices.

This modelling approach enables the researcher to better understand whether there is an equal positive and negative influence, or whether the positive (negative) results exceed the negative (positive) outcomes. Some recent studies also argue that the mixed findings of previous studies might be due to the possibility that the relationship between GOM practices and economic performance is further mediated by other factors (Dixton-Fowler *et al*., 2013; Zhu *et al.,* 2013). This research proposes that environmental performance should be considered as an important mediating factor for the relationship between the collective adoption of GOM practices and the two dimensions of organisational economic performance. That is, the improvement of environmental performance is expected to result in increasing the level of positive economic outcomes, and at the same time, it would lead to an increase in organisational spending caused by increased investment in various GOM initiatives.

The framework in this research also proposes that there is complementarity between various elements of GOM. It posits that it is important to conceptualise the complementarity and interdependency processes among different, yet interrelated, GOM activities when investigating the relationship between antecedents and consequences of GOM. GOM studies tend to treat various elements of GOM as competitive, rather than complementary, to each other, resulting in having inconclusive findings. Accordingly, the collective and complementary influence of various GOM practices is conceptualised in this research by integrating four distinct yet interrelated GOM practices into a second order factor called 'collective GOM competency'. As highlighted earlier, these 'first order' GOM practices (i.e. EMSs, eco-design, source reduction and external environmental management) are considered among the most important green practices that a firm might adopt to eliminate the negative environmental impacts of its products or production processes (Zhu and Sarkis, 2004; Sarkis *et al.,* 2010). It is important to highlight that a main reason for using four, rather than only two (i.e. external and internal) sets of GOM practices is to meet the minimum required criteria for using multivariate statistical techniques (SEM, which is the main data analysis technique used in this research) of having at least three first order factors to represent the second order factor (Hair *et al*., 2006; Byrne, 2010). Although the first order factors represent different environmental practices, it is assumed that their values change based on a firm's ability to effectively adopt various types of environmental practices simultaneously.

Accordingly, five main hypotheses and one proposition have been developed. The next section provides a detailed discussion of these hypotheses. It is worth noting that within this study both propositions and hypotheses were used to answer the research questions following the approach used by Mishra and Shah (2009).

P1: The collective GOM competency combining four sets of GOM practices will have greater performance impacts than the total performance obtained from using each one of these practices separately.

H1: Market stakeholder pressures (H1a) and non-market stakeholder pressures (H1b) positively influence the adoption of GOM practices by firms.

H2: A greater amount of resources and commitment allocated for the development of collective GOM practices directly leads to higher levels of environmental performance (H2a), greater business benefits (H2b), and greater levels of spending (H2c).

H3: Environmental performance is positively related toorganisational economic performance (i.e. business benefits (H3a) and spending (H3b)), and it mediates the relationship between the adoption of the GOM practices and economic performance.

H4: Environmentally oriented cross-functional collaboration mediates the relationships between market stakeholder pressures (H4a) and non-market stakeholder pressures (H4b) with adoption of GOM practices.

H5: Firm characteristics (pollution intensity (H5a), size (H5a) and international orientation (H5c)) moderate the relationship between CFC and the adoption of GOM practices.

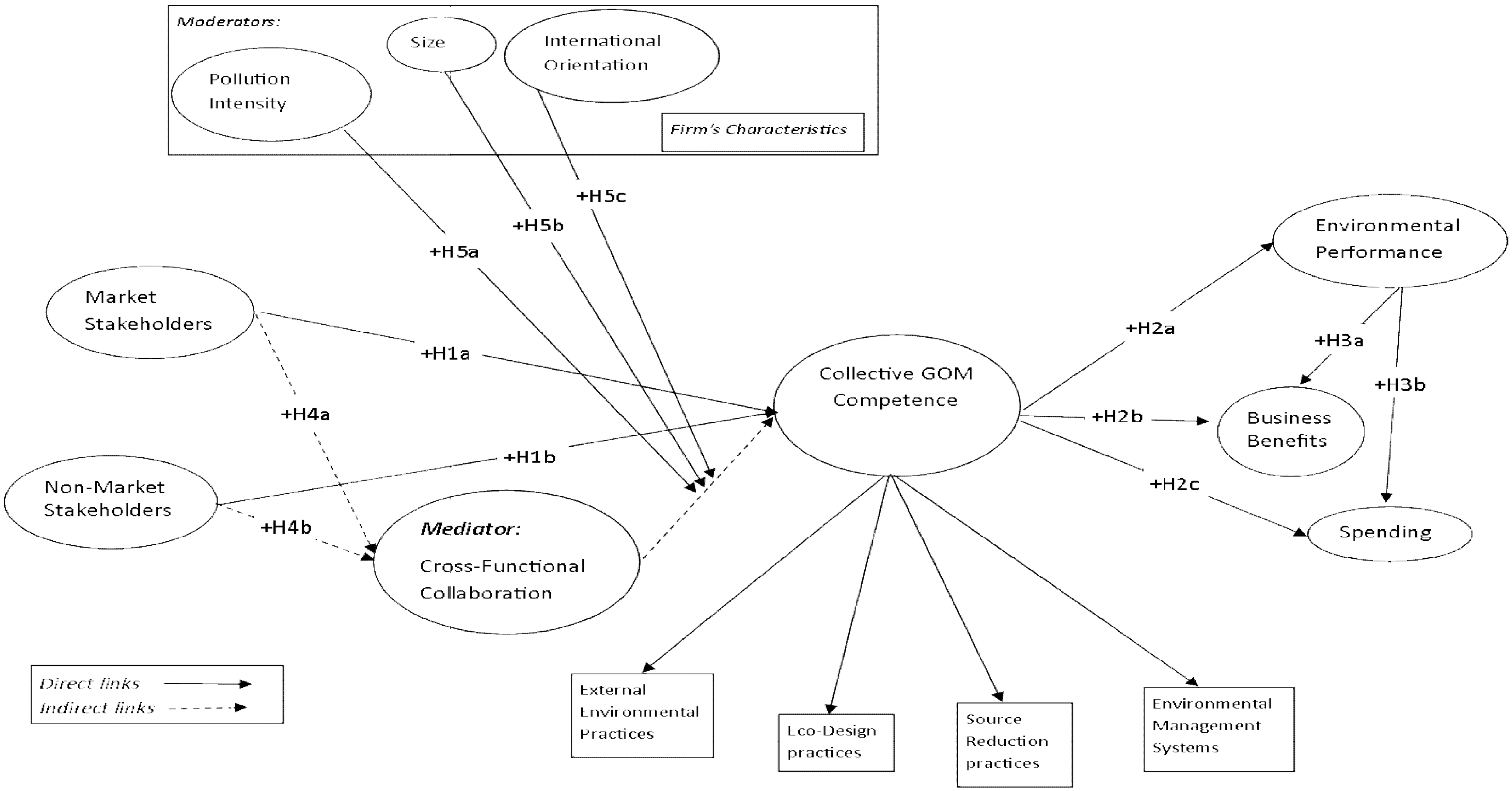


Figure 3.1: Research Conceptual Framework

3.3 Hypothesis development

3.3.1 Conceptualising the complementarities between GOM practices

Complementarity of GOM initiatives is about how internal and external GOM initiatives coordinate and are simultaneously adopted to effectively and efficiently achieve business and environmental objectives. It implies that two or more activities reinforce each other in such a way that the combined sum of the effect of these activities is more valuable than the value of applying these activities individually (Milgrom and Robert, 1995). While the development of specific environmental practices is considered important for the enhancement of organisational performance, according to the RBV of the firm the individual, isolated, adoption of a routine based practice will not be considered a competitive advantage (Sarkis *et al.*, 2010). The integration (or bundle) of internal and external resources and/or practices is considered firm specific knowledge and can be a good source of competitive advantage (Shah and Ward, 2003). This is because it is created within the firm and cannot be easily copied by competitors (Rigby and Zook, 2002; Shah and Ward, 2003).This research integrates the perspectives of the complementarity theory and RBV of the firm. It argues that internal GOM practices complement external GOM practices, such that simultaneous development and implementation of internal and external GOM practices can enable the firm to better satisfy requirements of various stakeholders, enhance its environmental and economic benefits and may lead to long lasting competitive advantage. The internal GOM practices of the firm may increase the benefits obtained from its external GOM practices, and the external GOM practices may enhance the effectiveness and efficiency of the internal GOM practices. For instance, integration of internal environmental practices can enable the firm to better formulate its environmental strategies (Nawrocka *et al.,* 2009), evaluate its internal ability and effectively scan for the external partners who can fill the gaps of firm's internal capabilities, so that it maximises the productivity of its external GOM investments. At the same time, alliance with external supply chain partners allows the firm to gain access to their partners' expertise (e.g., knowledge and technology) (Vachon, 2007). This alliance could, in turn, enable the firm to effectively and efficiently implement various internal GOM programs (Nawrocka *et al.*, 2009) or at least avoid any economic risks associated with the operations of supply chain members. If internal consistency of the activities that implement the different attributes of the GOM strategy is lacking, SCM cannot be useful to enable the firm to effectively respond to socioeconomic pressures (Monczka and Petersen, 2012; Wu *et al.,* 2014). On the other hand, stakeholder requirements sometimes conflict with each other (Rueda-Manzanares *et al.,* 2008). This suggests that the development of a specific green practice may satisfy the requirements of a specific group of stakeholders but not for others. This may highlight the need to simultaneously adopt various types of GOM practices to absorb the requirements of all or several stakeholders. Taken together, the above arguments imply that internal and external aspects of GOM programs are expected to complement each other in responding to various environmental concerns, which is expected to improve the overall firm business and environmental performance.

In this research the simultaneous adoption of individual routine based environmental practices (e.g. EMSs, eco-design and monitoring the environmental performance of suppliers) is expected to be more valuable than when these practices were used separately. Accordingly, following the Zhu (2004), and Mishra, and Shah (2009) approach, the simultaneous and complementary adoption of various GOM practices is conceptualised as a higher order construct called 'collective GOM competency'. The following proposition is formulated:

P1: The collective GOM competency combining four sets of GOM practices will have greater performance impacts than the total performance obtained from using each one of these practices separately.

3.3.2 Linking stakeholder pressures and GOM practices

As discussed in section 2.1**,** investigating the drivers for implementing different environmental practices and improving environmental performance arises from pressures of a number market and non-market stakeholders. Based on previous studies, different stakeholders can influence the adoption of environmental practices (Tilt, 1994, Henriques and Sadorsky, 1999; Sarkis *et al.,* 2010).For example, it has been recognised that pressure imposed by local government, especially in the form of regulations and incentives, is the biggest driving force (Freeman, 1984; Fowke and Prasad, 1996). Also, some studies have suggested that employees and managers (Hanna *et al.,* 2000; Zhang *et al.,* 2008) and external supply chain members(Vachon and Klassen, 2006; Vachon, 2007) are key forces for adopting environmental practices. However, the extent of these pressures will vary from one firm to another depending on the source of pressures (Henriques and Sadorsky 1999; Sharma and Henriques, 2005). Although market stakeholders tend to have more control over critical organizational resources, non-market stakeholders influence the firm's relations with its market stakeholders and impact its reputation (Baron, 2000), suggesting that both of these groups of stakeholders may influence environmental commitments. This leads to the question of whether all these stakeholders may force the firm to adopt various environmental practices at the same degree or whether some of them will have a more significant influence. The following hypothesis is formulated:

H1:Market stakeholder pressures and non-market stakeholder pressures positively influence the adoption of GOM practices by firms.

H1a: Market stakeholder pressures positively influence the adoption of GOM practices by firms.

H1b: Non-market stakeholder pressures positively influence the adoption of GOM practices by firms.

3.3.3 Linking GOM practices and performance

This research focuses on examining the complementary performance effects of four types of GOM practices: EMSs, eco-design practices, source reduction practices and the external EM practices. These four areas represent some of the main environmental activities firms may use when facing environmental concerns. Another question is whether GOM practices are directly and/or indirectly related to economic performance via environmental performance. The following sections discuss the theoretical arguments of the fundamental hypotheses developed in this research regarding the relationships between the adoption of GOM practices and organisational environmental and economic performance, where the latter is conceptualised as two distinct constructs (i.e., business benefitsand spending).

3.3.3.1 Linking GOM practices and environmental performance

EMSs, eco-design, source reduction and the external GOM practices can help in improving the environmental performance, if such improvement is broadly defined as reducing any environmental impacts (Shrivastava, 1995a). Good environmental performance can be achieved from the development of different environmental activities, but different practices may not always have the same impact on environmental performance (Henri and Journeault, 2008). For instance, some studies have suggested that internal environmental activities such as employees' involvement, top management support and having a formal EMS can have a significant effect on improving environmental performance (Klassen and Whybark, 1999; Bowen *et al.*, 2001b, Melnyk *et al*., 2003). Also, external environmental initiatives or what is traditionally called environmental supply chain management has grown in importance. For example, Zsidisin and Hendrick (1998) have highlighted some of the key elements for environmental purchasing, which can improve environmental performance. This includes; cooperation with suppliers to achieve environmental objectives, environmental specifications for purchased goods, suppliers ISO 14001 certification, and environmental auditing for suppliers' internal operations. Some empirical studies also found that environmental collaboration with suppliers and customers can have significant impact upon environmental performance (Bowen *et al*., 2001a; Vachon and Klassen, 2006; Vachon, 2007). Geffen and Rothenberg (2000) argued that coordinating external GOM efforts with internal GOM innovations can enable the firm to improve the level of environmental performance. These findings indicate that the joint adoption of both internal and external GOM practices is expected to have a positive influence on environmental performance. Accordingly, the following hypothesis is proposed:

H2a:A greater amount of resources and commitment allocated to the development of collective GOM practices directly leads to higher levels of environmental performance.

3.3.3.2 Linking GOM practices and economic performance

Internal and external GOM practices such as source reduction, eco-design and forming environmentally oriented collaborative relationships with supply chain members, require continuous improvement of pollution reduction and extensive employee involvement (Hart, 1995; Russo and Fouts, 1997; Vachon and Klassen, 2006; Zhu and Sarkis, 2004 & 2007). These practices can lead to significant improvement in organizational economic performance if managed properly. For example, internal GOM activities that focus on recycling or reusing production waste can enable the firm to achieve large savings (Hart, 1997; Roome and Wijen, 2006) and improve the level of efficiency and productivity (Schmidheiny, 1992). Waste reduction, waste management and eco-design initiatives improve the level of input utilisation (Rusinko, 2007; Zhu and Sarkis, 2008). Further, eco-design and source-reduction activities such as remanufacturing and substituting or reducing the level of harmful materials or components can improve the economic performance of the firm by reducing the cost of non-compliances with stakeholder environmental requirements (Bowen *et al.,* 2001a; Snir, 2001; Zhu and Sarkis, 2004). Darnall and Edwards(2006) and Melnyk *et al*., (2003) have also emphasised that the presence of EMSs should help to build a system of management, organisation, maintenance and control of environmental plans to enable continuous improvement in environmental and economic performance. Internal EMSs were found to play a significant role in improving the firm's overall performance, which includes operational measurements (e.g. quality, lead time, flexibility and innovation), economic measurements (e.g. reputation, cost reduction and profit improvement) and environmental measurements (e.g. waste reduction and environmental impacts) (Melnyk *et al*., 2003; Sroufe, 2003).

Similarly, the role of external GOM initiatives on economic performance has been recognised by the literature. For example, Vachon and Klassen (2006) believe that external GOM activities such as monitoring supply chain environmental activities help reduce the cost of any economic risks of non-compliance with regulations and other environmental liabilities in the supply chain. Previous studies have also shown that establishing environmentally oriented collaborative relationships with supply chain members can facilitate the effective adoption of internal GOM innovations, lead to competitive advantages (Chiou *et al.*, 2011) and increase business performance (Vachon, 2007). These findings show that both internal and external GOM practices can lead to good business outcomes, and ultimately the joint adoption of these practices is expected to offer greater business benefits to the firm.

On the other hand, another group of researchers questioned the causal relationship of sustainable practices and economic growth (Bowen *et al.,* 2001a; Welford *et al.,* 2003). They argued that the implementation of GOM practices can also lead to negative implications on economic performance (Zhu and Srakis, 2004). For instance, corporate environmental initiatives divert valuable resources and thus may lead to a reduction in financial performance (Wang *et al.,* 2008). Werbel, and Carter (2002) and Marquis *et al.,* (2007) also believe that sustainable activities may only enhance the personal reputations of managers but do not benefit profit oriented firms. This might be particularly true in cases where firms adopt voluntary actions without having any clear business benefits, and just because the manager or any other member of the supply chain is highly concerned with the sustainability issues (Marquis *et al.,* 2007). It may also occur when competitive pressures are so high that the firm follows what other competitors in the industry do (Hofer *et al.,* 2012). Link and Naveh (2006) and Zhu and Sarkis (2007) maintained that the adoption of internal GOM practices such as eco-design practice and introducing ISO 14001 certification, will enhance the environmental performance of the firm but will not always lead to economic improvement. In addition, greening the activities of external supply chain members requires more resources and extra coordination efforts with customers and suppliers (Vachon, 2007), which may result in increased cost and investment. In fact, the increasing production costs associated with GOM practices was considered a main barrier to the development of these practices for many firms (Min and Galle, 1997; Govindan *et al.,* 2014). Implementing new environmental initiatives is resource intensive, especially when several initiatives are adopted in parallel (Schrettle *et al.,* 2014). Therefore, taken together, the above arguments suggest that simultaneous implementation of various internal and external GOM practices is expected to lead to both greater business benefits and greater amount of spending. The following hypotheses are proposed:

H2b:A greater amount of resources and commitment allocated to the development of collective GOM practices directly leads to greater business benefits.

H2c:A greater level of resources and commitment allocated to the development of collective GOM practices directly leads to greater levels of spending.

3.3.3.3 Linking environmental performance and economic performance

Growing environmental concerns have forced many companies to develop various environmental programs to enhance their environmental performance. For a long time managers used to consider these environmental pressures as threats, rather than business opportunities, which may hinder their competitiveness (Sharma, 2000). Many of them also used to view environmental and economic performance as conflicting terms (Hart, 1995). They assumed that enhancing environmental performance required huge investments to adopt unnecessary clean activities and technologies, implying an increase in overall operational and production costs (Hart, 1995; Shrivastava, 1995b). Over the last few decades, several studies were conducted on the economic implications of improving environmental performance, but the findings were mixed (Dixton-Fowler *et al.,* 2013). For instance, some studies reported positive relationships, assuming that improvement of environmental performance from green initiatives can result in cost advantage (Gonzalez-Benito and Gonzalez-Benito, 2005) due to a more efficient of production process, a reduction of energy and inputs usage, and a reduction of waste treatment or disposal costs (Shrivastava, 1995a; Zhu and Sarkis, 2004; Wagner, 2005). Improved environmental performance was also found to be positively related to the stock market value of the firm (Jacobs *et al*., 2010) and a good contributor towards improving product quality (Pil and Rothenberg, 2003). On the other hand, bad environmental performance was found to be negatively correlated with the intangible asset value of the firm (Konar and Cohen, 2001). At the same time, others have even questioned the optimism of growth in environmental performance (Wally and Whitehead, 1994; Link and Naveh, 2006) and found no or even a negative relationship between environmental management and its associated environmental performance with the economic performance of the firm (e.g., Wagner, 2005; Iraldo *et al.,* 2009). Based on the above discussion, although no clear empirical evidence has been provided on these relationships, it is believed that improving environmental performance can create positive business outcomes whilst also increasing the amount of spending, and thus negatively affect the performance of the firm. Hence, the following hypotheses are proposed:

H3a: Environmental performance is positively related to organisational business benefits, and thus environmental performance mediates the relationship between the collective GOM competency and business benefits.

H3b: Environmental performance is positively related to organisational spending, and thus environmental performance mediates the relationship between the collective GOM competency and organizational spending.

3.3.4 Model mediator

There is always some degree of conflict between different parties involved in EM including the firm and its stakeholders (Born and Sonzogni, 1995). This is because, from one side the information regarding environmental concerns is scattered in different places within the firm and with different stakeholders (Lang, 1990), and from another side there is a high degree of interdependency between the firm and its stakeholders (Buysse and Verbeke, 2003).A more collaborative approach to address and manage the environmental issues may be needed, because it allows for exchange of resources among participants (Born and Sonzogni, 1995).

Some studies argue that firms are increasingly incorporating their environmental issues with other core functional processes in the firm (Carter, 2005; Wagner, 2011). CFC focuses on how internal departments within a firm operate as a single integrated system, rather than working individually to optimize the firm's overall environmental performance. It considers the flows of critical resources such as information, cash, materials and human resources.

Dillon and Fischer (1992) have argued that one of the main characteristics of proactive organisations is organisational responsibility, which includes CFC and decentralization of the environmental responsibilities. The adoption of GOM strategies requires continuous change to operational routines, which can be fostered through the development of basic capabilities such as CFC

(Aragon-Correa *et al.,* 2008). The availability of CFC and other internal environmental management supporting factors was also considered important to successfully adopt external GOM initiatives (Walton *et al*., 1998; Vachon, 2007). The cross functional team is an important element in establishing CFC and it may foster the development of cleaner production processes and technologies, sharing of critical environmental and social information and encourages sustainable buying responsibility (Carter and Jennings, 2002; Carter, 2005). CFC can also encourage a product stewardship strategy and bring experience from different departments together to deal with any environmental or social problem (Hart, 1995; Delmas and Toffel, 2008). CFC is important to develop organisational learning capabilities and to accumulate knowledge over time (Groenewegen and Vergragt, 1991; Carter and Jennings, 2002; Fiedler, 2010). When internal capabilities and knowledge accumulate, the firm gains more experience with pollution prevention practices (Groenewegen and Vergragt, 1991; Dean and Brown, 1995; Shrivastava, 1995a; Carter, 2005; Vachon and Klassen, 2008). By eliminating the functional barriers, encouraging teamwork, allowing more flexible, informal and effective communication between different functions, the internal collaboration capability helps in making quick decisions and responding faster to market and non-market requirements (Burns and Stalker, 1961; Heckscher and Adler, 2006; Fiedler, 2010). Arguably, CFC can lead to more cohesive environmental management strategies and can facilitate the adoption of various GOM practices to better respond to various environmental requirements. It seems therefore that CFC should mediate the relationship between stakeholder pressures and GOM practices. The following hypothesis is proposed:

H4: Environmentally oriented cross-functional collaboration mediates the relationships between market stakeholder pressures (H4a) and non-market stakeholder pressures (H4b) with adoption of GOM practices.

3.3.5 Moderating effects of firm characteristics on the effectiveness of CFC

This research also aims to extend the GOM literature in general and the "contingent" perspective research of organizational environmental capabilities in GOM in particular by developing and empirically testing a conceptual model of the contingency effects of organisational characteristics on the relationship between CFC and GOM practices. While there are studies assessing the effects of firm contingencies on the relationships between drivers and the implementation of GOM practices (e.g. Buysse and Verbeke, 2003; Kassinis and Vafeas, 2006;Zhu *et al.,* 2007; Hofer et al., 2012; Wu *et al.,* 2012; Genovese *et al.,*2013) and on the relationship between GOM practices and organizational performance (Molina-Azorin et al., 2009b; Zeng *et al.,* 2010b; Wagner, 2011; Dixton-Fowler *et al.,* 2013), the effects of firm contingencies on the effectiveness of internal environmental capabilities for implementing GOM practices, has not received enough attention.

In fact, even though findings of Sarkis et al. (2010) suggest that organizational environmental capabilities mediate the direct relationship between stakeholder pressure and the implementation of environmental practices, a main limitation of their work lies in failing to control for the effects of firm contingencies such as firm characteristics on this mediation. All firms may not have the same levels of visible environmental impacts from their operations (Brammer and Millington, 2006) and thus not all of them necessarily benefit from developing internal environmental capabilities such as CFC for effective implementation of GOM practices. Thus, there is a need to investigate whether all firms gain the same benefits from developing internal capabilities to implement GOM practices, especially in response to stakeholder requirements. There is an argument that some firms such as the highly internationalized and/or highly polluting firms may be more sensitive to environmental concerns as other domestic or less polluting companies (Bowen et al., 2001a; Dixton-Fowler et al., 2013), which may experience fewer expectations to adopt more advanced green practices, regardless of whether CFC is developed or not. Also, large companies may be more concerned about the enhancement of environmental performance than small companies (Melnyk et al., 2003; Wagner, 2011) and thus may effectively implement additional environmental programs if CFC is included. Adding moderating variables related to firm characteristics may help to explain some of the potential variation in the effective implementation of GOM practices when specific organizational environmental capabilities such as CFC are developed.

Accordingly, this research argues that the characteristics of the firm may strongly influence the importance of CFC and, ultimately, its relative benefits and mediating effect for the effective adoption of GOM programs. Three firm characteristics (size, pollution intensity and international orientation) are used in this research, which are likely to moderate the CFC—GOM practices relationship. Accordingly, this research argues that the characteristics of the firm may strongly influence the importance of CFC and, ultimately, its relative benefits and mediating effect for the effective adoption of GOM programs. Three firm characteristics (size, pollution intensity and international orientation) are used in this research, which are likely to moderate the CFC—GOM practices relationship. The following hypothesis is proposed:

H5: Firm characteristics (i.e. pollution intensity (H5a), size (H5a) and international orientation (H5c)) moderate the relationship between CFC and the adoption GOM practices.

Pollution intensity of the firm. Highly polluting firms (e.g., cement production, power generation and oil refining) are more environmentally sensitive than others (Wilmshurst and Frost, 2000). They are also characterised by bad environmental reputations due to their high levels of contaminations and other negative externalities to the natural environment compared to less polluting firms (Bowen *et al.,* 2001a). Therefore, the extent of the environmental pressures and challenges imposed on highly polluting firms are higher than those imposed on less polluting firms (Sharma and Vredenburg, 1998; Skjærseth and Skodvin, 2001; Dixton-Fowler *et al*., 2013). This suggests that highly polluting firms are more interested in increasing their environmental investments in developing various green initiatives to legitimise their operations (Sharma *et al.,* 1999; Berrone and Gomez-Mejia 2009). Functional collaboration may be more required in environmentally regulated, contaminated and problematic situations in order to avoid or at least minimise environmental risks, penalties and other violation costs associated with the firm's operations. CFC allows for more resource sharing and cooperation among various functions (Handfield *et al.,* 1997; Tan and Voderembes, 2006). A more effective implementation of environmental initiatives to deal with various environmental challenges of the highly polluting firms can be better accomplished when CFC is in place. For highly polluting firms to effectively adopt GOM practices, they should overcome internal organisational conflicts and barriers (Gonzalez-Torre *et al.,* 2010). On the other hand, when environmental problems are less prominent, the importance of CFC is expected to be lower, and thus it may not have that significant influence on the effective adoption of environmental programs. The following hypothesis is proposed:

H5a: The firm's pollution intensity moderates the relationship between CFC and the adoption GOM practices.

Firm Size. Previous studies suggested that because the amount of resources allocated to the development of organizational strategic capabilities differs for large and small firms, the firm size can influence the environmental effectiveness resulting from the development of these capabilities (Menyk *et al.,* 2003; Zhu and Sarkis, 2004; Hofer *et al.,* 2012). Large firms tend to be more concerned with and active in the development of GOM practices (Raymond *et al.,* 2008; Zhang *et al.,* 2008; Sarkis *et al.,* 2010) because their operations are more likely to be visible to a wider range of stakeholders (Wagner, 2011). Unlike smaller firms, larger firms tend to adopt several environmental initiatives in parallel, while the smaller firms tend to focus on a single or a most promising initiative, largely due to resource constraints (Schrettle *et al.*, 2014). Inter-departmental collaboration aims to resolve inter-departmental conflicts and to integrate various environmental efforts and decisions across various functional areas within the firm in order to have shared goals and visions about the environmental management (Carter and Jennings, 2002; Auh and Menguc, 2005). The advantages of CFC are expected to be more valuable to large firms, which tend to have more operational and business departments than smaller firms. Therefore, the effectiveness of CFC for adopting GOM practices is expected to differ for firms with different size.

H5b: Firm size moderates the relationship between CFC and the adoption GOM practices.

Firm international orientation.(i.e. the degree of dependence on international markets)Internationalisation and demands of international stakeholders have been identified as important drivers for the development of environmental initiatives for many companies (King and Lenox, 2001; Zeng *et al.,* 2003). However, globalization and operating in the international markets have also imposed more environmental challenges on international firms (Zhu *et al*., 2005). For instance, operating in multiple countries typically involves dealing with environmental requirements of both domestic as well as the international stakeholders (Zhu and Sarkis, 2004). This implies that for highly internationalized firms more environmental data and resources need to be shared and effectively processed, and more effective and efficient decisions should be made in order to enhance or at least maintain market competitiveness. The interdepartmental collaboration may be needed to have a shared vision about the environmental responsibilities and for making better and effective decisions regarding the type of GOM practices to be adopted to better match the requirements of various stakeholders (Hart, 1995; Christman, 2000). Due to variations in language, values, norms, commitments, management styles, experience and expectations, in international oriented firms, more conflicts may arise between parties involved in the adoption of GOM practices. This may reveal that more internal collaborative effort is needed to resolve the conflicts among members of GOM practices development for the international firms, which ultimately may lead to more effective implementation of these practices.

H5c: The international orientation of the firm moderates the relationship between CFC and the adoption GOM practices.

CHAPTER 4 RESEARCH METHODOLOGY

Having discussed the theoretical base of this research (Chapter 2), and the research objectives, questions, conceptual framework and hypotheses (Chapter 3), the objective of this chapter is to discuss, explain and justify the methodological background of this research. As this research aims to discover the reality, have a universal explanation and a better understanding of the relationship between antecedents and consequences of GOM practices, the methodology adopted is a mix of both a quantitative and a qualitative methods. However, the quantitative method using a survey approach is considered the main methodology adopted. The qualitative method using case studies was applied to complement, contextualise and further explain the findings of the quantitative methods. The discussion regarding the objectives, processes and findings of the case study analysis will be provided in Chapter 6, after presenting the findings of the quantitative methods (Chapter 5).

The current chapter is presented in three main sections. The first section (Section 4.1) describes the adopted research philosophy of this study followed by a justification for using a questionnaire based survey as the main methodology for data collection. In section two (Section 4.2.) the survey development and data collection process are explained. A discussion of the techniques that wereused for data analysis in this research is presented in the third section (Section 4.3).

4.1 Research paradigm

As pointed out in Chapter 1, the objective of this research is to understand stakeholder influences on environmental management commitments. Hence, this research can be considered a social science study that tends to explain human life or behaviour and how it interacts with social institutions and the surrounding environment (Beck and Sznaider, 2006).Numerous research approaches can be used to deal with social science issues and the selection of the research approach to be adopted is normally influenced by the aim and type of research to be conducted (Saunders *et al.* 2009; Collis and Hussey, 2009). This section highlights the differences between the main research philosophies and paradigms in social science studies, and the most important research implications arising from these. A research paradigm refers to an integrated system of beliefs and practices that influence how researchers make their decisions to select both the questions they intend to study and methods that they will use to study them (Morgan, 2007).

As all research is focused towards a purpose, and is expected to bring new knowledge in the respective field of study, it is important to link it with the research philosophy (Collis and Hussey, 2009). A research philosophy can be broadly defined as how a researcher perceives the world which, in turn, shapes the paradigm of research and affects the way to perform the research strategy (Easterby-Smith *et al.,* 2008). A range of philosophical perspectives and paradigms are available in social science research, which affect the approaches the researcher can use to develop knowledge in the respective field. However, each one of these paradigms has its own assumptions, perceptions and beliefs about the three major questions that the researcher has to consider; Why research?, What to research? and how to research?(Creswell, 2009). These aspects are related to the epistemological, ontological and axiological concerns of these philosophical perspectives and paradigms (Baker 2003; Collis and Hussey, 2009). It is necessary to understand these aspects in order to differentiate between the available research paradigms and to select the most suitable one for this research.

Epistemology has been defined differently by previous studies but simply speaking epistemology is an important aspect of philosophy that examines the nature and limits of human knowledge (Mir and Watson, 2000). It is about what we know or what can be considered as knowledge in a particular discipline and how we link it to reality (Baker,2003; Saunders *et al.* 2009). Ontology explains our view on the nature of reality and the attributes of existence, which reflects the assumptions researchers form about how the world operates (Saunders *et al.* 2009). Axiology is concerned about the ethical, logical and aesthetical values that go into research (Baker,2003; Creswell, 2009). These perspectives are consequential to each other. This means that the research ontological perspective influences its epistemological perspective, which influences the selection of the methodology (De Vaus, 2001; Baker 2003). Therefore, understanding and discussing these aspects assists the researcher in the choice of the research paradigm that should be in line with the objective and nature of the research.

Adopting an overall research paradigm involves the choice between various research approaches that are available and have been discussed heavily in the literature. These paradigms have been classified mainly based on two major philosophical perspectives (i.e. either the research involves an objective or subjective approach) and there are several other paradigms that are aligned between them (Easterby-Smith *et al*., 2008). Objectivism and subjectivism have been described in the literature, and each one of these has its own epistemological, ontological and axiological assumptions and methodological implications (see Table 4.1.1). While the objectivist approach is mainly guided by the interest to predict and control phenomena, the subjectivist approach is guided by the interest to explain and understand phenomena (Burrel*et al.,* 1979).The objectivists assume that the social world is made up of relatively inflexible, hard and tangible structures which exist and operate independently of the individual's mind. The role of the researcher is to look for universal laws that can be used to describe this reality (Burrel and Morgan, 1979; Creswell, 2009). They also believe that, as reality exists independently of the researcher, knowledge can be acquired and communicated to others (Creswell, 2009). On the other hand, the subjectivists assume that reality is subjective, intangible and does not exist outside an individual's mind and thus the role of researcher is to explain this reality from their unique point of views and experiences (Easterby-Smith *et al.,* 2008). Subjectivists also believe that, as everything is context-dependent and located inside individual’s mind, knowledge cannot be discovered but can be exposed and the researcher cannot be separated from what is being researched (Collins and Hussey, 2009).The preceding discussion on the differences between the objective and subjective paradigms reveals that it is important for the researcher to critically review the available philosophical perspectives. This can improve the researcher’s confidence about the research findings and that the most appropriate methodology has been adopted.

Table 4.1.1: Major paradigms of research in social sciences

Paradigm	**Objectivist**	**Subjectivist**
Alternative Names	Positivist Scientific Deductive Quantitative	Interpretivist Humanistic Inductive Qualitative
Ontology (i.e. nature of reality)	Reality is objective and given	Reality is subjective and is product of the mind "Reality is socially constructed"
Axiology(i.e. the aim)	To explain the phenomena through universal laws	To understand the phenomena through interpretation
Epistemology (i.e. what can be accepted as knowledge and how to link it to the reality)	Knowledge can be acquired "Context-independent"	Knowledge must be experienced. "Context-dependence"
Methodological Implications		
Objective	Examine relationships	Explain how people create, modify and interpret the world or explain what is happening
Approach	Hypothetic-deductive	Inductive reasoning
Techniques	Measurement	Conversations
Operationalisation	Concepts must be operationalised to enable facts to be measured quantitatively	Qualitative approaches-small samples investigate in depth
Results	Causality	Understanding and correlation
Generalisation	To generalise about human social behaviour it is critical to select sufficient sample	Everything is context-dependent; patterns identified and theories are then developed for better understanding
Source: Hussey and Hussey (1997);Collins and Hussey (2009); Saunders *et al.*(2009).		

The existence of numerous philosophical perspectives complicates the process of selecting and adopting the most scientific approach or the most appropriate research design for a particular study. This is because each of these paradigms has its own philosophical assumptions and methodological implications. Researchers need to ask themselves: what is the most scientific approach that can be used? In fact, the absence of a common methodology that can be adopted by researchers, regardless of their field of study, makes some researchers argue that there is no single right approach(Hughes and Sharrock, 1997). Hughes and Sharrock (1997, p. 162) argued:

> *"There is no absolute basis for scientific knowledge"… "Since the nature of philosophy, and its relationship to other forms of knowledge, is itself a major matter of philosophical dispute, there is, of course, no real basis for us to advocate any one view on these matters as the unequivocally correct conception of the relationship between philosophy and social research"*

These arguments indicate that there is no wrong or right paradigm and, hence, the researcher needs to adopt a research method that is more suitable to the problem he/she is investigating. This is because some research problems could be better addressed by using either qualitative or quantitative approaches or even a mix of both (Creswell, 2009). Thus, the philosophical beliefs researchers make about how the world operates should guide their decision about how to conduct a research (Hussey and Collis, 2009; Saunders *et al.* 2009).

The selection of a particular research methodology (i.e. qualitative, quantitative or mix) should be a consequence of the research philosophical background. Table 4.1.2 provides a general guide to the suitability of various research techniques to different philosophical perspectives.

Table 4.1.2: Research methods and their philosophical bases

Research approach	Subjectivism	Objectivism
Ethnographic	Strictly interpretivist	
Participant-observer	Strictly interpretivist	
Game or role playing	Strictly interpretivist	
Focus groups	Mostly interpretivist	
In-depth surveys	Mostly interpretivist	
Scenario research	Mostly interpretivist	
Action research	Mostly interpretivist	
Case study	Have scope to be either	Have scope to be either
Field experiments	Have scope to be either	Have scope to be either
Large-scale survey		Strictly positivistic with some room for interpretation
Simulation and stochastic modelling		Strictly positivistic with some room for interpretation
Laboratory experiments		Strictly positivistic with some room for interpretation
Forecasting research		Strictly positivistic with some room for interpretation
Source: Remenyi *et al.* (1998) and Saunders *et al*., 2009		

This research falls mainly into the category of objectivist approach of science. This is because it aims to discover the reality and to have a universal and generalizable explanation for the relationships between drivers, enablers, practices and performance of environmental management in Omani manufacturing firms. In fact, early research on GOM mainly followed the subjectivism approach using inductive research methods such as case studies in order to obtain more rich and descriptive information and to gain more preliminary insights in these complex and real work phenomena. However, the use of the objectivism approach employing deductive research methods such as a large scale survey has increased dramatically and become the dominant approach over the last decade (Gimenez and Tachizawa, 2012) to obtain a more universal understanding of GOM related issues. This may reflect the maturity stage of GOM research. Accordingly, considering the purpose of this study, a large scale cross sectional survey was selected as the main research methodology. Section 4.1.2 further explains the rationale for adopting this approach.

After the researcher has decided the nature of the study, the next step is to decide the type of design used to answer the research question (Saunders *et al.,* 2009). Section 4.1.1 describes the research design adopted followed by a justification of the selected research methodology.

4.1.1 Research design

Discussing the main differences between the available research paradigms has assisted the researcher in shaping a comprehensive research design for this study which is required before starting data collection and analysis. Research design can be broadly defined as the overall strategy and the logical structure that a researcher adopts to conduct his/her research (Creswell, 2009). It is about what the researcher has to do to complete the research and to successfully provide a clear answer to the research questions. It includes specifying the data to be collected, data collection tools and procedures, type of data analysis and identification of data collection sites (Edmondson and McManus, 2007). The researcher needs to ensure that the design chosen matches the particular research question and allows the researcher to consider alternative explanations, which ultimately help in determining the most empirically convincing explanation (Yin, 2003).

It has been argued that scientific knowledge needs always to be "provisional" (De Vaus, 2001). This doubtful view of research confirms the importance of adopting a proper research design in order to improve the clarity of the research findings as much as possible. The primary objective of research design is to ensure that the collected data would allow the researcher to answer the research questions as clearly as possible (Edmondson and McManus, 2007). In fact, improper research design can lead to drawing unconvincing or very weak conclusions (De Vaus, 2001). Accordingly, following mainly the objectivists paradigm a comprehensive research design has been developed using several resources (see Figure 4.1).

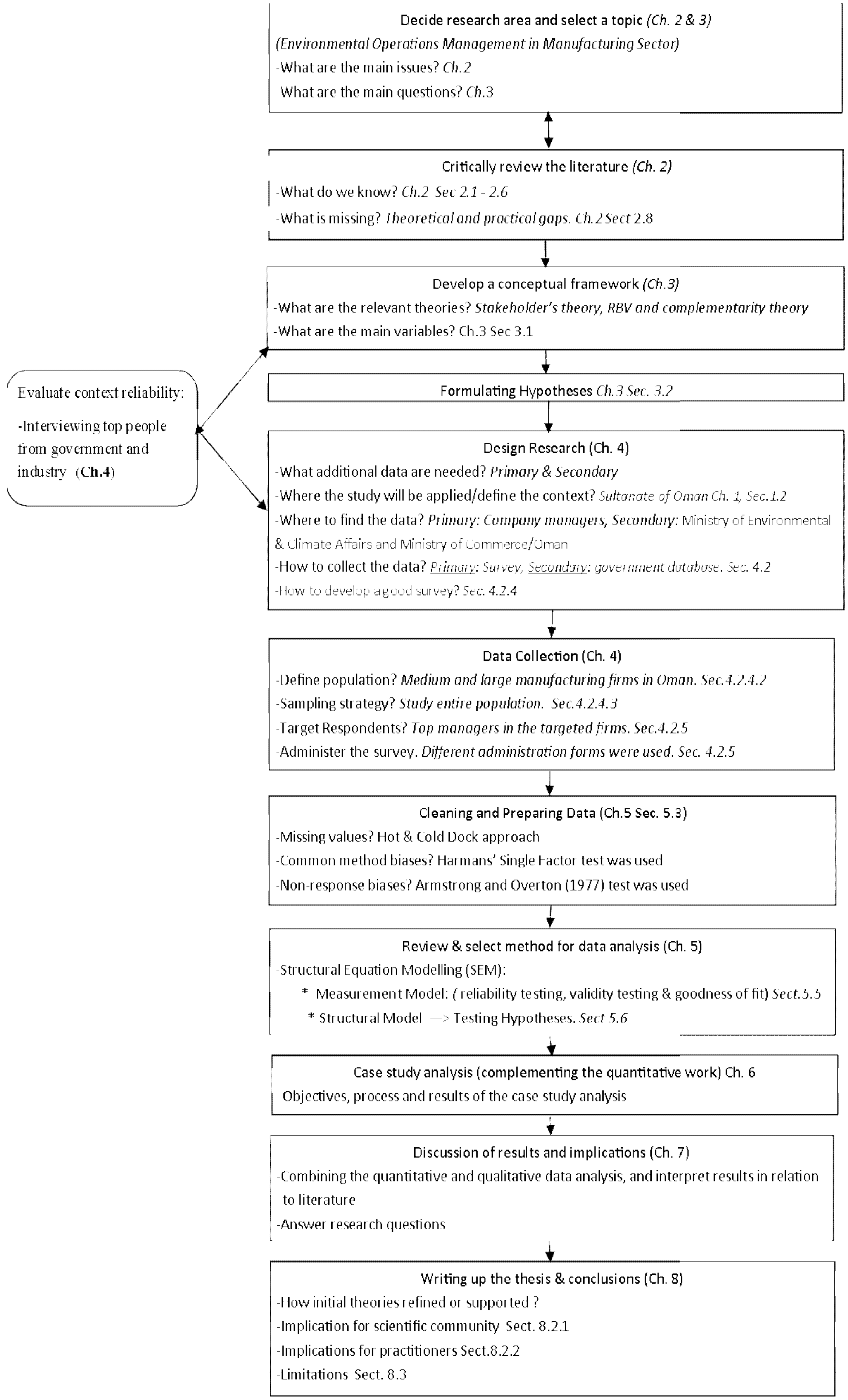


Figure 4.1: Steps in research design(adapted from Saunder *et al*., 2009; Creswell, 2009)

Figure 4.1 shows that initially the literature on firm's EM has been critically reviewed to determine the theoretical and practical gaps and to develop a conceptual framework for this study. After developing the conceptual framework, some preliminary meetings were conducted with top people from the government and industry. These meetings aimed to evaluate the context reliability of this research and to check the availability of data needed to answer the research questions and to empirically test different relationships involved in the conceptual framework (Table 4.1.3 provides an overview of the objectives of these initial meetings). A list of hypotheses hasthen been formulated. These hypotheses were tested later using real survey data. Then, some case studies were conducted to further justify and better explain the findings of the survey data, which in turn enable one to draw a meaningful conclusion and to provide a clear answer for the research questions. Next, the findings of the quantitative and qualitative data analysis were combined and interpreted in relation to the existing literature. By answering the research questions, final implications for the scientific community and for practitioners were highlighted.

Table 4.1.3: Summary of the objectives of the preliminary meetings conducted at the early stages of the research (April 2011)

To	Meeting with	Objective	Findings
Ministry of Commerce and Industry-Oman (OMCI)	-Director of Industrial Information Department (DII)	-Collecting some general information and secondary data about the status of manufacturing sectors in Oman	- DII provided the researcher with a useful and a detailed statistics about development of the targeted firms. It was realized that economic performance reports of Omani firms are not publicly available, and thus mainly subjective measures will be used to measure the economic performance of the firms
Ministry of Environment and Climate Affairs-Oman (OMECA)	-Two division heads from the OMECA -A senior environmental inspection specialist	-Having a general understanding of the Omani government efforts to improve the environmental performance of Omani manufacturing firms	Omani government imposes strict regulations on Omani manufacturing firms to improve their environmental performance, which is encouraged by the international environmental agreements that Oman has signed and increasing environmental pressures of the local community
PetroCo. A petrochemical company in Oman with more than 400 full time employees. PetroCo is an ISO 14001 certified company.	HSE Manager and Procurements Manager	-Having a general overview of the extent to which Omani firms are concerned about environmental management, reasons for their concerns, what they have done to protect the environment and how important these efforts are in improving performance.	The company management fully supports the health, safety and environment (HSE)policy and encourages all staff to take a pro-active approach in implementing this policy and to strictly adhere to it. Also, PetroCo works very hard to comply with local and international applicable legislations to protect the environment and prevent pollution. The firm faces strong pressures from their Asian and European customers and their shareholders to improve their environmental performance. PetroCo considers EM as a challenge that has to be dealt with. Managers believe that the short-term economic benefits of EM are ambiguous.

4.1.2. Rationale for the adopted research methods

Like epistemology and ontology, the research methodology can contribute to the research paradigm, which tends to be qualitative, quantitative, or mixed. The research methodology narrowly specifies the direction to implement the research design and to achieve the research objectives(Collins and Hussey, 2009). The choice of the specific research methodology by a researcher reveals the type of data to be collected (i.e. numeric or text information), how these data will be collected (i.e. closed or open-ended questions), how they will be analysed (i.e. statistical procedures and hypothesis testing or non-statistical procedures) and how results will be reported (a well-defined format or non-standard formats based on the purpose of the research)(Edmondson and McManus, 2007). Numerous research methodologies have been proposed by previous studies for conducting social science studies. However, the selection of a particular methodology should be based on three main factors: the research objectives/problems, the audience for whom the research findings will be reported and the researcher's personal experience (Remenyi*et al.,*1998; Creswell, 2009).

Qualitative procedures are best used when the researcher is aiming to have an in-depth understanding of a particular phenomenon in its contextual setting (Hughes and Sharrock 1997; Easterby-Smith *et al.,* 2008). It is also used when the investigated topic is new or has never been tested with a particular population (Creswell, 2009). On the other hand, quantitative research methodologies are normally used when the research objective is determining factors that influence certain outcomes (or what is called causality) or identifying the most significant predictors for outcomes (Saunders *et al.,* 2009). Also, it is best used when the issues under investigation are well established, when the researcher is intending to generalise research findings to a population and/or to test, explain or modify an existing theory (Hussey and Collis, 2009). Various quantitative tools are available and social surveys are often considered key examples of these tools (Creswell, 2009).

A quantitative research methodology with a questionnaire-based data collection approach was adopted in this study. This is because the area of

GOM is a well-established topic (Sarki *et al.,* 2011; Gimenez and Tachizawa, 2012; Sarkis, 2012). Also, as highlighted in Chapter 3, this research aims to identify the most significant factors that influence the adoption of GOM practices among Omani manufacturing firms, the economic and environmental performance implications of adopting these practices, and to generalize the findings to the entire population. These objectives can be better achieved using quantitative research methods (Saunders *et al.,* 2009). The survey-questionnaire based methodology is an effective method for this research as it helps in gathering data from a large number of people, especially when target respondents may not have enough time to set for an interview(Saunders *et al.,* 2009). In addition, data on plant-level green practices and performance are not sometimes publicly available. Thus, environmental practices and performance of the firm have usually been measured using the self-perception of managers (Aragon-Correa *et al*., 2008), suggesting the need for using a questionnaire-based survey approach. In fact, it has been noticed that operations management researchers have increasingly been using questionnaires and interviews as the main methodology for data collection for empirical research (Rungtusanatham *et al.,* 2003; Fisher, 2007; Boyer and Swink, 2008). The use of certain types of comprehensive data gathering efforts (e.g. questionnaire) by previous operations management researchers has given them more generalizable evidence about trends and norms in specific populations of firms and enabled interpretations about firms in general (Forza, 2002; Fisher, 2007). Further, the use of empirical data improves the external validity of outcomes and their relevance to practitioners (Wacker, 1998; Boyer and Swink 2008). Although a quantitative research methodology was mainly adopted in this research, a qualitative case study approach was also adopted mainly to complement the quantitative work. Complementing the quantitative methods with qualitative work might help researchers to clarify theoretical hypotheses/propositions and the basis of the quantitative results (Östlund *et al*., 2011). This in turn can offer more realistic insights and better understanding of relationships between theory and empirical outcomes. Because the large scale survey was used as the main method of data collection, the following section describes in detail the survey development and data collection processes.

4.2. Survey development and data collection

The literature has been reviewed to determine the most suitable approach and methods for data collection which can help to empirically test the proposed conceptual framework. Based on Section 4.1, positivism/objectivism is the overall research paradigm of this research, in which the researcher examines relationships in a way that can better explain the phenomena through universal laws and tries to discover the reality without interacting with what has been researched (Hussey and Collis, 2009). In this paradigm of research, most of the data collected are numeric, which implies that quantitative approaches of data collection and analysis are used (Saunder *et al.,* 2009). In this research, a large-scale survey was selected as a main method of data collection, which was also supported by secondary data obtained from OMCI and OMECA. These secondary data are related to general information about Omani firms and their environmental performance. The survey was developed based on the literature. The objective of this section is to discuss the process of survey development and data collection processes.

Initial exploratory meetings:

In addition to the developed survey, four meetings were conducted at the early stages of the research with three top officials from OMCI, OMECA and with managers from a large petrochemical manufacturing company in Oman (see Table 4.1.3). Based on participants' requests, these meetings were not recorded but field notes were taken. These meetings were conducted in order to gain a better understanding of the current situation of environmental management in Oman, to assure the reliability of the proposed research in the Omani context and to determine the main factors to be studied in this research. The general themes of the meetings conducted with OMECA managers were about the current environmental challenges in Oman in relation to the operations of the manufacturing firms and what the Omani government has done to reduce the impacts of these problems on the natural environment and on the quality of human life in Oman. Meetings revealed that most environmental problems in Oman that are related to the manufacturing sector are due to the operations of highly contaminated industries (e.g. oil & gas production and refinery, chemical companies, cement companies etc.), which at the same time are considered the cornerstone of the Omani economy. In particular, one of the most obvious environmental problems highlighted by these managers involves waste management and the disposal of highly contaminated waste materials/items. This problem may have been caused by the lack of advanced waste disposal and recycling facilities for these materials in Oman. Also, from these meetings it was observed that the Omani government is very concerned with the environmental issues and that OMECA has imposed strict environmental regulations and standards that must be satisfied by all companies operating within the Sultanate. Moreover, ajointmeeting with the Health, Safety and Environment (HSE) manager and the procurement manager of a petrochemical company (PetroCo) was conducted in order to gain a general overview of how Omani manufacturing firms perceive environmental management and their current efforts to green their operations. This helps in evaluating the reliability of the current study in the Omani context. The general themes of this meeting were determining the importance of EM is the company, what the company has done/is doing to improve its environmental capabilities, the main drivers for its various environmental activities and how managers perceive EM (i.e. threats or opportunities). PetroCo is operating in the petrochemical industry, which is known for its high contamination levels. More than 40% of its owners are international investors, and more than 90% of its production is exported to South Asian and European markets. The main drivers for PetroCo environmental initiatives are the requirements of shareholders and international customers. The strategic importance of EM for PetroCo, has encouraged the company to increase its environmental investment to develop various environmental programs. These programs range from pollution control initiatives such as installing state of the art environmental technologies to the implementation of long-term green practices such as obtaining ISO14001certificate, training employees on various environmental activities and working collaboratively with government and customers to find effective solutions for the environmental problems associated with the products and operations of the firm. The company considers its environmental initiatives as a good way to reduce the environmental impacts of its operations. At the same time, it considers investment in environmental management as an excess cost that must be paid, which sometimes may result in non-financial business benefits to the firm. Such business benefits include obtaining the environmental permit from OMECA in order to operate within the Sultanate, increasing customer satisfaction, enhancing the firm's international and local reputation and reducing the costs of non-compliance liabilities. Taken together, these meetings show that drivers, practices and performance of EM are considered important elements in the EM model of Omani manufacturing firms. Further case studies were also conducted at the end of the quantitative data analysis process to support, contextualize and better explain the findings of the quantitative research methods.

4.2.1 An overview of survey techniques

This section aims to describe the development of the survey/questionnaire that was used to collect the data needed to conduct this research. It begins with a brief explanation of the meaning of the survey and when it can be used. Then, the important steps that need to be considered when designing a survey are highlighted.

The use of field-based empirical research methodologies in operations management has been growing steadily over the last decade, in which survey designs with questionnaires have been one of the most popular methodologies (Rungtusanathm *et al.,* 2003; Fisher, 2007; Boyer, 2008; De Horatius, 2011). The same trends were also noticed in GOM research (Gimenez and Tachizawa, 2012). In general, survey research may refer to a group of methods, which focus on quantitative analysis, and where data from a large number of firms are gathered using different methods such as telephone interviews, mail questionnaires, internet questionnaire, or from published data (Saunder *et al.,* 2009). These data are then analysed using statistical techniques (Saunder *et al.,* 2009; Creswell, 2009).

There are three main types of survey research and researchers need to understand the differences between these in order to select the most appropriate type, matching the research objectives (Malhotra and Grover, 1998). The first type can be considered 'exploratory' research, which is used when the aim is to gain preliminary insight on a topic. It usually provides the foundation for a more extensive survey (Filippini, 1997; Creswell, 2009). Also, it provides initial evidence of relationships between concepts and assists in validating the boundaries of a theory (Forza, 2002). The second type of survey research can be classified as 'explanatory' which is used to find causal relationships between constructs by using theory based expectation on why and how constructs could be related (Malhotra and Grover, 1998). The last type of survey research is referred to as 'descriptive', and it aims to describe the distribution of a phenomenon in a population. Its primary objective is not theory development but it can provide useful tips for theory testing and theory development (Wacker, 1998). This research intends to investigate the potential effects of other factors, moderators and mediators, on the relationship between stakeholder pressures, GOM practices and performance of firms and how these constructs are related to each other. Thus, a mix of exploratory and explanatory types of survey research will be used.

Recently Gimenez and Tachizawa (2012) provided a review of the main research methods used by previous GOM studies, and found that questionnaire based survey approaches are the most dominant. This is also obvious from the results of research methods used by some relevant environmental management studies that were combined by the author and these are presented in Table 4.2.1. The results in Table 4.2.1 also show that using multiple industries and a single country approach are more common than studies using a single industry or multiple countries. The use of a single country allows the researcher to easily control for the effect of country environmental expectations' differences on the relationships under investigation (Drixton-Flower, *et al*., 2013). Using multiple industries, on the other hand, allows researchers to understand and show what is happening within several industries rather than being restricted to environmental practices of isolated extreme cases (Walley and Whitehead, 1994; Clark *et al*., 1994; Porter and Van Der Linde, 1995; Sroufe, 2003). This research adopted the approach of using a single country and multiple industries for collecting data.

Table 4.2.1: Previous relevant environmental studies

Author/s	Scope/Industry
Christmann, (2000)	Survey of 487 U.S chemical companies
Geffen & Rothenberg (2000)	Interviews with 3 U.S automotive manufacturing firms
Bowen *et al.,* (2001a & 2001b)	Survey of 138 large publicly limited UK based companies/ multiple manufacturing sectors
Buysse &Verbeke (2003)	Survey of 450 highly water polluted Belgium manufacturing firms/multiple manufacturing sectors
Del Brio & Junquera (2003)	Survey of 5531 Spain manufacturing firms/ multiple manufacturing sectors.
Melnyk *et. al.* (2003)	Survey of 5000 U.S ISO certified manufacturing firms/ multiple manufacturing sectors
Pil & Rothenberg (2003)	Survey of 42 automotive assembly plants and interviews with 17 automotive assembly plants/from several countries
Carter, (2005)	Survey of 1000 US based consumer products manufacturing firms
Chan, (2005)	Survey of 2000 China manufacturing /Foreign invested industrial enterprises from multiple manufacturing sectors.
Rao & Holt (2005)	Survey of 52 South Asia ISO14001 certified manufacturing firms
Sharma and Henriques (2005)	Survey of 240 Canadian based, forest product companies
Darnall & Edward (2006)	Survey of 135 U.S.-based manufacturing firms, publicly traded and ISO 14001 certified
Matos and Jeremy (2007)	Interviews with 2 Canadian based companies (an agricultural biotechnology and an oil and gas company)
Vachon (2007): Vachon & Klassen, (2008)	Survey of 360 medium & large, north American manufacturing firms/ from multiple manufacturing sectors
Delmas & Toffel (2008)	Surveyof 3160, publicly traded /U.S based manufacturing firms/ from multiple manufacturing sectors
Zhu *et al.,* (2008)	Survey of 380 Chines based firms/multiple manufacturing sectors
Sarkis *et al.,* (2010)	Survey of 1150 US based auto-manufacturers
Zeng *et al.,* (2010b)	Survey of 500 Chines based firms/multiple manufacturing sectors
Wagner (2011)	Survey of 4080 German & Dutch manufacturing firms/ multiple manufacturing sectors

The survey is usually related to the deductive approach and used to answer what, who, how much, how many and where questions (Forza, 2002; Saunder*et al.,* 2009). The survey approach is popular because it allows the collection of a large amount of data from a large population in a very economical way by using a questionnaire directed to a sample. It also allows for easy comparison among the collected data (Easterby-Smith*et al.*, 2008). In addition, it involves collecting information from individuals about themselves or about the social groups to which they belong. The survey aims to explore relationships that are common among organisations and, thus, to provide generalizable conclusions on the object of study (Rungtusanathm *et. al.,* 2003). Yet, for a survey to succeed in explaining causal relationships between constructs or even in providing descriptive statistics, it must be properly designed (Lan, 2004).Therefore, several guidelines suggested by previous studies were considered by the researcher in order to develop a good survey for this research. These guidelines are presented in Figure 4.2 and will be discussed in the following sections.

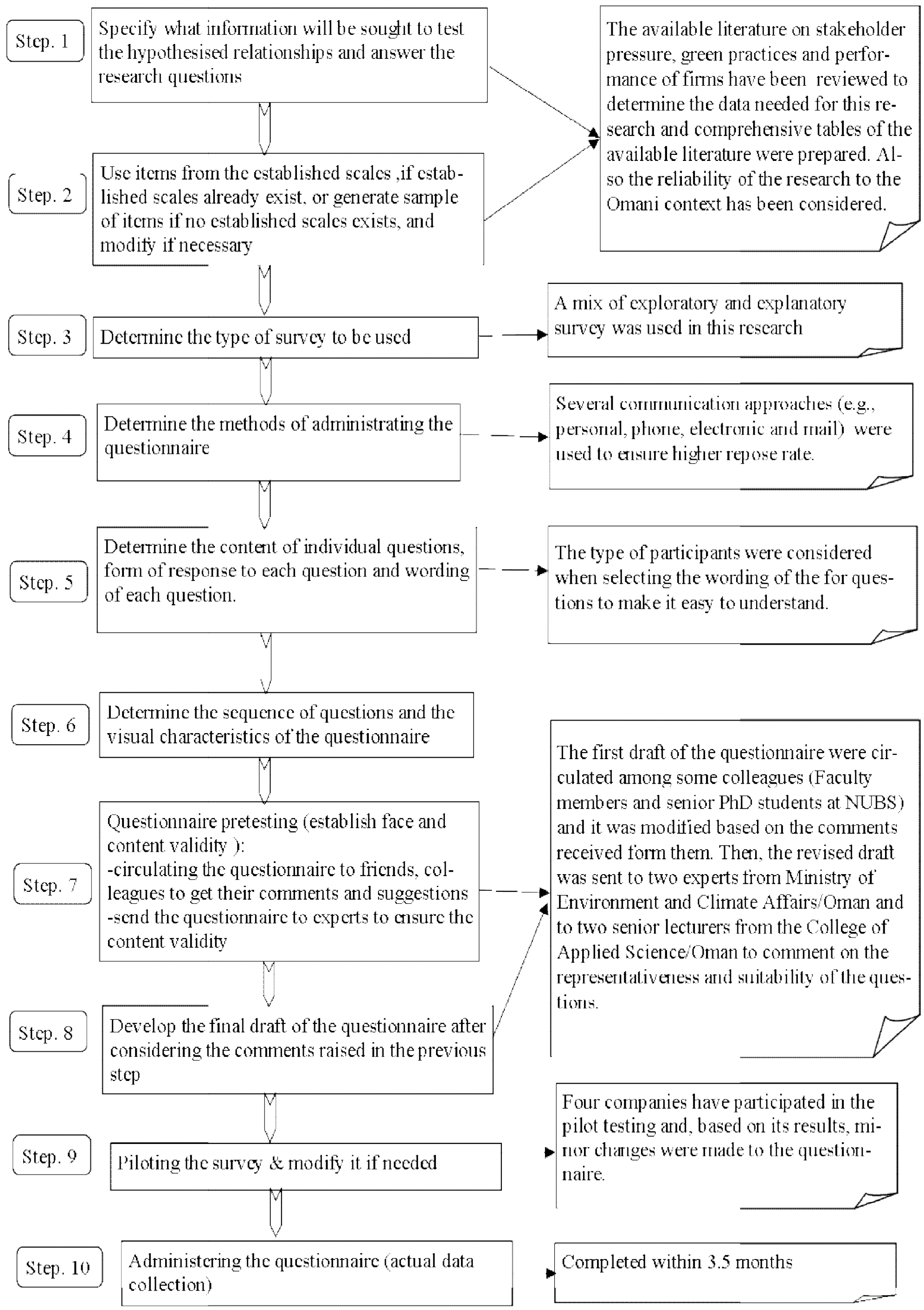


Figure 4.2: Guidelines for successful survey development (adopted from: Saunders*et al.*, 2009, Easterby-Smith *et al.*, 2008, and Creswell, 2009)

4.2.2 Operationalization of the study constructs

This study investigates the linkage between stakeholder pressures, environmental practices and performance of manufacturing firms. It also focuses on examining the possible moderated (conditional) mediating role of the CFC capability on the relationship between stakeholder pressures and the adoption of environmental practices. According to the research conceptual framework (Figure 3.1), the research objectives, questions and hypotheses (see Chapter 3), thirteen factors/constructs were developed in order to achieve the objectives of this research. The factors are:

A. *Independent variables:*

- Stakeholder pressures which include:

1. Market stakeholders
2. Non-market stakeholders

B. *Dependent variables:*

- Green operations management practices which includes:

3. Eco-design
4. Source reduction
5. Environmental Management Systems (EMSs)
6. External environmental management

- Performance which includes:

7. Environmental performance
8. Business benefits /Positive economic performance
9. Spending/Negative economic performance
10. Mediator: Environmentally oriented CFC capability
11. Moderator 1: Firm pollution intensity
12. Moderator 2: Firmsize
13. Moderator 3: Firm degree of internationalisation/international orientation

The data for all of the above factors were obtained using the developed survey except for some variables related to company identification information (e.g. size, industry, ownership and age), which were obtained from secondary reports of OMCI when this data was not provided by the respondents (see Section 4.2.5.2). Accordingly, 61 questions(items) were developed based on the GOM literature and were modified based on the characteristics of the

Omani industrial manufacturing sector. All items in the questionnaire were measured using a 1-5 point Likert's scale. The definition and development of each of these constructs will be discussed individually and a summary of the constructs and their related items will be provided at the end of this section. It is important to mention that contextual reliability of the constructs was considered by conducting preliminary meetings with managers from the industry and government in Oman. These items are by no means exclusive but they try to provide a comprehensive measure of the combination of numerous environmental management components (i.e. divers, enablers, practices and performance). The following subsections discuss in detail the development of the above constructs.

A. Measurement of stakeholder pressures constructs:

As highlighted in Section 2.1.1, the extent to which stakeholder pressure influences the adoption of various green practices has been studied from different perspectives by previous researchers (see Table 2.1). Various items have been used to develop constructs related to stakeholder pressure. Based on these studies (e.g. Baron, 1995 & 2000; Logsdon and Kristi, 1997; Cummings and Doh, 2000; Stevens *et al.,* 2005; Lankoski, 2009; Lawrence, 2010), the stakeholder pressure was classified in this research as (1) Market stakeholders and (2) Non-market stakeholders. Market stakeholders are those that are usually involved in direct, economic transactions with the enterprise and they play a critical role in its value chain (Stevens *et al.* 2005; Lawrence, 2010). These consider responses to employee requirements, customer needs, supplier requirements, shareholders or investors demands and threats from main competitors. Non-market stakeholders are those that, normally, are not involved with any kind of direct, economic transactions with the enterprise but they can affect or be affected by the enterprise activities, and at the same time can influence the firm's relationships with market stakeholders. Items related to non-market stakeholder pressures include government environmental regulations, general community and public requirements, demands of NGOs, the media and environmental associations (Baron, 2000; Cummings and Doh, 2000; Lawrence, 2010). Managers were asked to indicate on a 1-5 Likert scale the degree to which each stakeholder exercised pressure on their firms' environmental management activities, where 5 represents 'very strongly', 4 'relatively strong', 3 'to some degree', 2 'a little bit', and 1 'not at all'. Table 4.2.2 provides a list of environmental pressures firms may face to adopt various green practices. The measurements of stakeholder environmental pressures are needed to test hypotheses H1a and H1b.

Table 4.2.2: Items to measure the environmental pressures constructs

Market pressures: -Pressure from customers -Pressure from external shareholders -Pressure from internal shareholders -Pressure from employees -Pressure from suppliers -Pressure from competitors *Non-market pressures:* -Pressure from central government -Pressure from the media -Pressure from environmental associations (NGOs) -Pressure from society
adopted from: Baron, (1995);Fireman & Clarke (1996) ; Cummings &Doh (2000); Stevens *et al.*(2005); Delmas & Toffel (2008);Lankoski, 2009; Lawrence, 2010 and Sarkis *et al.,* (2010)

B. Measurement of GOM practices constructs:

GOM has received great attention from academics and practitioners which can be seen from the growing number of studies that have been published during the last decades (Sarkis, 2012; Wu *et al.,* 2012). However, as mentioned in Section 2.3 and based on observations of Table 2.2, the literature has discussed issues related to adoption of GOM practices from different perspectives and various measurements have been used to operationalise and measure GOM practices. This shows that there is still no agreement among researchers over which constructs or indicators should be considered the most appropriate measure of GOM, which may partially explain the variations of empirical findings of previous studies. Previous studies, however, offer some indications as to how GOM practices can be measured in different contexts.

This empirical study was applied in one of the Gulf Cooperation Council (GCC) countries and as of yet the researcher is unaware of any environmental management research conducted on the GCC manufacturing sector. Considering the context and objectives of this study, four constructs were developed (eco-design, source reduction, EMSs and external EM) and twenty eight items were used to capture the GOM practices a firm may implement to green its internal and external operations. Items of these four constructs will be subject to factor analysis and, thus, the names and/or number of these constructs might be changed accordingly. Depending on the results of the factors analysis, these four GOM practices constructs will be combined later and represented by a higher order constructs named collective GOM competency. Accordingly, managers were asked to evaluate on a 1-5 Likert scale the extent to which their company has developed the listed environmental practices, where 5 represent ‘carrying it out fully’, 4 ‘carrying it out to some degree’, 3 ‘considering it currently’, 2 ‘planning to consider it’, and 1 ‘not considering it’. In the following subsections, a brief definition of each construct is presented and the items used to measure them are introduced. The measurements of environmental management practices are needed to test proposition P1, hypotheses H1, H2, H3, H4 and H5.

1. Eco-Design (design for the environment):

The eco-design or what can be called 'design for the environment' construct measures the extent to which firms generate products and/or use production processes that minimise the impact on the natural environment. This involves various green activities which can be incorporated throughout the entire PLC including procurement, manufacture, use and disposal stages of the product. An eco-design is a long term pollution prevention strategy that considers the design of products in such a way that they can be easily disassembled, remanufactured or recycled (Kurk and Eagan, 2008). The successful implementation of these practices requires investment in developing infrastructures such as technology and human resources (Sarkis*et al.,* 2010). An eco-design strategy can offer firms numerous advantages over their competitors by considering production of more durable products and designing products or production processes with less energy consumption (Tukker*et al*., 2001). The literature was used to select a list of items to measure the eco-design construct (Table 4.2.3).

Table 4.2.3: Items to measure the eco-design construct

- Redesigning the product or the production process to eliminate any potential environmental problems - Using packaging and pallets which can be reused or recycled - Increasing the overall life of the product - Use of various techniques to make it easier to disassemble and dispose of products at the end of their useful life - Remanufacturing a product where some of the parts or components are reused while others are replaced -Use of standardised components
Adopted from: Melnyk *et al.*,(2003); Gonzalez-Benito (2005); Wu *et al*., (2012); Zhu &Sarkis (2004 & 2007) and Sharma & Henriques (2005)

2. Source reduction:

The second construct reflectingGOM practices is source reduction (or waste minimisation). Unlike the eco-design practices, source reduction practices are operational pollution prevention strategies that aim to eliminate or reduce the volume of waste generated in daily company operations. These involve waste reduction, mistake proofing, housekeeping activities, elimination or reduction of harmful materials, identification of greener substitute materials, and the recirculation of inputs and outputs such as internal recycling (Gupta, 1995; Sarkis and Rasheed, 1995; Sarkis *et al.,* 2010). Source reduction can be achieved through the enhancement of the product design or the production process and through the adoption of greener purchasing strategies (Wu *et al.,* 2012). It is associated with total quality environmental management programs that focus on preventing or reducing the source of production waste and can be seen as a translation of TQM techniques and principles that focus on reducing or preventing any source of quality defects (Melnyk *et al.,* 2003). The adoption of these practices can help firms to reduce their production cost through the reduction of raw materials. Based on the literature, a list of six items were selected to measure the extent to which Omani manufacturing firms adopt various activities related to source reduction (see Table 4.2.4).

Table 4.2.4: Items to measure the source reduction construct

- Increase the use of recycled materials to manufacture products - Reducing the level of materials/components that are considered harmful - Recycling of waste for internal use - Reducing the variety of raw materials used in producing the company products -Sales of excess inventory to avoid obsolescence -Replacing a more environmentally problematic material with a lesser problematic material
Adopted from: Sarkis and Rasheed (1995);Melnyk *et al.*,(2003); Gonzalez-Benito (2005);Sarkis *et al*., (2010)

3. Environmental Management Systems (EMSs):

The third group of environmental practices are those related to EMSs. These activities concern the policies and the procedural aspects of environmental management and, hence, they may overlap with other green activities (Sroufe, 2003). They may include any sort of formal or informal system and procedures for training employees on various environmental activities, monitoring, summarising, evaluating and reporting environmental performance to internal and external stakeholders (Melnyk*et al.,* 2003). A list of items were combined from the literature to measure the extent to which Omani manufacturing firms adopt activities related to EMSs (see Table 4.2.5).

Table 4.2.5: Items to measure the environmental management systems construct

- Using advanced inventory management techniques to avoid obsolete inventory - Providing on-going support from the company's top management for the environmental activities - Conducting regular maintenance on production equipment and technologies - Providing training to employees/managers on various environmental management areas - Adopting environmental management systems and procedures for internal use - Ensure that all waste is disposed in more environmentally friendly ways - Environmental compliance and internal auditing programs
Adopted from: Melnyk *et al., (*2003); Sroufe (2003) and Zhu & Sarkis (2004)

4. External environmental management:

While the three preceding environmental practices represent the internal environmental management practices, the fourth construct concerns external GOM practices. External environmental practices aim to identify and reduce environmental impact throughout the entire supply chain by extending the environmental management outside the firm's internal operations (Vachon, 2007). Firms can manage and green the activities of upstream and downstream supply chain members either by adopting more environmental inspection and control practices of its external supply chain members including customers and suppliers or by employing more environmentally oriented collaborative practices with these members (Min and Galle, 2001; Vachon and Klassen, 2006 & 2008). Such activities may include requesting suppliers and/or customers to be in compliance with particular environmental regulations, asking suppliers to commit to eco-design and waste reduction goals, working together with supply chain members to find environmental solutions related to supply chain activities and conducting knowledge sharing and joint planning environmental activities with them. Table 4.2.6 lists items to measure the extent to which Omani manufacturing firms adopt various environmental activities related to external environmental management.

Table 4.2.6: Items to measure the external environmental management construct

- Working with SC members to develop a mutual understanding of responsibilities regarding environmental performance - Working with supply chain members to reduce the environmental impact of the entire SC - Conducting joint planning sessions, workshops and knowledge sharing activities with SC members to anticipate and resolve environment-related problems - Including environmental considerations in selection criteria for suppliers - Providing suppliers with written environmental requirements for purchased items - Providing customers with detailed and written environmental information related to products - Requiring suppliers to have formal or informal environmental management system - Requiring suppliers to be in compliance with particular environmental regulations

- Requesting suppliers to provide environmental information to assure their environmental Compliance
Adopted from: Vachon & Klassen (2006 & 2008) and Vachon (2007)

C. Measurement of environmental and economic performance constructs: Various environmental performance measurements have been used in previous studies to measure the environmental impact of enterprise activities, and yet no common measurement exists (Montabon *et al.,* 2007). Some studies have concentrated on public reaction to environmental activities (i.e. stakeholder satisfaction, e.g.Rueda-Manzanares*et al.,* 2008)and features of the effective practices (i.e. improving quality, delivery time, capacity and flexibility, e.g. Gonzalez-Benito, 2005). Other studies have used more explicit and precise environmental measures that focus on the environmental outcomes of green practices (i.e. emission reduce and reduction of resource consumptions, e.g., Zhu and Sarkis,2004 &2008). In this study more explicit environmental performance measurements are used because these can give stakeholders more reliable information when comparing environmental performance and when making strategic environmental decisions (Zhu and Sarkis,2004).

When considering the economic implications of environmental efforts, most previous studies have not clearly distinguished between positive and negative economic performance. Klassen and McLaughlin, (1996), Corbett and Klassen (2006) and Zhu and Sarkis (2004) are an exception to this. They have clearly measured economic outcomes of environmental activities according to two different types of economic performance (positive and negative) on the basis that the adoption of green practices can have business advantages as well as increase spending. As a result, they recommended that positive and negative economic performance are related to each other, yet they are different constructs and they suggest an extended economic performance construct based upon the positive and negative economic implications of green practices. By having a closer look at theGOM literature, it was clear that researchers are not only aiming to differentiate between environmental performance and economic performance, but they are also interested in resolving the confusion associated with the influence of adopting these green practices on business benefits and spending. Therefore, this study has also considered the positive and negative effects of EM on economic performance.

However, for the purpose of this study and for better clarification between the positive and negative economic performance, these constructs were renamed in this research as business benefits and spending increase respectively.

Economic performance was measured through more operational performance measures rather than using aggregate economic performance measures such as market share and profitability (see Table 4.9). This is because most of these environmental practices are operationally concentrated, which suggest that the metrics used to measure their effects should be also operationally focused (Zhu and Sarkis 2004; Vachon and Klassen, 2008). Moreover, the initial meetings conducted with PetroCo managers revealed that enhancing firm reputation and satisfying customers were also considered important indirect business benefits that a firm might gain from its environmental efforts. Thus, two additional business benefits related to firm reputation and customer satisfaction were added. In fact, during initial meetings with the government and industry people, directors from OMECA and OMCI have clearly stated that cumulative data related to economic and environmental performance of most Omani firms are not publicly available. The researcher also realised that managers of Omani firms are reluctant to share details of their firm's financial and environmental performance. In addition, during the survey development process some experts from OMECA and two senior lecturers from the College of Applied Sciences/Oman have suggested using indirect indicators to measure the economic and environmental performance of the firm in order to give a good impression regarding the intention of the research. Such an approach was also recommended and adopted by previous studies conducted in less developed countries (Bruton and Lau, 2008). Accordingly, managers were asked to assess the extent to which implementing the listed environmental practices has affected their firm's economic and environmental performance based on fifteen environmental and economic indicators on a scale of 1-5, where 5 represents 'very strongly', 4 'relatively strong', 3 'to some degree', 2 'a little bit', and 1 'not at all'. An overview of the environmental and economic performance constructs and their underlying indicators can be found in Table 4.2.7. These metrics were compiled using multiple sources from the relevant literature. The measurement of environmental and economic performance is needed to test hypothesis H2 and H3

Table 4.2.7: Items to measure the environmental and economic performance constructs

Items for environmental performance: -Reduction of solid waste disposal -Reduction of air emissions -Reduction of water emissions -Decrease of consumption of hazardous/harmful materials -Reduction of environmental accidents -Improve firms' environmental situation *Items for spending (negative economic performance) construct*: -Increased operational costs -Increased training costs -Increased cost of purchasing environmentally friendly materials -Increased overall environmental investment *Items for business benefits (positive economic performance) construct:* -Decrease fee for waste treatment -Decrease fee for waste discharge -Decrease cost of energy consumption -Enhance firm's reputation -Increase number of customers
Adopted from: Carter, (2005); Zhu & Sarkis (2004 & 2007)

5. Measurements of CFC construct (i.e. mediator):

The CFC for environmental management measures the degree to which firms develop an inter-departmental collaboration capability in order to facilitate the implementation of environmental management practices. It concerns the extent to which EM practices are achieved through CFC rather than focusing on a particular department. As all the above environmental management practices are integrative and socially complex (Sarkis *et al.*, 2010), the development of the CFC capability may improve the firm's ability to successfully adopt these green practices. Such activities may include the firm's ability to establish teamwork and cross-functional communication for environmental management. A list of metrics was adopted from the literature to measure CFC for environmental management construct as shown in Table 4.2.8. The measurement of the firm's development of CFC capability is needed to test hypothesis H4.

Table 4.2.8: Items to measure the CFC for environmental management construct

-Working together to reduce environmental impacts of firm's activities -Achieving environmental goals collectively -Sharing critical information about firms' environmental activities and performance -Making joint decisions on ways to reduce overall environmental impacts of firms' products
Adopted from: Vachon and Klassen (2006 & 2008); Vachon (2007) to fit with the context of CFC

6. Measurement of the firm's pollution intensity, size, and international orientation (i.e. moderator 1, 2 and 3 respectively):

Pollution intensity, size and international orientation concern the influence of the firm’s contamination levels, size and international orientation on the expected benefits of developing internal environmental capabilities such CFC for adopting GOMpractices. For instance, Sharma and Vredenburg (1998) argue that firms with different pollution levels are expected to have different environmental pressures, economic benefits and costs, with highly polluting firms more likely to have higher pressures, commitment and performance. Furthermore, Wagner(2011) argues that larger firms are more visible to stakeholders and thus face more pressure to adopt the environmental practices that better satisfy the requirements of their stakeholders. The same thing may also apply to firms with a strong international orientation. The **international orientation** measures the extent to which the firm depends upon international markets, which includes the foreign/global and regional markets, and how the international markets influence their environmental management choices, and ultimately the effectiveness of these choices in responding to various environmental challenges. Iinternational orientation is acquired when a firm operates within international markets (Bansal, 2005). It has been found that for companies operating in international markets the extent of stakeholder pressure to adopt green practices is expected to be higher than those depending only on the domestic market (Zyglidopoulos, 2002). This is because international firms need to consider the environmental requirements of the local as well as international stakeholders. Taken together, the above arguments imply that as the environmental impacts of highly polluting firms, large size firms, and highly internationalized firms are more visible, the development of CFC capability is expected to be more beneficial for them. The level of pollution intensity, size, and international orientation of the firm should influence and moderate the effectiveness of CFC.

To the knowledge of the researcher, there are no general and precise criteria for classifying pollution intensity. However, most of the previous studies have classified pollution intensity mainly based on the industry to which firms belong (Bowen *et al.,* 2001a; Zeng *et al*., 2010b). In the UK, chemicals, energy production and utilities, metal, oil, automotive, pulp and paper, and mining industries are classified to be highly polluting industries (Bowen *et al.,* 2001a). In the US, pulp and paper, chemical, petroleum refining, plastic, machinery manufacturing, automotive, metals, electrical and electronics and electric utilities industries are considered to be highly polluting industries (Delmas and Toffel, 2008). In China, the chemical, coal, building materials, pharmaceutical, metallurgical, textile, mining, leather, paper and printing and oil refining industries are considered to be highly polluting industries (Zeng *et al*., 2010b). The classification of OMECA was used as an indicator to measure pollution intensity. The term **highly polluting** firm is used in this research to refer to those firms with higher levels of water, air or solid waste which may seriously damage the natural environment compared to less polluting firms.

Previous studies have measured firm size using the number of full-time employees (Wagner, 2011) and/or annual turnover (Buysse and Verbeke, 2003). Due to the difficulty of obtaining the total turnover of Omani manufacturing firms, in this research only the total number of full-time employees was used as an indicator to measure the size of the firm. Data related to firm size was obtained by asking managers to specify the number of full-time employees in their firm and when the answer was not provided by the respondent this figure was obtained from secondary reports of OMCI. Regarding the indicators to measure the degree of the firm's international orientation, a list of items was compiled based on the literature (see Table 4.2.9). From the above discussion, it should be clear that of the three moderators proposed in this research only the international orientation construct was measured using multiple indicators. For the remaining two moderators (i.e. pollution intensity and size) there was no specific set of indicators designed to measure them. Rather, during the data analysis, these two factors were evaluated using dummy coded variables (1=highly polluting/large firms, 2=less polluting/smaller firms). The measurement of pollution intensity, size and international orientation are needed to test hypotheses H5a, H5b and H5c respectively.

Table 4.2.9: Items to measure the firm's international orientation

- Our firm actively considers the effect of our environmental activities on our sales to foreign customers -Regional government environmental regulations influence our firm's green environmental management activities - Our firm actively considers the effect of our environmental activities on our international competitiveness - Our firm actively considers the effect our environmental activities have on our export sales
Adapted from: Wu *et al.,* (2012)

4.2.3 Summary of measurement variables:

A summary of the 61 items that will be used in this research questionnaire and their respective labels as well as constructs to which they belong are presented in Table 4.2.10

Table 4.2.10: Summary of the measurement items and their labels

Items	Labels	Related construct
-Pressure from customers -Pressure from central government -Pressure from external shareholders -Pressure from internal shareholders -Pressure from employees -Pressure from the media -Pressure from professional environmental protection groups -Pressure from society -Pressure from suppliers -Pressure from competitors	StP1 StP2 StP3 StP4 StP5 StP6 StP7 StP8 StP9 StP10	Stakeholder pressures (StP)
-Using advanced inventory management techniques to avoid obsolete inventory -Providing on-going support from the company's top management for the environmental activities -Conducting regular maintenance for the production equipment and technologies -Providing training to employees/managers on various environmental management areas -Adopting environmental management systems and procedures for internal use -Ensure that all waste is dispose in more environmentally friendly ways -Environmental compliance and internal auditing programs	EMS1 EMS2 EMS3 EMS4 EMS5 EMS6 EMS7	Environmental management systems (EMSs)
-Redesigning the product or the production process to eliminate any potential environmental problems -Using packaging and pallets which can be reused or recycled -Increasing the overall life of the product -Use of various techniques to make it easier to disassemble and dispose products at the end of their useful life -Remanufacturing a product where some of the parts or components are reused while others are replaced -Use of standardised components	EcD1 EcD2 EcD3 EcD4 EcD5 EcD6	Eco-design practices (EcD)
-Increase the use of recycled materials to manufacture products -Reducing the level of materials/components that are considered harmful -Recycling of waste for internal use -Reducing the variety of raw materials used in producing the company products -Sales of excess inventory to avoid obsolescence	SRd1 SRd2 SRd3 SRd4 SRd5	Source reduction practices (SRd)

-Replacing a more environmentally problematic material with another non problematic material	SRd6	
-Working with supply chain members to develop a mutual understanding of responsibilities regarding environmental performance -Working with supply chain members to reduce the environmental impact of the entire supply chain activities -Conducting joint planning sessions, workshops and knowledge sharing activities with supply chain members to anticipate and resolve environment-related problems -Including environmental considerations in selection criteria for suppliers -Providing suppliers with written environmental requirements for purchased items -Providing customers with detailed and written environmental information related to products -Requiring suppliers to have formal or informal environmental management system -Requiring suppliers to be in compliance with particular environmental regulations -Requesting suppliers to provide environmental information to assure their environmental compliance	ExEM1 ExEM2 ExEM3 ExEM4 ExEM5 ExEM6 ExEM7 ExEM8 ExEM9	External environmental management practices (ExEM)
-Reduced solid waste disposal -Reduced air emissions -Reduced water emissions -Decreased consumption of hazardous/harmful materials -Reduced environmental accidents -Improved firms' environmental situation	EnP1 EnP2 EnP3 EnP4 EnP5 EnP6	Environmental performance (EnP)
- Increased overall environmental investment - Increased operational costs -Increased training costs -Increased cost of purchasing environmentally friendly materials	Sp1 Sp2 Sp3 Sp4	Spending(Sp) (negative economic performance)
-Decreased cost for energy consumption - Decreased fee for waste treatment - Decreased fee for waste discharge - Enhanced firm's reputation -Increased number of customers	Sv1 Sv2 Sv3 Sv4 Sv5	Business benefits (Sv) (positive economic performance)
-Working together to reduce environmental impacts of firm's activities -Achieving environmental goals collectively -Sharing critical information about firms' environmental activities and performance -Making joint decisions about ways to reduce overall environmental impacts of firms' products	CFC1 CFC2 CFC3 CFC4	Environmentally oriented CFC(CFC)
- Our firm actively considers the effect of our environmental activities on our sales to foreign customers - Regional governments' environmental regulations influence our firm's green environmental management activities - Our firm actively considers the effect of our environmental activities on our international competitiveness - Our firm actively considers the effect our environmental activities have on our export sales	Glb1 Glb2 Glb3 Glb4	International orientation(Glb)

4.2.4 Survey development

The developed survey consists of five pages. The first page was the cover page which was designed to be persuasive and brief. Seven aspects were highlighted in the cover letter:

- The title of the survey, which is "environmental management in Omani manufacturing firms". This title is concise and can easily be understood. In fact, the research does not only focus on studying the current status of environmental management in Omani manufacturing firms, but also evaluates the antecedents (drivers and enablers) and consequences of adopting green practices on the firms' performance. It was recommended by some experts from the OMECA and a senior lecturer from College of Applied Sciences/Oman that adding the word 'performance' to the title might dramatically reduce the response rate. This is because managers might form a negative impression on the survey and they might reject it on the basis that the survey aims to assess their firm's performance, which is often regarded as a highly confidential and sensitive issue.
- The main objectives of the research (i.e. examining the effects of stakeholder pressure on the adoption of various green practices and evaluating the effectiveness of green practices on economic and environmental performance).
- The main expected advantage of the research for participating firms (assist managers in making strategic decisions when investing in environmental management activities in response to various stakeholder pressures)
- The institutions with which the constructed survey is associated, which added a high level of credibility to the survey (i.e. the Omani Ministry of Higher Education as the sponsoring organisation and the University of Nottingham as the awarding institute where the research was conducted).
- Instructions and guidelines regarding who should respond to the questionnaire and how it should be completed and returned. In addition, the researcher's contact details were provided for any clarification if required.
- The assurance of confidentiality regarding the information provided.

- The assurance that the participating firms will receive an executive summary of the research findings, which can be considered a non-monetary incentive for the targeted firms to participate in the survey.

The second page was designed to collect two types of information:

- Company identification information such as ownership, location of operations, number of workers, years in business, types of products produced and percentage of export and import from the company's overall production. The objective of this information is to determine the characteristics of the sample and whether they fall into the category of targeted firms or not. Also, this information was collected to control for the effects of firm characteristics on the proposed relationships. Secondary data were also collected from OMCI(see Section 4.2.5.2) to verify the information provided by the respondents for this part of the survey. These data can also give some indications for the existence of the common method bias in the collected data (see Section 5.3.2 for details on methods used to test for the existence of common method bias in the collected data).
- Respondent identification information such as, position and total years of experience in the company. This information was used to determine the respondents' characteristics and whether the questionnaire was answered by the right person or not.

The remaining three pages formed the most important part of the survey and they were designed in a way that allowed the respondent to move easily from one part to another. The three pages were divided into five parts: (1) GOM practices, (2) stakeholder pressures, (3) environmental and economic performance, (4) international orientation and (5) CFC for environmental management. Each part contains a set of items (developed in Section 4.2.2) to measure the constructs under investigation. All items were presented on a 1-5 point Likert scale and the survey aimed for a ten-minute completion time. Finally, the survey was concluded with a reminder of the return address and acknowledgment for participation (see Appendix 1, for a copy of the questionnaire).

To explore the content validity of the developed items, several unstructured exploratory meetings were conducted with people from the government and industry. From these meetings it was noticed that Omani manufacturing firms face an increasing amount of pressure from different groups of stakeholders, especially from government agencies, shareholders and international customers. It was also noticed that Omani firms have developed various environmental practices mainly to comply with national and international environmental regulations, improve their level of efficiency and improve their image and reputation. After conducting these exploratory meetings, a first draft of the questionnaire was developed and circulated among ten second and third year PhD candidates. These PhD students were from the Nottingham University Business School (i.e. from the operations management division, the strategic management division and the corporate social responsibility division). The main reason for choosing PhD students from these departments was that the researcher believes that these students are better able to understand the content of the questionnaire. The first draft of the questionnaire was also sent to two senior lecturers from the College of Applied Science/Oman and two experts from OMECA. Both these experts have more than 10 years of experience in the area of environmental management. The questionnaire was refined based on the comments received from colleagues and experts. Because all items in the questionnaire were in English, the questionnaire was translated to Arabic using the back-translation approach described in the next section. After translating the questionnaire and to further enhance the validity and reliability of the measurement items, the survey was piloted to15 randomly selected manufacturing firms, from a wide range of firm size and industry sectors. This gave the researcher an idea about the types of firms that were more likely to participate in this research. The contact details of these companies were obtained from OMCI. Two versions of the questionnaire (Arabic and English) were sent to each company, and companies were contacted by phone after one day to ensure that they had received the questionnaire. Some of the companies preferred to receive the questionnaire by fax. Another copy was sent to them via the fax. Four companies provided useable responses and all of these firms had more than 22 employees, which may suggest that smaller firms are less interested in participating in this kind of research. This is because small firms do not have the ability to implement more advanced environmental practices (Raymond *et al.,* 2008; Lee, 2008; Wu *et al.,* 2012).All responses were received via e-mail. All respondents were firms with more than 75 employees. Three responses came from the chemical industry, while the fourth one was from the plastics industry. Based on the results of the pilot study, minor changes were made to the questionnaire, particularly to questions related to part 1 of the questionnaire. All the previous steps; literature review, interviews and initial testing, were used to establish the content and face validity of the instrument and to improve the quality of the final version of the questionnaire before administering the large-scale survey.

4.2.4.1 Translating the survey

The double translation procedure which is also called back-translation is, arguably, one of the most effective and acceptable translation procedures (Douglas and Craig, 2007). This is because the survey translation process goes through a number of filters performed independently by researchers (Douglas and Craig, 2007). In this type of translation, there should be at least two bilingual professionals, who are independently translating the developed questionnaire. The first translator translates the survey from the original language into the targeted language and the second translator uses the result of the first translator and independently translates the survey back to the original language. Then, the researcher can compare the differences between the two versions and consult the translators if any inconsistencies were found in order to revise the questionnaire and improve its quality. In this research the developed questionnaire was initially written in English and then translated to Arabic by a seniorOmani lecturer from the English department of the College of Applied Sciences/Oman. Next, the Arabic version of the survey was translated back to English by a senior lecturer from the English department of the Sohar University/Oman. The researcher checked the scientific terminologies used in the two versions of the questionnaire to avoid any misinterpretation by the targeted respondents. It is worth noting that the researcher is fluent in both languages, Arabic and English, and therefore was able to check both versions of the questionnaire.

4.2.4.2 Definition of study population –Small, Medium &Large Manufacturing Enterprises

There is no consistent definition or a single accepted criterion that defines whether an enterprise is considered small, medium or large, neither between nor within countries (Chandy and Gerard, 2000). The differences in defining an enterprise to be a small, medium or large even exist within closer and may be similar economic zones like the UK and EU zones (National Archives, 2003; European Commission, 2006).In general, there are three main dimensions that have been used to determine whether a firm is considered small, a medium or a large enterprise: the annual turnover, the number of employees and the total assets of the company (Chandy and Gerard,2000).

In Oman, due to the scarcity of company financial data, most private and public agencies have used the number of employees as a base for classification. However, no consensual definition exists and several institutions are still using different definitions. For example, OMCI defines companies with up to 10 workers as small; companies with up to 99 are considered medium and those with more than 99 as large (DGI, 2010a).Onthe other hand, the Omani Ministry of National Economy considers companies with up to 19 workers as small enterprises, while those with up to 99 are medium and those with more than 99 are large enterprises (MNE, 2011). In addition, financial institutes in Oman (e.g. banks) have used different definitions based on company turnover. Because it is hard to obtain company financial data, in this research the number of employees was adopted as the base for the classification of enterprises.

The focus of this study is on manufacturing enterprises with >19 full-time employees and excludes very small firms, which are unlikely to be suitable for this research because they tend to be less motivated to adopt green practices due to their constrained resources (Raymond *et al.,* 2008; Lee, 2008). The cut-off number of employees (> 19) for the targeted firms was selected to ensure a good number of firms in the sample and at the same time to have some degree of confidence that the environmental issues are explicitly incorporated in the strategy and operations of the targeted firms. For the subsequent inferential analysis, the median of the firm size is used to split the sample to medium and large firms in order to have a sufficient number of firms to represent each group. This is also recommended for conducting the moderation tests using multivariate statistical techniques such as Structural Equation Modelling (Hair *et al*., 2006).

4.2.4.3 Sampling strategy and unit of analysis:

With respect to sampling strategies, it has been argued that researchers need to present sufficient information about the target population, the sampling frame, and the sampling procedures to clarify how the final sample was selected (Rungtusanatham *et al.,* 2003; Saunders *et al.,* 2009). Sampling can be defined as the process of selecting a portion of the population, which will be a representation of the entire population (Boyer and Swink, 2008). Three main types of sampling strategies have been used in previous studies, i.e. probability sampling, non-probability sampling and population study (Forza, 2002). While with the sampling techniques (i.e. both probability and non-probability sampling) a subset of the population is used to represent the whole population, in the population studies researchers consider all units within the target population (Nolan and Heinzen, 2011). Unlike the sampling techniques, the population studies allow researchers to generalise research findings without adopting a sampling strategy (Boyer and Swink, 2008; Saunders *et al.,* 2009). In this research, the population study approach was adopted. This is because the researcher is targeting all manufacturing firms in Oman with >19 full-time employees and can access the entire population, suggesting no sampling strategy was needed. Also, it is important to mention that the population frame used in this study is a listing of all manufacturing firms with >19 full-time employees in Oman, received from OMCI, from which the researcher obtained the contact details for all the targeted firms. The manufacturing sector was selected in this research because its pollution is expected to be higher than the service sector.

Related to the issue of sampling is the description of the Unit of Analysis (UoA). The UoA is the major entity or object that researchers are intending to analyse in their studies and about which generalisations are to be made (Lan, 2004; Creswell, 2009).Clearly determining the UoA can help to understand how the selected UoA relates to a broader body of knowledge (Easterby-Smith *et al.,* 2008; Barratt *et al.,* 2011). Also, it can assist in identifying applicable literature that can be used to clarify the phenomenon under investigation which in turn helps maintain consistency throughout data collection and analysis (Barratt *et al.,* 2011). In Operations Management studies, the UoA can be a manufacturing plant or factory, a primary product line, an individual employee, a system, a business unit or a relationship between buyers and suppliers-networks (Flynn *et al.,* 1990: Forza, 2002). Whether individuals, plants, divisions or corporate levels are selected as the UoA depends on the research questions and hypotheses/propositions (Easterby-Smith *et al.,* 2008). This research considers the individual firm as the unit of analysis. Having provided a clear definition for the study population, UoA and sampling strategy it is necessary to discuss the data collection process.

4.2.4.4. Target respondents

This research targets a single respondent from a top and middle level management within the targeted companies, which is consistent with other GOM studies (e.g. Bowen *et al.,* 2001a; Darnall *et al.,* 2008; Zhu *et al.,* 2005 & 2013). Targeting a single respondent to rate diverse, yet interrelated, topics of GOM (i.e. drivers, practices and performance) in a firm may create some biases by increasing the degree of subjectivity in the responses obtained. This may show the importance of surveying more than one respondent per company. However, targeting more than one respondent per company most of the time is costly and likely to negatively influence the response rate, which forces many researchers to use a single respondent (Miller *et al.,* 1994; Youndt *et al.,* 1996; Vachon, 2007). Among the possible ways to reduce the potential effects of using a single respondent on the final findings of the research are to carefully select the target respondents and/or to obtain objective data to measure the constructs under investigation (Podsakoff *et al.,* 2003; Chang *et al.,* 2010). The selection of the top and middle level managers as the target respondents in this research came after conducting some preliminary interviews with managers from the government and industry at the early stages of the research. These interviews revealed that in general these managers were knowledgeable about the different areas of interest in this research, thus they are suitable for the targeted companies. The responses of these managers regarding the environmental performance of their firms will be further validated later using some objective data and by conducting some interviews with managers of Omani manufacturing companies.

4.2.5. Data collection

Two types of data were collected, primary and secondary data. The primary data were collected through the questionnaire; the secondary data were obtained from OMCI and OMECA. The data collection process took around three and a half months and was completed throughout the entire Omani territory which reveals sample representativeness. The following sub-sectionsprovide further discussion on the data collection process, which is also illustrated in Figure 4.3A.

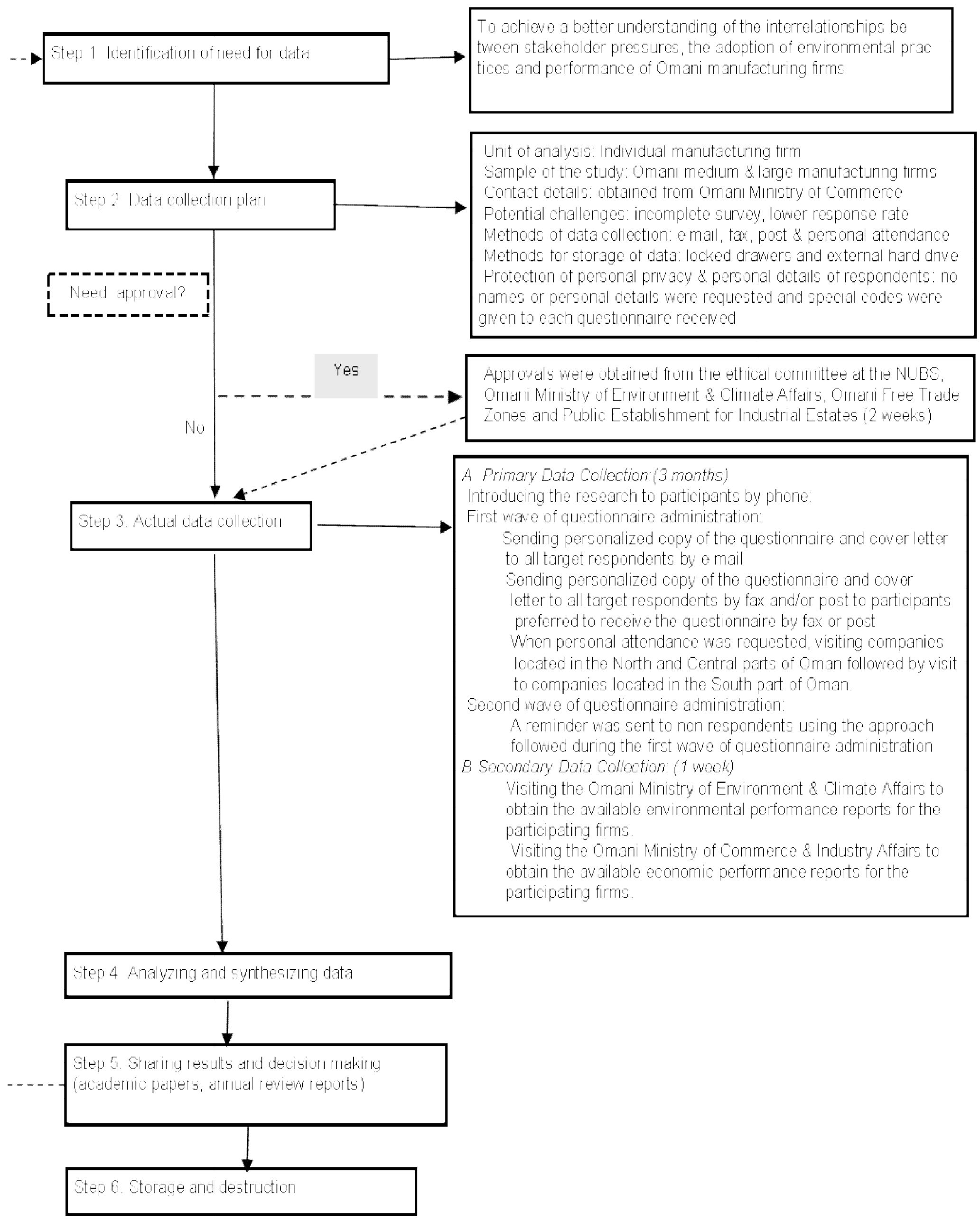


Figure 4.3A: The survey data collection protocol

4.2.5.1. Primary data collection and survey administration:

After excluding all Omani manufacturing firms with less than 20 employees, the list of 574 manufacturing enterprises obtained from Omani Ministry of Commerce and Industry was used for the survey study. Three sets of surveys were administered in different places within Oman (i.e. the Centre, the North and the South part of Oman) with two to three weeks between each. The targeted firms are located in different industrial areas in Oman (indicated with

★ in Figure 4.3B).A lot of travel was needed to reach the targeted firms, especially to visit those companies that requested the personal attendance of the researcher. While more than 90 % of the firms are located in the six industrial estates(i.e. Rusayl, Nizwa, Sohar, Sur, Raysut,Al Mazunah andBuraimi) the remaining firms are located in the three Omani Free Trade Zones (FTZ) (i.e. Salalah FTZ, Al Mazunah FTZ and Sohar FTZ), and some being located outside these industrial areas. The researcher used the navigation system of the Public Establishment for Industrial Estates (PEIE) to determine the location of each company when a personal visit was needed. This navigation system can be found at the PEIE website (http://map.peie.om/webpages/default.aspx).

The data collection process took around three and a half months. The first two weeks were used to finalise the procedural formalities for obtaining the approval from Nottingham University Business School (NUBS), OMECA, PEIE and FTZs. All of these organizations have given their full cooperation and support.

A good response rate is needed for the research to be able to provide representative findings (Forza, 2002; Creswell, 2009). Based on the results of previous studies, which have used a similar research design, a response rate of around 20 - 25% or more is desired to offer representative findings. For example, Christmann, (2000), Del Brio and Junquera (2003), Melnyk *et al.,* (2003), Carter, (2005), Sharma and Henriques (2005),Vachon (2007), Delmas and Toffel (2008),Vachon and Klassen (2008), Sarkis *et al.,* (2010), Zeng *et al.,* (2010b) and Wagner (2011) have made their conclusions based on 18.1%, 6.5%, 10.4%, 21.5%, 28%, 24%, 23%, 17%, 23%, 13.7% , 25% and 16.1% response rate respectively. Malhotra and Grover (1998) argued that for production and operations management research to be reliable a response rate of more than 20% is desirable. In fact, it has been noticed that a low response rate is becoming an obvious limitation and challenge in large-scale Operations Management survey based studies because business managers, especially in the manufacturing sector, are increasingly unwilling to respond to questionnaires (Singhal *et al.,* 2008). In this research with a population of 574 manufacturing firms at least 114 (20 %) usable questionnaires are required in order to achieve the minimum desired response rate.

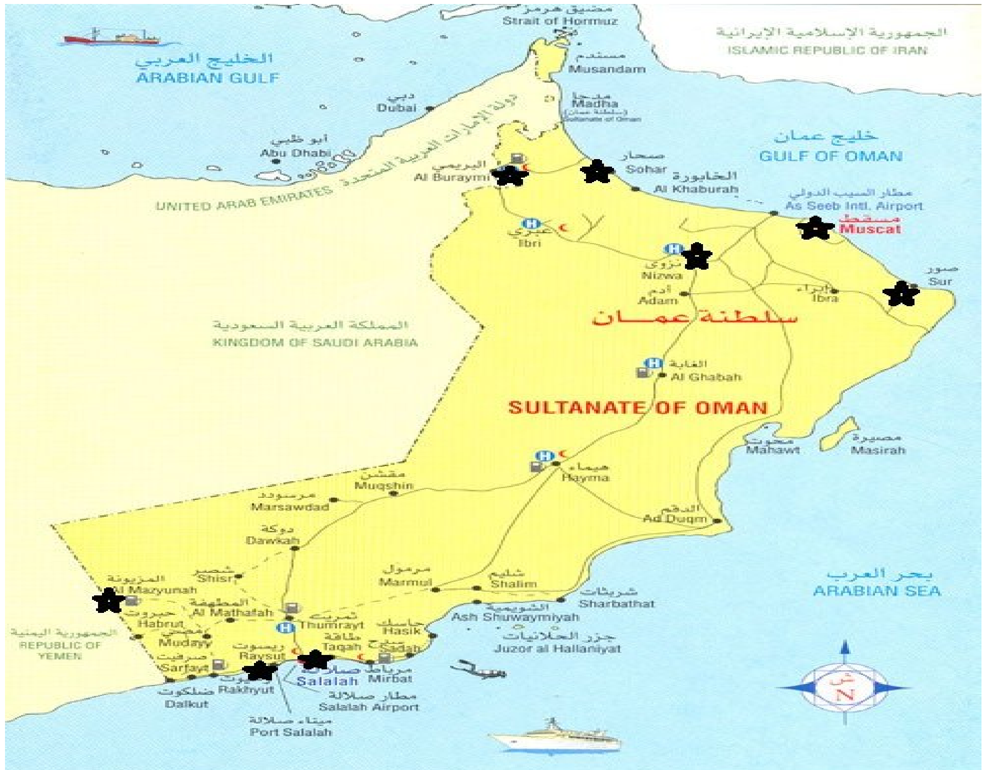


Figure 4.3B: Locations of the main industrial areas in Oman (Source: PEIE, 2011)

In order to ensure a high response rate a very systematic procedure to distribute the survey was followed. Initially, phone calls were made and e-mails were sent by the researcher to the target managers, explaining the objectives of the research and requesting their cooperation by completing the questionnaire. These phone calls were also used to collect the contact details for the respondents and to determine the preferred way of receiving the questionnaire (i.e. mail, fax,e-mail or by hand). The final two options for administering the survey (i.e. by e-mail or by hand) tended to be the most effective way in getting more responses, with around 47% of responses being received by e-mail, around 30% by hand, and the remaining 25% by fax and mail. Total confidentiality was assured for respondents and each questionnaire was coded by a unique serial number in order to match the information to each company and to facilitate the follow-up processes with non-respondents.

4.2.5.2. Secondary data

The secondary data was collected from OMCI and OMECA. Data collected from OMCI included information about the number of manufacturing firms in Oman, number of employees, years of establishment of the firm, type of ownership, percentage of export and import and the contact details of all firms. This data provided a good initial understanding of the target population.

Some additional secondary data were obtained from OMECA. Initially the ministry was visited to discuss the research objectives with the top officials, to determine the main variables to be included in the study and to check the reliability of this study in the Omani context. Later, during the data collection period, the ministry was visited to obtain the approval to conduct the current research (it is the first study of its kind in Oman) and to learn the procedures used by the ministry to control and check the environmental impacts of the Omani manufacturing firms. This visit also aimed to learn the ministry's classification on highly polluting and less polluting firms. In Oman, chemicals (including dyes, insecticides, pharmaceutical products, detergents, fertilizers, perfumes and cosmetics), plastic, refined oil and liquid natural gas, paper, non-metallic mineral products (including cements and its primary products, marble and ceramic products), manufacturing of machine and equipment, and manufacturing of electronic appliances and electronic machines industries are considered as highly polluting industries (NCSI, 2006; A Director from OMECA, personal interview, February 20, 2012). A similar approach of classifying firms based on the national pollution industries classification was used by previous studies (e.g., Bowen *et al.*, 2001a; Garces-Ayerbe *et al.,* 2012). OMECA was also visited at later stages of the research to collect more objective data and secondary reports about the environmental performance of the Omani firms which had participated in the survey. Obtaining the information from multiple sources enables the researcher to detect the existence of common method bias in the received responses (Podsakoff *et al.,* 2003). The main reason for obtaining these reports was to overcome the limitation of using perceptual measures of a single respondent from each firm to assess firm environmental performance. After visiting OMECA, the researcher was able to review the environmental performance report of only 54 companies (OMECA does not keep the environmental reports of all manufacturing companies in Oman). A general review of these reports revealed that all of the 54 companies have good environmental reputations. Good environmental performance was expected from these firms and matched largely how the managers had evaluated the environmental performance of their firms in the received responses. This suggests that common method bias should not be a problem in this research (more discussion on procedural and statistical techniques used in this research to reduce and detect the presence of common method bias is provided in Section 5.3.2).

4.3 Data analysis techniques: Structural equation modelling

As noted in Section 4.2.2 the proposed EM model developed for this research contains multiple dependent (constructs or unobserved variables) and independent variables (measurement items or observed variables). The examination of relationships between these variables is needed in order to answer the research questions. This can be achieved by a simultaneous multiple regression analysis and factor analysis that can be effectively done by using Structural Equation Modelling (SEM) as illustrated in Figure 4.4.

Structural equation modelling has been widely used for data analysis by previous OM empirical studies (Forza, 2002; Shah and Goldstein, 2006). It is a multivariate statistical method, which can be used when a series of regressions needs to be performed and when observable items are related to multiple unobserved latent factors either directly or indirectly (Figure 4.4) (Hair *et al.,* 2006; Tabachnick and Fidel, 2007). SEM assembles and combines simultaneous regression analysis, path analysis and factor analysis. It is a more comprehensive technique than using a single statistical tool (Sroufe, 2003; Shah and Goldstein, 2006).

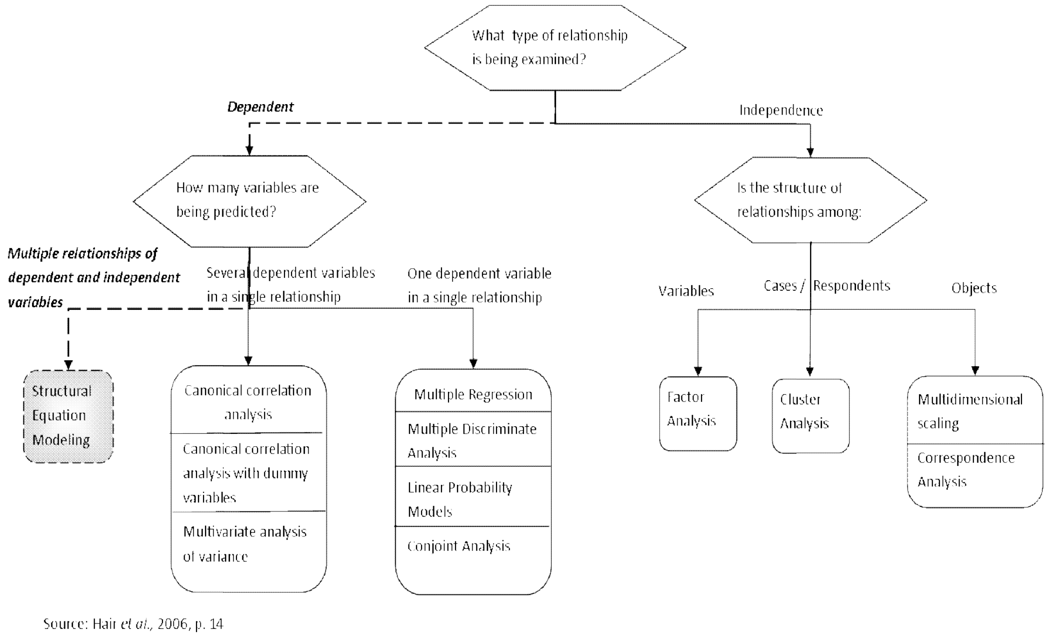


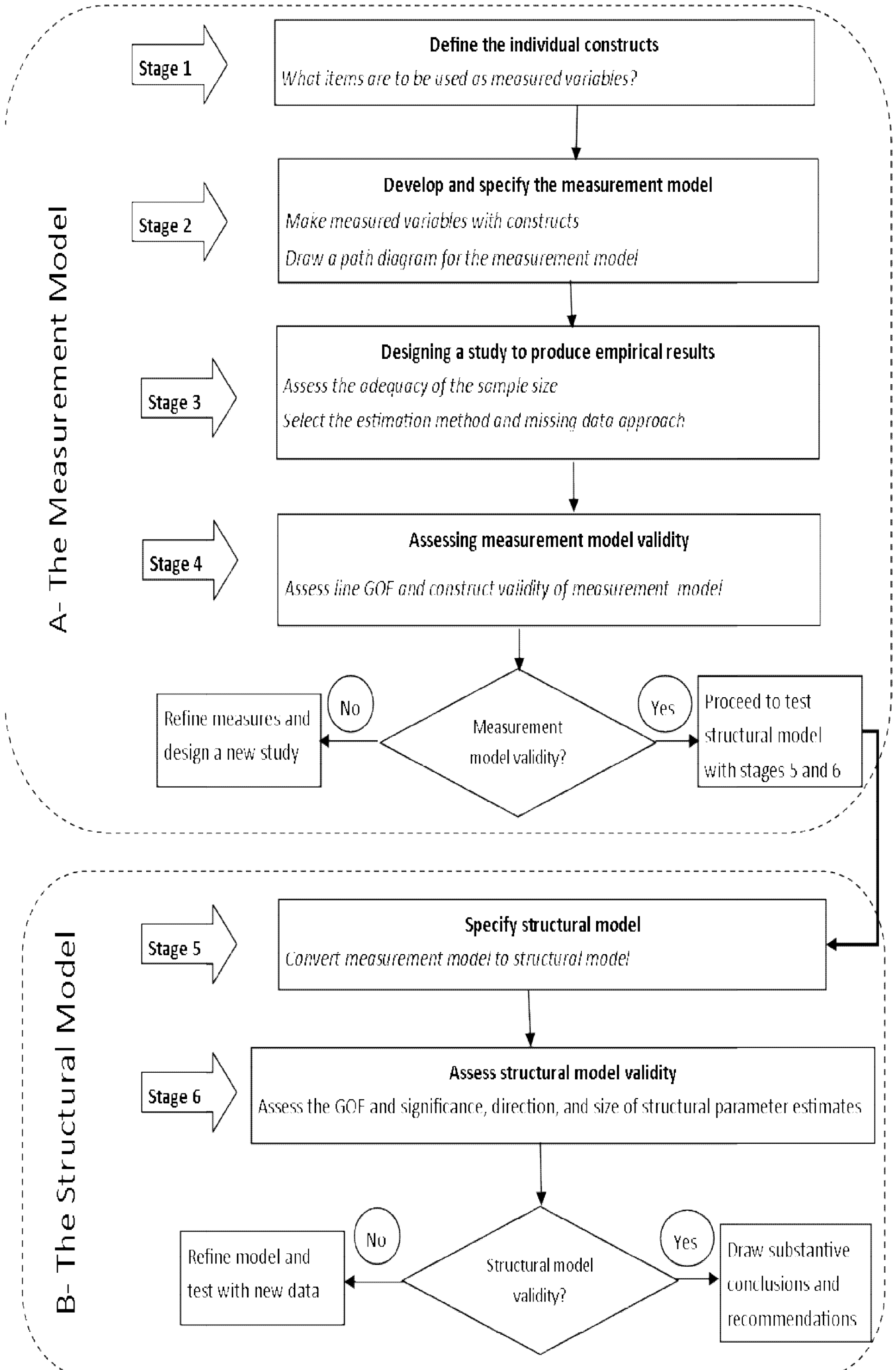
Figure 4.4: selecting a multivariate technique

SEM uses the confirmatory approach (or Confirmatory Factor Analysis/CFA) when analysing the structural conceptual framework of the phenomenon under study, which means that the patterns of multiple relationships between observed variables need to be specified *a priori* (Tabachnick and Fidel, 2007). This theoretical framework represents the causal relationships between multiple observation variables (Hair *et al.,* 2006). SEM is used with the assumption that (1) the causal relationships of observed variables under investigation are represented by a series of multiple regression (i.e. structural) equations, and (2) these links can be demonstrated pictorially to allow for a better visualization of the conceptual theories under investigation (Tabachnick and Fidel, 2007; Byrne, 2010). The proposed theoretical model can then be examined using simultaneous multiple regression analyses to determine how well it conforms and fits with the data. Because SEM requires *a priori* specification of patterns of relationships between the observed variables under investigation, it has been considered as best way to analyse data for 'inferential' objectives (Hair *et al.,* 2006). Compared to other multivariate statistical procedures such as Exploratory Factor Analysis (EFA), SEM (or CFA) is more capable of measuring and correcting for measurement errors. This is the proportion of the latent construct that measurement variables under study are unable to capture due to various reasons (which range from simple data entry errors to errors related to incorrect definition of the construct) (Hair *et al.,* 2006). This implies that the SEM methodology can provide a better chance of detecting theoretical relationships (Byrne, 2010). Further, data analysis through the traditional multivariate statistical procedures is based solely on the interrelations between observed variables. On the other hand, the analysis in SEM considers both the observed variables (i.e. variables that can be directly measured and observed) and unobserved variables (i.e. latent variables that cannot be directly observed) (Anderson and Gerbing, 1988; Hair *et al.,* 2006). The SEM methodology enables also the study of the interrelations between two different yet interrelated types of latent variables: exogenous and endogenous. The exogenous latent variables represent the independent variables in the model and they can be influenced by external factors that are not included or explained by the model (Tabachnick and Fidel, 2007). The endogenous latent variables represent the dependent variables in the model that can be influenced, directly or indirectly, by the independent variables included in the proposed model and thus the model can explain any changes in the endogenous variables (Hair et al., 2006; Tabachnick and Fidel, 2007). These characteristics of SEM make it popular and suitable for non-experimental research problems such as those investigated in this PhD research.

There are two main approaches in which the SEM can be used to examine complex theoretical models: 1) covariance based-SEM (CB-SEM), and 2) variance based-SEM (PLS-SEM). Each of these techniques has its merits and the researcher's choice of a technique should be based on the nature and objectives of the research (Henseler *et al.,* 2009; Roberts *et al.,* 2010). In general, most of the previous SEM studies considered covariance-based SEM to examine if and to what degree a specified model is able to reproduce the covariance (correlation) matrix among the measurement items (Hair, *et al.,* 2006; Peng and Lai, 2012). This is also consistent with SEM implementations in the most commonly used softwares such as AMOS, LISREL and EQS (Anderson and Gerbing, 1988; Byrne, 2010). The PLS technique, although less popular, is an alternative to the more conservative CB-SEM technique. PLS is recommended when the focus is to predict the amount of the explained variance in the dependent latent constructs, when the latent constructs are modelled as formative and when a problematic data set (e.g. non-normal data) that may prevent solutions in CB-SEM was used (Peng and Lai, 2012;Roberts *et al.,* 2010).

Due to the rich theoretical information available to develop the theoretical model under investigation, this research can be considered as covariance (or parameter) oriented in nature (Hair *et al.,* 2006; Shah and Goldstein, 2006; Henseler *et al.,* 2009; Roberts *et al.,* 2010). This is consistent with the existing literature that considers studying the relationships between the antecedents and consequences of adopting GOM practices (e.g. Zhu and Sarkis 2004; Sarkis *et al.,* 2010; Zhu *et al.,* 2008a; Wagner, 2011). Also, given the objective of this study of suggesting an alternative theoretical model that best explains the relationships between stakeholder pressure, GOM practices and the performance of the manufacturing firms, the CB-SEM has explicitly been designed to suggest alternative models that best match the sample covariance matrix. Moreover, all latent constructs used in this research were modelled in a reflective way and thus the use of the CB-SEM is further justified (Peng and Lai, 2012; Roberts *et al.,* 2010).

As shown in Figure 4.5, there are six main stages involved in testing a SEM. While the first three stages have already been covered and discussed in this and previous chapters of this thesis, the remaining three steps will be covered and discussed in the following chapters. Also, there are two main components of models in SEM: (1) the *measurement model (i.e. the inner model)*, which uses the CFA to show the relations between unobserved (or latent) variables and their indicators and to try to reduce the number of observed variables (or indicators) to a smaller number of unobserved latent variables prior to the performance of the structural model, and (2) the *structural model (i.e. the outer model),* which shows the potential causal relationships among the independent and dependent latent variables (Shah and Goldstein, 2006; Henley *et al*., 2006). More details about the application of the measurement model in this research are presented in Section 5.5.The application of the structural model is presented in Section 5.6 of this thesis.



Source: Hair et al., 2006. p. 759

Figure 4.5: Six-stage process for SEM.

4.4 Conclusion of methodology chapter

The main objective of this chapter was to position this PhD research in the domain of Social Sciences studies and to introduce the philosophy, approach and strategy adopted in this research. Based on the objectives of this research, the positivist research approach was used. Accordingly, an appropriate quantitative research method was selected, which will be complemented by some qualitative work. The rationale for using the quantitative research strategy in this study was the well-established literature about the factors influencing the firms' adoption of certain green practices and their implications on performance. A hypothetical-deductive research approach will be used in this research:an integrative conceptual framework was built and a list of hypotheses were developed. These hypotheses will be tested using real data collected by a survey targeting the managers of Omani manufacturing firms.

The process of the survey and constructs development have been highlighted in Sections 4.2.1, 4.2.2 and 4.2.3. In order to ensure a high response rate, the researcher followed a very systematic plan and procedures (Section 4.2.5). Finally, an overview of the statistical techniques for data analysis was provided in Section 4.3. SEM was selected as the most appropriate data analysis tool for this research.

CHAPTER 5 RESULTS OF DATA ANALYSIS

This chapter presents the outcomes of the data collected through the survey. The data were purified for missing values, outliers or any source of bias. After the purification stage, the data were analysed in three main stages. First, descriptive statistical analysis was conducted to give a general idea about the mean and standard deviation for each measurement item. The descriptive statistics also include a discussion about the sample and respondents characteristics. Then, an assessment of the measurement quality was performed by conducting reliability and validity tests to identify the interrelationships between the measurement items and constructs (latent variables) created for this study. This testing is needed to identify how different items relate to each other and to check if items can be grouped in a smaller set of factors (or constructs). The preliminary tests and assessment of measurement quality were conducted using SPSS and AMOS Graphic program version 20.0. Finally, hypothesis tests were conducted using CFA and SEM to examine relationships between different constructs.

The current chapter is presented in five main sections. It begins with an overview of the response rate from the survey (Section 5.1), followed by a discussion of the procedures used to clean the data from any source of bias or missing values (Section 5.3). Sample characteristics and distribution of responses for each measurement item are reported in Section 5.4. Section 5.5 discusses the findings of the statistical techniques used to assess the quality of the measurement model. Finally, the results of SEM and hypothesis tests are presented in Section 5.6.

5.1 Total response

Very systematic procedures were followed during the data collection and survey administration process in order to ensure a high response rate for the developed survey (Section 4.2.5). In Section 4.2.5,it was argued that a response rate of 20-25% was needed. As a result of all the efforts spent to approach companies and respondents,138 usable responses were obtained which is equivalent to a 24 % response rate. A response was considered valid when the respondents had provided answers for at least 90% of the questions (Hair *et al.,* 2006). It is worth noting that the actual total response was 153,but 15responses were excluded for certain reasons (e.g., leaving many questions unanswered(i.e. missing data exceeded 10%), providing the same answer for all questions or detection of common method bias (Hair *et al.,* 2006)). This response rate is normal for cross-sectional and large scale survey studies (Singhal *et al.,* 2008; Creswell, 2009) and it is in line with the response rate obtained by many of the previous survey studies in the area of environmental management and green operations management(see Table 5.1.1). More than 100 phone calls were made and several e-mails were sent to clarify reasons why some targeted companies did not respond. The most obvious reasons for non-response were time constraints and the firm's policy not to respond to questionnaires.

Table 5.1.1: Response rates obtained by some previous environmental studies

Author/s	Response Rate
Christmann (2000)	18.1%
Buysse &Verbeke (2003)	31%
Del Brio& Junquera (2003)	6.5%
Melnyk *et. al.* (2003)	10.35%
Carter, (2005)	21.5%
Chan, (2005)	28%
Rao & Holt (2005)	10%
Sharma & Henriques (2005)	24%
Darnall & Edward (2006)	38%
Vachon (2007): Vachon & Klassen, (2008)	23%
Delmas & Toffel (2008)	17%
Zhu *et al.,* (2008a & 2008b)	13%
Sarkis *et al.,* (2010)	13.7%
Zeng *et al.,* (2010b)	25%
Wagner (2011)	16.1%
Source: Combined by the author from multiple sources	

5.2 Data entry

Before processing the data, it is essential for the researcher to transfer the data from the questionnaire to a computer database (Forza, 2002). Accordingly, responses to the survey were entered into the SPSS using labels introduced in Table 4.14for each ordinal variable. Also, for the nominal data such as respondent position, additional codes were introduced to facilitate their use during the data analysis. To ensure that the data set was complete and free of any error, the researcher double-checked the data entered for each response. In the second step, a set of responses were randomly selected, and again double-checked against the data in the computer database. After entering all the data into SPSS, the data were purified.

5.3 Data cleaning

Many statistical procedures including SEM are sensitive to missing values and outliers (Hair *et al.,* 2006). It is therefore critical to examine the data for missing values, outliers and any source of bias.

5.3.1 Handling missing data and outliers

Missing data is normal in survey research. It happens when the respondent leaves a question blank or provides an inappropriate answer (Creswell, 2009). This may be due to various reasons: refusal to answer a question; the respondent did not know the answer; the respondent escaped the question by mistake; or the researcher escaped by mistake to transfer the answer to the computer database (Saunders *et al.,* 2009). Numerous procedures are available to deal with missing data. The most common techniques are to simply delete any cases with missing data (listwise) or to delete those questions with missing data (itemwise) (Hair *et al.,* 2006). Although listwise or itemwise omission helps to reduce the degree of bias in the dataset, they often lead to a significant reduction in the total sample size and number of measurement items available for further analysis (Tabachink and Fidell, 2007). In this research, out of 138 usable responses obtained, there were 127 cases (92.2% of responses) with complete data and 11 cases (7.8%) for which some missing values (i.e. <10% of responses obtained on all measurement items) were detected. The low percentage of cases with missing values (7.8%) reveals that the incomplete data does not cause significant concerns in the subsequent data analysis of this research. The Hot and Cold Deck imputation approach was used to deal with the missing values in this research (Hair *et al.,* 2006). This is because there was relatively little data missing (i.e. <10% for an individual observation, <10% for a variable) and because missing data occurred completely at random (i.e. missing values of the dependent variables are not dependent on the independent variables, with no bias in the values of dependent or independent variables).In the Hot Deck approach, the missing values were replaced by data collected from the most similar participants. In the Cold Deck approach, missing values were obtained from secondary sources. The Cold Deck approach was used to complete data missing in the first section of the questionnaire (i.e. part 1) which is related to general information about the participating companies. These data were obtained from secondary reports of OMCI. The Hot Deck approach was used to deal with data missing in parts 2, 3, 4, 5 and 6 of the questionnaire. In cases where no similar participants were found, the mean value approach was used to replace the missing values. The Hot and Cold Deck imputation approaches were used because they can provide better options of replacing the missing data compared to other techniques that calculate missing values as the mean of the entire sample (Hair *et al.,* 2006). The missing data imputation approaches used in this research have helped to increase the sample size.

Related to data cleaning is the examination of outlier points. Outlier points indicate the existence of extreme observations that usually have very high or low values for some questions(Easterby-Smith *et al.*, 2008). A small number of outliers are expected in large-scale survey studies (Easterby-Smith *et al*, 2008). The existence of outliers can be the result of errors in the data transcription or it can be an expected variation among population (Hair *et al.,* 2006). If outliers are detected, one can decide to discard these or use statistical remedies to eliminate or reduce their influence on the research conclusions (Forza, 2002). The presence of outliers in the dataset makes statistical analysis difficult. The skewness test and case wise diagnostics outlier test in SPSS were performed in this research. The tests detected few outliers, which did not significantly deviate from the remaining set of observations and appeared to be a legitimate part of the study sample. Accordingly, the researcher decided to keep these in order to reduce the risk of limiting the model generalization (Hair *et al.,* 2006; Tabachink and Fidell, 2007). Finally, because many of the statistical tests assume that data are normally distributed (Hair *et al.,* 2006; Shah and Goldstein, 2006), it is worth noting that the metric data collected from the survey was tested for normality using the skewness and kurtosis statistics and a visual inspection of the normal probability plot of the study variables. The assumption of data normality is more likely to be violated if the skewness and/or kurtosis values of the study variables exceed ±1 (Kline, 1998; Hair *et al.*, 2006). When using the normal probability plot to assess the data distribution, the actual distribution of the data is compared against a straight line that represents the perfect form of the normal distribution. As can be seen from Table 5.4.1, the skewness and kurtosis values of the study variables appear to be satisfactory. Also, Table 5.4.1 indicates that kurtosis and skewness values for each group of dependent and independent variables appear to be within the acceptable ranges. Finally, a visual inspection of the normal probability plots for the study variables, obtained using the SPSS, showed no evidence of extreme departures from the normality assumptions specified for the data. The above tests revealed that this data was approximately normally distributed so that the assumption of data normality was met in this research.

Well-established procedures were used to clean the data from missing values and outliers. However, more examination may be required in order to improve the quality of data analysis. Accordingly, the researcher has further controlled for the potential effects of common method bias and non-response bias.

5.3.2 Handling common method bias and non-response bias

Previous studies have shown that Common Method Biases (CMB) and Non-Response Biases (NRB) can be a problem in social science research and can be one of the main reasons of measurement errors. Podsakoff *et al.* (2003:1) have defined the CMB as "the variance that is attributable to the measurement method rather than to the construct of interest". CMB may result from different sources such as the content of the specific items, response format, the general context and the type of scale used (Podsakoff *et al.,* 2003). The issue of CMB becomes of a particular concern when self-reported measures are used to collect data from the same respondent and at the same time for both the dependent and independent measures (Chang *et al.,* 2010). On the other hand, NRB has been defined as "the differences between the answer of non-respondents and respondents" (Lambert & Harrington, 1990: 5). It occurs when some targeted entities decide not to respond to the research questionnaire and when the non-responders may differ in some way from those who respond (Forza, 2002). Both types of bias, CMB and NRB, can influence the validity of the empirical research outcomes about the relationships among the measurement of various constructs by inflating or deflating the observed links between constructs (Lindell and Whitney 2001; Chang *et al.,* 2010).

Appropriate methods and remedies are needed to reduce the potential influences of these biases.

In this study, due to the difficulty of obtaining responses from multiple respondents in the targeted companies and the difficulty of obtaining reliable objective data related to drivers, practices and performance of GOM among Omani manufacturing firms, a single respondent per company was used to respond to the items of the developed questionnaire at the same point in time. The respondents had an average of fifteen years of work experience in their companies, hold middle and higher-level management positions and they are key informants on the GOM activities that are being adopted or planned in their companies. The management positions and the total years of experience of these respondents reveal that they are knowledgeable on the main drivers, implementation and performance outcomes of various GOM practices under investigation. Using responses of middle and upper level managers is consistent with existing GOM studies (e.g. Bowen et al., 2001a & 2001b; Zhu and Sarkis, 2004; Lai et al., 2005; Vachon and Klassen, 2006; Vachon, 2007; Zhu et al., 2005; 2007; 2012; 2013) which suggest that these managers will have the required knowledge to respond on issues related to adoption of GOM practices of the firm. In fact, Carter et al., (1998) found that top and middle level managers' support and knowledge of EM are key factors to effective implementation of GOM practices in Germany and US firms.

Because a single respondent per company was used in this research, the collected data are likely to be affected by CMB (Lindell and Whitney 2001; Chang *et al.,* 2010). Numerous remedies were proposed in previous studies to address, control for or reduce the potential influences of any sources of CMB, especially those caused by a single respondent bias. Figure 5.1 presents some of these techniques, which have also been followed in this research. Remedies to control for CMB can generally be classified into two approaches; 1) procedural remedies, and 2) statistical remedies (Podsakoff *et al.,* 2003; Chang *et al.,* 2010). In the first approach, researchers try to minimize or eliminate the source of bias through the design of the survey or by obtaining objective measures of the predictor variables from different sources (Hair *et al.,* 2006). Accordingly, in this research, three dummy questions were added in the final draft of the questionnaire (see Table 5.3.1). The researcher checked if respondents provided similar answers to these questions. The cases that provided different responses for two or more dummy were items eliminated from further analysis. CMB was also reduced by following a systematic questionnaire design (Chang *et al.,* 2010). This included using different scale types; questionnaires being sent with a reminder that it should answered by the manager in charge of environmental management in the company; terminologies used in the questionnaire were simplified to maximum level possible; and confidentiality of the respondent and the data provided were assured (Section 4.2.4). Also, secondary data obtained from OMECA and the OMCI were used to detect the existence of the CMB in the received questionnaires. This was done by checking if the subjective information provided by the respondents matched the information obtained from the ministries. In particular, this was done for most questions in part 1 of the questionnaire, and question related to environmental performance in part 4 (secondary reports of environmental performance were available at OMECA for some companies). The results showed that CMB was detected in four of the returned questionnaires and, thus, the researcher decided to exclude these from further analysis. More data was also collected at later stages of the research by conducting case studies. The data was obtained from multiple sources and by interviewing multiple respondents in each case study to further validate the inferential findings from the analysis of survey data (see Chapter 6).The interviews conducted at this stage revealed that middle and top-level managers in general are aware of the main drivers, practices and performance of GOM of their companies. It also showed that the managers interviewed within each company share almost similar views about the main drivers, practices and performance of GOM implemented by their companies but the top managers were able to provide more details about these topics.

Further, to help ensure good quality of the data collected, in this research series of ANOVA tests with factor- composite scores for stakeholder pressures, GOM practices, environmental performance, economic performance and CFC respectively were conducted. The respondents were classified into three main groups based on their general management roles (Table 5.3.2), and then respondents' position was used as a predictor in these tests. Results of the ANOVA tests revealed that no statistically significant differences exist (*p*

>0.05) between the mean scores of responses obtained from the three groups of respondents (Table 5.3.3). These results suggest that the respondents' positions do not significantly influence the quality of the data collected and that these managers are aware about the main drivers, practices and performance of GOM implemented by their companies.

Table 5.3.1: List of dummy items used to check for the existence of common methods bias

Dummy items	**Matched measurement items**
Cross functional communication and collaboration for environmental improvements	Working together to reduce environmental impacts of our firm's activities (CFC1)
Recycling and consuming production waste internally	Recycling of waste for internal use (SrD3)
Potential conflicts between our products and environmental regulations will affect our firm's environmental management activities	Regional governments' environmental regulations influence our firm's green environmental management activities (Glob2)

Table 5.3.2: Classifications of respondents' positions.

Respondents' positions	Number (%)
Production, Operations & Quality Managers	25+30+8=63 (45.65%)
Top managers (GM and CEO)	41+3=44 (31.88%)
Others (HSE & other managers)	29+2=31 (22.46%)
Total	138 (100%)

Table 5.3.3: ANOVA test results of respondent's position affecting the factor-composite score of different constructs.

	F-value (P)
Respondent's position→ Stakeholder pressures	2.238 (0.111)
Respondent's position→ GOM practices	2.782 (0.074)
Respondent's position→ Environmental performance	0.231 (0.794)
Respondent's position→ Economic performance	1.427 (0.244)
Respondent's position→ CFC	2.400 (0.095)

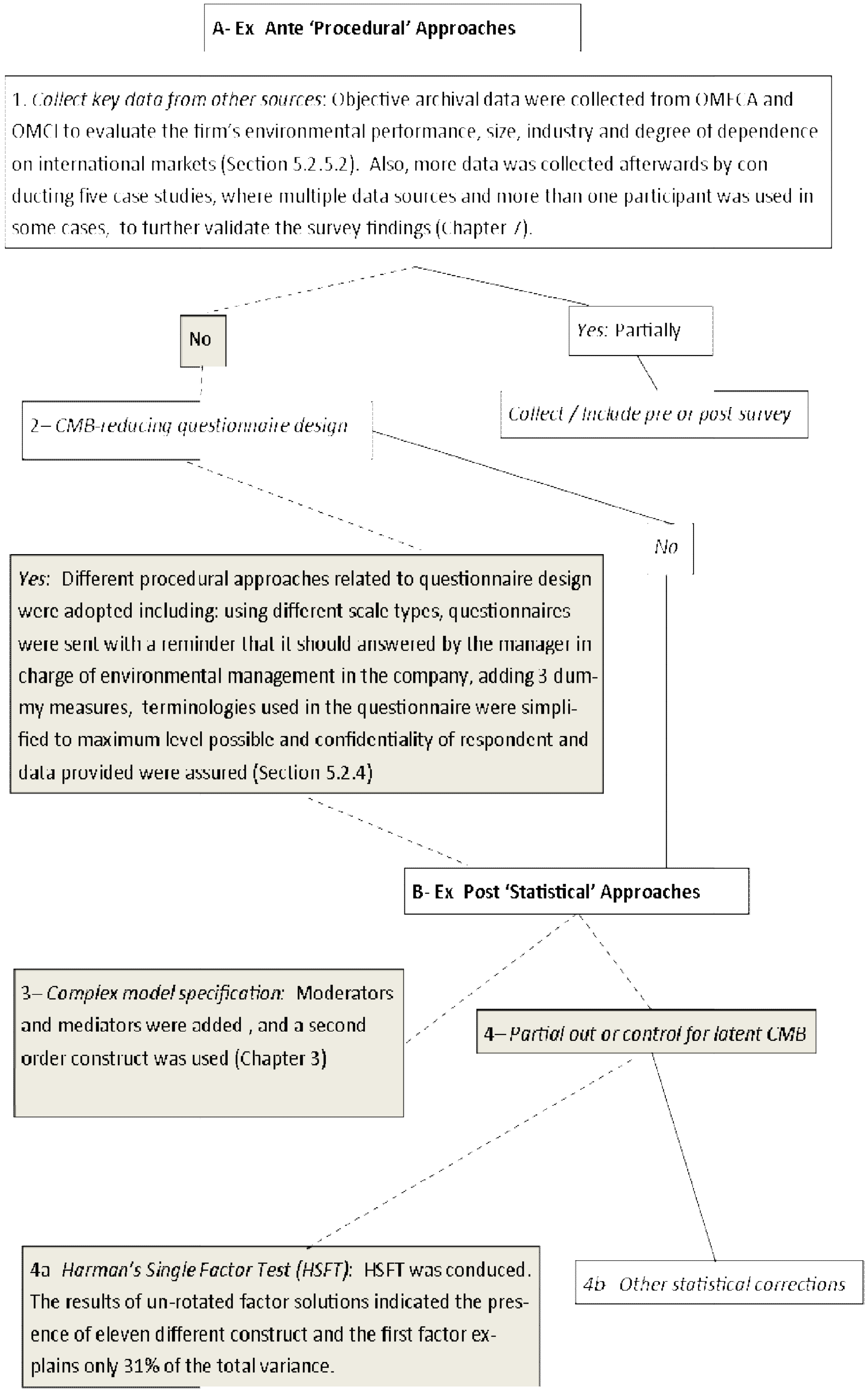


Figure 5.1: Approaches for handling common method bias (adopted from Chang *et al.*,2010)

The second approach of detecting CMB can be considered as 'statistical remedies', in which researchers try to assess the extent to which CMB could be a problem (Lindell and Whitney 2001; Podsakoff*et al.,* 2003). There are various statistical methods to control for CMB, but Harman's single factor test is the most widely used approach(Podsakoff *et al.,* 2003; Malhotra*et al.,* 2006). In Harman's single factor test, all the variables are subject to Exploratory Factor Analysis (EFA). Subsequently, CMB is expected to exist if (1) a single factor emerges from un-rotated factor solutions, or (2) a first factor explains the majority of the covariance among the variables (Podsakoff *et al.*, 2003). Accordingly, the researcher conducted the un-rotated EFA analysis with eigenvalue greater than 1 and it revealed eleven different factors (Table 5.3.4). Also, it revealed that the first factor explains only a fraction of the variance (31.46%). Hence, no general or single factor is apparent, which indicates that CMB is unlikely to affect the final results of this study. In addition to Harman's test, augmenting complex model specifications by adding moderators and mediators to the conceptual model and using a higher order construct are other statistical remedies to reduce the likelihood of CMB (Chang *et al.,* 2010). Such complicated specifications of the model make the respondents' responses of dependent and independent variables unlikely to be part of their cognitive maps of how these variables interact (Podsakoff*et al.,* 2003; Chang *et al.,* 2010).

Table 5.3.4: Total Variance Explained (Harman's single factor test)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of V*	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	17.305	31.463	31.463	17.305	**31.463**	31.463	7.003	12.733	12.733
2	3.965	7.209	38.672	3.965	7.209	38.672	5.810	10.563	23.296
3	3.360	6.108	44.780	3.360	6.108	44.780	4.949	8.998	32.295
4	2.759	5.016	49.796	2.759	5.016	49.796	3.168	5.760	38.055
5	2.386	4.338	54.134	2.386	4.338	54.134	3.123	5.679	43.733
6	2.092	3.804	57.938	2.092	3.804	57.938	3.110	5.655	49.389
7	1.784	3.243	61.181	1.784	3.243	61.181	3.035	5.518	54.906
8	1.473	2.679	63.859	1.473	2.679	63.859	2.876	5.228	60.135
9	1.358	2.469	66.329	1.358	2.469	66.329	2.568	4.670	64.805
10	1.239	2.253	68.582	1.239	2.253	68.582	1.678	3.050	67.855
11	1.193	2.168	70.750	1.193	2.168	70.750	1.592	2.895	**70.750**

Extraction Method: Principal Component Analysis. *V= Variance

NRB can affect the credibility of the research findings. This is because non-respondents change the sample frame and thus can lead to having a sample that does not accurately represent the population. This in turn can limit the generalisability of the research findings (Lambert and Harrington, 1990). There are several methods to identify and control for the potential effects of NRB. The most common protection method against the NRB is striving to increase the level of response (Greer*et al.,* 2000; Lindell and Whitney 2001). Different ways to increase the response rate have been employed by the researcher. These include sending introductory letters in advance; making advance phone calls; attachment of personalised cover letter into the questionnaire; sending the questionnaire with paid-return mail envelopes; non-monetary incentives (i.e. participated firms will receive the executive summary of the research findings); promise of confidentiality of the information provided, using various communication approaches based on the preferences of the respondents; and making several follow-up reminders. In addition, Armstrong and Overton's (1977) statistical technique of detecting and controlling NRB was conducted. The early sets of respondents were compared with the set of the late respondents. This techniques works under the assumption that late respondents to the survey are most likely to resemble the non-respondents (Armstrong and Overton, 1977: Carter, 2005). The results of Armstrong and Overton's (1977) test revealed no significant differences between the two sets ($p>.05$) when comparing the mean values of stakeholder pressures, CFC and the international orientation measurement items. This shows that combining the two databases is acceptable as the NRB is not present in the collected data (Armstrong and Overton, 1977; Lambert and Harrington, 1990; Greer *et al*., 2000).

5.4 Preliminary data analysis

Some of the data collected are nominal in nature and are best analysed through descriptive statistics. Most of the data, however, are ordinal in nature and these are best analysed using inferential or parametrical statistical techniques (Hair *et al.,* 2006; Tabachnick and Fidell, 2007). This section aims to report the results of the descriptive statistics and the preliminary data tests that were conducted using the SPSS version 20.0. The results of the inferential statistics will be discussed later in detail.

Initial data tests allow the researcher to detect any source of systematic errors and to examine whether the data meets the underlying assumptions of the selected tests (Easterby-Smith *et al.*, 2008; Saunders *et al.,* 2009). These tests are essential to ensure that a reliable analysis can be conducted. The descriptive statistics were performed to show the distribution of responses for each measurement variable and to investigate the sample characteristics.

5.4.1 Distribution of responses

After entering the data into SPSS, data was analysed through descriptive statistics. The distribution of responses for each measurement item is presented in Table 5.4.1.

The results in Table 5.4.1 reveal that respondents have generally claimed that their companies are strongly adopting environmental activities related to EMS (mean response is 4.01), eco-design (mean response is 3.69), source reduction (mean responses is 3.47) and external EM (mean response is 3.27). Also, respondents generally perceived that their firms are facing high environmental pressures from multiple sources. They perceived more pressure from the non-market forces (mean response for market pressure is 3.15 and for non-market pressure is 3.37). The results also show that the respondents believed that their companies are highly concerned about the environmental requirements of the international markets (mean response is 3.812). Further, these results imply that respondents have generally claimed that their firms have given considerable attention to the development of environmentally oriented CFC capability (mean response is 4.01). Moreover, respondents have claimed that their firms have high environmental performance (mean response is 3.62) and high positive economic performance (mean response is 3.34) but also high levels of spending (mean response 3.08). The low standard deviations, skewness and kurtosis values show that the distribution of responses to items are fairly normally distributed.

Table 5.4.1: Distribution of responses for each measurement item

Construct	Measurement Items	Mean	S.D**	skewness	Kurtosis	Construct	Measurement Items	Mean	S.D*	skewness	kurtosis
Stakeholder pressure (StP) – Market	StP1	3.5	1.24	-.607	-.532	Environmental Performance (EnP)					
	StP3	3.02	1.27	.079	-.851		EnP1	3.6	1.212	-.616	-.447
	StP4	2.87	1.195	.425	-.863		EnP2	3.71	1.251	-.765	-.398
	StP5	3.18	1.135	-.409	-.595		EnP3	3.45	1.147	-.478	-.460
	StP9	3.28	1.038	-.181	-.622		EnP4	3.71	1.221	-.712	-.169
	StP10	3.1	1.179	-.281	-.697		EnP5	3.49	1.176	-.618	-.450
	Average	3.15	1.17	-.113*	-.461*		EnP6	3.78	.982	-.513	.222
Non-market	StP2	3.7	1.27	-.843	.079						
	StP6	2.76	1.31	.125	-.775						
	StP7	3.17	.901	-.602	-.649						
	StP8	3.86	.965	-.613	-.489						
	Average	*3.37*	*1.10*	*-.523**	*-.135**		*Average*	*3.62*	*1.164*	*-.671**	*-.071**
Environmental Management Systems (EMS)	EMS1	4.07	1.024	-.760	-.022	Spending(Sp)					
	EMS2	4.13	.891	-.860	-.251		Sp1	3.17	1.113	.024	-.632
	EMS3	4.28	.579	-.701	-.660		Sp2	3.07	1.125	.074	-.719
	EMS4	3.67	1.134	-.719	-.150		Sp3	2.91	1.070	.212	-.655
	EMS5	3.61	1.165	-.602	-.317		Sp4	3.17	1.150	.020	-.742
	EMS6	4.14	.868	-.737	-.059						
	EMS7	4.14	.706	-.850	-.353						
	Average	*4.01*	*.91*	*-.602**	*-.508**		*Average*	*3.08*	*1.144*	*.105**	*-.186**
Eco-Design (EcD)	EcD1	3.9	1.104	.677	.131	Business Benefits (Sv)	Sv1	3.1	1.168	.027	-.640
	EcD2	3.79	1.24	-.812	-.533		Sv2	3.28	1.182	-.229	-.710
	EcD3	4.01	.873	-.603	.454		Sv3	3.37	1.158	-.504	-.524
	EcD4	3.33	1.191	-.507	-.827		Sv4	3.47	1.080	-.631	.100
	EcD5	3.49	1.16	-.660	-.662		Sv5	3.48	1.257	-.387	-.573
	EcD6	3.63	1.21	-.845	-.084						
	Average	*3.69*	*1.13*	*-.644**	*.447**		*Average*	*3.34*	*1.163*	*-.340**	*-.206**
Source Reduction (SRd)	SRd1	3.11	1.26	-.394	-1.021	Cross- Functional Collaboration (CFC)	CFC1	4.09	.879	-.639	-.059
	SRd2	3.04	1.25	-.819	-.088		CFC2	4.09	.850	-.519	-.504
	SRd3	3.23	1.374	-.078	-.846		CFC3	3.89	.860	-.416	-.445
	SRd4	3.67	1.142	-.466	.094		CFC4	3.97	.858	-.490	-.196
	SRd5	3.59	1.13	-.791	-.387						
	SRd6	4.18	.818	-.763	-.435						
	Average	*3.47*	*1.16*	*-.556**	*-.058**		*Average*	*4.01*	*.861*	*-.643**	*.185**
External EM(ExEM)	ExEM1	3.55	1.12	-.460	-.706	International Orientation (Glb)					
	ExEM2	3.24	1.19	-.293	-.863		Glb1	3.76	.925	-.785	.275
	ExEM3	2.86	1.32	-.120	-.773		Glb2	3.84	.911	-.669	.178
	ExEM4	3.31	1.13	-.453	-.722		Glb3	3.85	.845	-.628	.172
	ExEM5	3.43	1.25	-.468	-.748		Glb4	3.80	.915	-.741	.502
	ExEM6	3.52	1.23	-.702	-.449						
	ExEM7	2.72	1.25	.321	-.777						
	ExEM8	3.49	1.23	-.587	-.624						
	ExEM9	3.31	1.31	-.448	.688						
	Average	*3.27*	*1.23*	*-.310**	*-.760**		*Average*	*3.812*	*.899*	*-.709**	*.520**

**composite scores of the skewness and kurtosis for each group of dependent and independent variables*
***S.D= Standard Deviation*

5.4.2 Sample and respondents characteristics

The characteristics of the sample were evaluated based on the ownership, number of workers, location of operations, years in business and the main activity (see Table 5.4.2). Table 5.4.2 shows that, of the responding firms, 130 (94.2%) were fully or partially privately owned firms and 8 (5.8%) were government owned firms. Also, the results reveal that 39 (28.3%) of these have workers ranging from 20-99 and 99 (71.7%) have over 99 workers indicating that majority of the respondents are large firms. The results show that large firms are more likely to respond to this kind of survey than smaller firms, which supports the researcher’s decision of excluding the smaller firms from the targeted population. Furthermore, Table 5.4.2 shows that the responding firms are from fifteen different manufacturing industries. Most of the responding firms 104 (75.4%) were from six different industries; chemical products industry 23 (16.7%), fabricated metals industry 22 (15.9%), plastic products industry 19 (13.8%), electronic appliances and electronic machines industry 14 (10.1%) and non-metallic mineral products industry 13 (9.4%) and basic metals industry 13 (9.4%). The remaining 44 (31.8%) firms are from other industries such as refined oil & liquid natural gas, wood & paper products, basic metals, leather & saddles, publishing activities, printing & photocopying industries, medical & optical equipment and machinery industries, and textiles & garments industries.

Table 5.4.2: Sample Characteristics

Ownership	No	%
Publicly traded	27	19.6
Privately owned	103	74.6
Government owned	8	5.8
Total	138	100.0
Number of Workers	No	%
20-99	39	28.3
more than 100	99	71.7
Total	138	100.0
Company Operations	No	%
Oman only	37	26.8
Oman based but export outside	89	64.5
Subsidiary of an overseas company	12	8.7
Total	138	100.0
Age of the company in Oman		
2-5 years	18	13.0
6-10 years	21	15.2
more than 10 years	99	71.7
Total	138	100.0

Main Company Activity	No	%
Chemical products	23	16.7
Plastic products	19	13.8
Non-metallic mineral products	13	9.4
Basic metals	13	9.4
Fabricated metals products	22	15.9
Manufacturing of machines & equipment	10	7.2
Electronic appliances & electronic machines	14	10.1
Food & beverage	7	5.1
Wood & wood products	1	0.7
Paper & paper products	1	0.7
Publishing activities, printing, photocopying	4	2.9
Refined oil & liquid natural gas	5	3.6
Textiles & Garments	3	2.2
Leather & saddles	2	1.4
Medical & optical equipment and machinery	1	0.7
Total	138	100.00

The respondents were also assessed in terms of position and years of experience in the company (see Table 5.4.3). Among the 138 respondents, 25 (18.1%) were responsible for production management, 30 (21.7%) were responsible for operations management, 8 (5.8%) were responsible for quality management, 29 (21%) were directly involved with Health, Safety and Environmental (HSE) management, 41 (29.7) were general managers, 3 (2.2%) were CEOs and 2 (1.4) were in other categories. Therefore, with these positions of all respondents, it is likely that they are directly involved in or aware of their firms' environmental management. In addition, 129 (93.5%) of the respondents have claimed that they had more than 8 years of experience in management, 8 (5.8%) between 2-7 years, and 1 (.7%) had less than 2 years of management experience, suggesting that these respondents are experienced enough to provide the information required by the survey.

Table 5.4.3: Respondents Characteristics

Respondents Positions	Number	Percentage	Years of Experience	Number	Percentage
Production Manager	25	18.1	< 2 years	1	.7
Operations Manager	30	21.7	2-7 years	8	5.8
Quality Manager	8	5.8	8-15years	55	39.9
Health. Safety and Environmental (HSE) Manager	29	21.0	> 15	74	53.6
			Total	138	100.0
General Manager	41	29.7			
CEO	3	2.2			
Others	2	1.4			
Total	138	100.0			

5.5 Assessment of the measurement quality

Conducting the preliminary tests gives the researcher a better feeling for the collected data, which helps to better understand the final results of the study. The second stage of the data analysis involves the assessment of the measurement quality or 'the measurement model' (Hair *et al.*, 2006; Shah and Ward, 2007). A simple path diagram of a measurement model is depicted in Figure 5.2A.

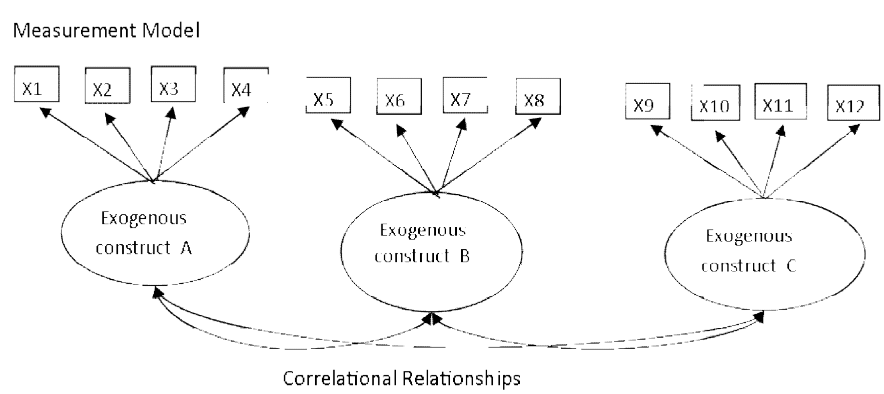


Figure 5.2A: A simple representation of measurement model

The assessment of the measurement model focuses on evaluating the quality of items or indicators used in the survey to measure the set of constructs that are intended to be studied (Hair *et al.,* 2006). This is important when these constructs are measured using multiple items. The measurement model also specifies the relationships between the observed indicators and the underlining unobserved-latent constructs (Henseler *et al.,* 2009). It reflects how the latent constructs are conceptualised (Henseler *et al.,* 2009; Roberts *et al.,* 2010). In SEM, the unobserved-latent constructs can be conceptualised as either reflected or formed by its observed indicators. While in the first situation the researcher theoretically posits that the relationship is going from the latent construct towards its indicators (i.e. the construct is reflected by its indicators), in the second situation the researcher assumes that the relationship is going from the indicator towards their underlining latent construct (i.e. the latent construct is formed by its indicators). Concerning the decision of whether to conceptualise a construct as reflective or formative, Hair *et al*. (2006), Henseler *et al.,*(2009) and Robert *et al.,* (2010) argued that there is no definitive answer of which to use. The most important thing is the content domain of the construct, no matter which conceptualisation approach is used (Hair *et al*. 2006; Robert *et al.,* 2010). Thus, considering the objectives of this research, all unobserved latent constructs are conceptualised as reflective constructs.

The assessment of the measurement quality can be achieved by performing reliability and validity tests of the developed constructs. This aims to ensure that the theoretical constructs developed by the researcher have empirical relevance (Byrne, 2010). These tests can reduce the influence of the measurement errors on the conceptual relationships and ultimately prevent any misleading conclusions (Forza, 2002; Singhal *et al.*, 2008). In fact, measurement error is considered one of the main sources of errors in large-scale survey studies, which rely on perceptual measures (Forza, 2002). It relates to the inaccuracies in measuring the actual value of variables under investigation due to improper design of the measurement instrument, including data entry errors, improper response scales or respondents' errors (Hair *et al*., 2006).

5.5.1 Reliability testing

Reliability testing focuses on studying the consistency and stability in the measurement items (Tabachink and Fidell, 2007). Numerous methods and statistical procedures are available in the literature to estimate the measurement reliability. However, the most commonly used procedures are the internal consistency technique, the alternative form technique, splitting the dataset into half technique and test-retest (Hair *et al,* 2006). The researcher has the choice of using one or multiple approaches for conducting reliability tests (Forza, 2002; Hair *et al,* 2006). In this study, the internal consistency technique was adopted and SPSS was used to perform this test. The internal consistency technique relies on employing various algorithms to measure the interrelation and homogeneity of multiple items (Forza, 2002; Tabachnik and Fidell, 2007). In other words, it measures the extent to which a set of items work together as a group to independently measure a certain construct. The measurement of internal consistency has been achieved in this research by using Cronbach's alpha coefficient test (Cronbach, 1987). The Cronbach's alpha coefficient test is considered as the most common reliability indicator used in operations management survey studies (Rungtusanathm *et al*., 2003). The Cronbach's alpha coefficient (α) test is concerned with studying the number of items used to measure a certain construct (?) and the average inter-correlations between these items (ρ). Cronbach's alpha is calculated by using the following formula: ($\alpha = \frac{?\,\rho}{1+(?\,-1)\rho}$).α value should be above 0.70 for exploratory research (Nunnally, 1978; Cronbach, 1987).The results of the reliability tests for each construct are reported in Table 5.5.2, and discussed in Section 5.5.3.1.

5.5.2 Validity testing

In empirical studies, theoretical constructs cannot be directly observed but are indirectly observed through a multi-item measurement scale (Flynn *et al.,* 1990; Hair *et al,*2006). The construct validity test assesses the extent to which a set of measurement items that are used to measure a certain construct conform to the theoretical aspects of that construct (Rungtusanathm *et al.,* 2003). Construct validity can be evaluated according to discriminant and convergent validity (Forza, 2002; Rungtusanathm *et al.,* 2003). The convergent validity or the 'unidimensionality' test aims to study the consistency and homogeneity between measurement items of the same construct. The discriminant validity, however, focuses on assessing heterogeneity among measurement items of different constructs (Tabachink and Fidell, 2007). The convergent validity can be checked by using Exploratory Factor Analyses (EFA)and discriminant validity can be checked by using Confirmatory Factor Analyses (CFA) (Forza, 2002; Hair *et al.* 2006). Definitions of EFA and CFA and how these have been used to test the reliability and validity of the eleven constructs developed in this research (summarized in Table 4.2.10) are provided in the following subsections. Because firm size and pollution intensity were operationalised in this research using dummy variables(no specific set of indicators were used to measure these variables), these two variables were not included in the reliability and validity tests. A similar approach was also adopted by previous SEM studies (e.g. Auh and Menguc, 2005; Wagner, 2011; Ye *et al.,* 2013).

5.5.3 Factor analysis

Factor analysis has been widely used in social science and operations management survey studies that deal with large amount of data (Shah *et al.,* 2006). It is a statistical method used to identify relationships among multiple observed and unobserved variables (Byrne, 2010). The inter-correlations and joint variations between variables allow for summarisation of numerous observed items into a smaller and more meaningful number of unobserved constructs called factors or 'latent variables' (Hair *et al.,* 2006). There are two types of factor analysis: Exploratory Factor Analyses (EFA) and Confirmatory Factor Analyses (CFA) (Hair *et al.*2006). EFA is used to explore the underlying relationships between a large numbers of measurement variables. In conducting EFA, the researcher initially assumes that any measurement variable (or item) may be linked with any construct. Accordingly, the researcher uses the factor loading of measurement variables to understand and determine the most logical structure that can be obtained from the collected data (Tabachnik and Fidell, 2007). In the CFA, the researcher aims to examine if the number of constructs and the measurement items loaded on these constructs conform to the pre-established conceptual structure (Hair *et al.,* 2006). Thus, researchers conduct CFA to check if the measurement items used to develop a construct of interest are really associated with that construct and not with any other.

5.5.3.1 Exploratory factor analysis and constructs reliability results

The performance of EFA is recommended in order to determine the number of constructs and indicators that should be used for the final conceptual structural model (Hair *et al.,* 2006). The EFA was performed using SPSS version 20. While conducting the EFA three main issues were considered: the type of factor extraction method, factor rotation methods, and the optimal number of factors (or constructs) to be used.

The factor analysis of the 61 conceptual items that were developed for this research was performed using EFA. Following suggestions of previous studies (e.g., Forza, 2002; Hair *et al.,* 2006; Henley*et al.,* 2006; Tabachnik and Fidell, 2007) the performance of EFA in this research has gone through the following five steps:

1- Using the principal components extraction method and varimax rotation factor analysis to determine the construct's unidimensionality. The principle components extraction method is best used in reducing a set of observed variables to a smaller number of unobserved variables that can explain most of the variance in the observed measurement variables (Henley *et al.,* 2006). Also, the varimax rotation method is by far the most common form of rotation method used in EFA by previous empirical studies (Hair *et al.,* 2006; Byrne, 2010). This is because it helps to provide the most meaningful separation of measurement items, which in turn can simplify the interpretation of the constructs under investigation (Hair *et al.,* 2006).

2- Determining the suitability of the data for factor analysis by using the Kaiser-Meyer-Olkin Measure (KMO) (must be >0.5) and Bartlett's tests must be significant (<0.05).

3- Calculating Cronbach's alpha for each construct and computing the degree of item-construct correlation (or factor loading). A widely accepted rule of thumb is that Cronbach's alpha should be at least 0.70 for a well-established construct and around 0.60 for a newly developed construct (Forza, 2002). Regarding the choice of the factor loading value, Hair *et al.* (2006) have argued that this should be based on the justification of the researcher. However, for a measurement to provide an acceptable significance, a factor loading with value greater than .5 is needed (Tabachnik and Fidell, 2007). Further, item communalities, which measure the amount of variance accounted for by the construct solution for a particular measurement item, were considered when deciding to remove or keep an item. Items with communalities value of less than 0.5 were considered for removal (Hair *et al.,* 2006).

4- Deleting any construct that has Cronbach's alpha coefficient of less than 0.6 and any item with a low factor loading or that has cross loaded into more than one construct.

5- Constraining the number of constructs, relocating measurement items if required and selecting the optimum number of constructs, which accounts for a higher percentage of total variance (> 60 %) and makes the most logical conceptual structure.

The above guidelines were followed and these five steps were repeated until a clear construct structure was obtained. All items loaded satisfactorily onto only a single construct and the Cronbach's alpha coefficient for each construct is greater than or equal to 0.7. Factor analysis with the principle components extraction method and the varimax rotating resulted in having eleven different factors, which explains around 70.75% of the total variance (Table 5.3.4 in section 5.3.2). The result of the KMO and Bartlett's Tests (Table 5.5.1) reveal that the data are suitable for factor analysis (KMO = 0.850 and Bartlett's 5779.1/ d.f. 1485).

Table 5.5.1: KMO and Bartlett's Data Suitability Tests

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.850
Bartlett's Test of Sphericity Approx. Chi-Square	5779.076
D.f.	1485
Sig.	0.000

Also, the EFA results show that the reliability coefficient for all constructs is higher than the recommended Cronbach's alpha value (see Table 5.5.2), indicating a high levels of internal consistency. This can also be seen as indicator for the measurement scale validity (Hair *et al.,* 2006). 43 out of 61 items have survived the EFA process and represent eleven constructs proposed in the initial conceptual framework in Section 4.2.2.

Table 5.5.2: EFA results and reliability analysis for each construct

Construct	Items	Communality	Factor Loading	Alpha	Construct	Items	Factor Loading	Communality	Alpha
Market Stakeholder pressure	StP1	0.708	0.793	0.876	Environmental Performance	EnP1	0.825	0.698	0.889
	StP3	0.821	0.847			EnP2	0.842	0.737	
	~~StP4~~*	-------	------			EnP3	0.836	0.767	
	~~StP5~~*	-------	------			EnP4	0.760	0.795	
	StP9	0.707	0.521			EnP5	0.534	0.777	
	StP10	0.722	.764			~~EnP6~~*	------	------	
Non-Market Stakeholder pressure	StP2	0.777	0.794	0.793	Spending	~~Sp1~~*	------	------	0.819
	StP6	0.591	0.524			Sp2	0.600	0.739	
	StP7	0.682	0.719			Sp3	0.768	0.801	
	StP8	0.703	0.613			Sp4	0.901	0.749	
Eco-Design	EcD1	0.622	0.823	0.786	Business Benefits	~~Sv1~~*	------	-------	0.812
	EcD2	0.614	0.663			Sv2	0.887	0.816	
	EcD3	0.591	0.640			Sv3	0.937	0.823	
	~~EcD4~~*	------	-------			Sv4	.653	0.716	
	EcD5	0.588	0.533			~~Sv5~~*	------	------	
	~~EcD6~~*	------	-------						
EMSs	EMS1	0.626	0.621	0.808	Cross-Functional Collaboration	CFC1	.842	0.803	0.925
	~~EMS2~~*	------	------			CFC2	.916	0.816	
	~~EMS3~~*	------	------			CFC3	.858	0.810	
	EMS4	0.698	0.750			CFC4	.826	0.778	
	EMS5	0.778	0.861						
	~~EMS6~~*	-------	------						
	EMS7	0.633	0.674						
Source-Reduction	SRd1	0.582	0.554	0.750	International Orientation	~~Glb1~~*	------	-------	0.844
	SRd2	0.661	0.690			Glb2	0.735	0.717	
	SRd3	0.646	0.664			Glb3	0.667	0.668	
	SRd4	0.704	0.764			Glb4	0.836	0.777	
	~~SRd5~~*	------	-------						
	~~SRd6~~*	------	-------						
External EM	ExEM1	0.782	0.819	0.874					
	~~ExEM2~~*	-------	-------						
	ExEM3	0.835	0.780						
	ExEM4	0.855	0.866						
	ExEM5	0.788	0.863						
	~~ExEM6~~*	-------	--------						
	~~ExEM7~~*	-------	--------						
	ExEM8	0.709	0.541						
	~~ExEM9~~*	-------	------						

Extraction Methods: Principle Component Analysis, Rotation Method: Varimax with Kaiser Normalisation
* Item was deleted during EFA because either it has loaded into more than one factor or has a very low factor loading

5.5.3.2 First order confirmatory factor analysis

As highlighted earlier, the main objective of EFA is to investigate how and the extent to which the observed measurement variables are related to their fundamental constructs without having *a priori* knowledge about the nature of these interrelationships. CFA, on the other hand, aims to verify whether a pre-determined set of variables are interrelated in the predicted way and thus, a prior knowledge about the relations between variables of interest is needed before conducting CFA (Tabachnik and Fidell, 2007). In other words, CFA aims to test the extent to which the data set fits with the hypothesized measurement model that was developed based on an existing theory and/or proves findings of previous analytical research. In SEM studies, CFA represents what is known as 'a measurement model'. This usually precedes the 'structural model', which is used to test hypothesized relations between the latent variables under study (Hair *et al.,* 2006; Byrne, 2010). The measurement model test (or CFA) is needed in order to conduct the structural model and to test the validity of the constructs.

The AMOS Graphic software version 20 was used to conduct the CFA. Because of its user-friendly nature, AMOS is considered as the best alternative SEM software compared to the traditional LSREL software (Hair *et al.,* 2006). The data was initially transferred from SPSS to AMOS using the data transfer option available in AMOS. Figure 4.5 in Section 4.4, indicates that there are six stages involved in testing SEM. The first four stages are related to the measurement model and the remaining two stages are related to the structural model. The following steps and guidelines suggested by previous studies (e.g. Forza, 2002; Hair *et al.,* 2006; Tabachnik and Fidell, 2007; Byrne, 2010) were followed while conducting CFA:

1- Define the number and structural model of the factors that the researcher believes are underlying the variables that need to be studied. In Chapters 2 and 3, the literature was used to develop the conceptual framework and to determine the number and nature of constructs.
2- Specify the measurement items to measure the constructs of interest and develop the measurement model. In Chapter 4,Section 4.2.2, the measurement items for the constructs were developed using the environmental management literature. The list of measurement items and their underlying constructs were summarised in Table 4.2.10.
3- Collect sample data to test the proposed model. Section 4.2.5presented the process of data collection and Section 5.4provided some descriptive statistics about the collected data. Section 5.3discussed all the

procedures used to purify the data in order to use it for CFA and SEM. In addition, results of the KMO test indicated an adequate sample size.

4- Fit the measurement model to the data to test how well the hypothesized model describes the covariance among all the measurement items used to develop the model. If the model fits with the data, the model fit statistical tests will show a good fit and then the model can be accepted. A poor model fit, however, indicates that some measurement items measure more than one constructor that other theoretical relationships between constructs may have not been considered while developing the conceptual model (Sharma *et al.,* 2005; Tabachnik and Fidell, 2007). The maximum likelihood Estimation (MLE) of the model fit procedure was selected to obtain the factor loading estimates. MLE is the most common SEM estimation and model fitting procedure used by previous CFA studies. MLE is considered a robust estimator method because it can provide reliable and valid estimation results even when the assumption of multivariate normality distribution is violated and with a sample size as small as 50 (Satorra and Bentler, 1994; Rao and Holt, 2005; Hair *et al.,* 2006). When considering the model fit indices, previous studies showed that several indices are available to assess how well the model fits the data. However, Incremental Fit Indices (IFI), Absolute Fit Indices (AFI) and Parsimonious Fit Indices (PFI) are the most common indices adopted by previous CFA studies (Hair *et al.,* 2006). Table 5.5.3 provides a brief explanation of fit indices in each category and recommended cut-off values. Concerning which indices the researcher should report for model fit, previous studies have argued that it is not required to report every index obtained from the program outputs (Hair *et al.*, 2006; Shah and Goldstein, 2006). Reporting various indices, however, is recommended as each index reveals a different aspect of the model fit (McQuitty, 2004; Hair *et al.,* 2006; Shah and Goldstein, 2006; Tabachnik and Fidell, 2007). Hair *et al.* (2006) have argued that reporting three to four indices can provide enough evidence of model fit. In fact, some studies argue that as the model fit indices can be affected by the model complexity, the number of variables involved, data normality and the sample size, the researcher should report approximate fit indices that are more suitable for their data conditions (McQuitty, 2004; Sharma, 2005; Shah and Goldstein, 2006; Steiger, 2007). For example, the χ^2statistics and the GFI have been recently dropped from the list of reported fit indices due to their high sensitivity to the sample size (Tabachnick and Fidell, 2007;Kenny, 2009). This research follows Hair *et al*., (2006) recommendations of reporting one or two absolute fit indices (i.e. RMSEA, GFI), one or two incremental fit indices (i.e. CFI, IFI, TLI), one goodness of fit index (i.e. CFI, TLI), one badness of fit index (i.e. RMSEA), one or two parsimonies fit indices (i.e. PCFI, normed χ^2 (χ^2/d.f), AIC) in addition to the χ^2values with degree of freedom.

Table 5.5.3: Examples of model fit indices

Categories of Model Fit Indices	Description	Measures under the category	Recommended cut-off values
Absolute Fit Indices (AFI)	Examine how well a predetermined model fits the data *without* comparing it to any baseline model and it offers the most essential good of fit indices	~Chi-Squared test($\chi2$) ~ Root Mean Square Error of Approximation (RMSEA) ~ Goodness-of-fit Index (GFI) ~ Adjusted goodness-of-fit statistic (AGFI) ~ Root Means Square Residual (RMSR) ~ Standardized Root Mean Residual (SRMR) ~Normed Chi-Squared ($\chi2$/d.f)	P value $\geq$.05 (RMSEA) $\leq$ .08 (GFI)> .8 (AGFI)>.8 (RMSR) $\leq$0.10 (SRMR)$\leq$0.10 Normed χ^2 $\leq$3.0
Incremental (Comparative) Fit Indices	Assess the improvement of model fit by *comparing* the predetermined model with an alternative and more restricted baseline model	~Incremental Fit Index (IFI) ~ Comparative Fit Index (CFI) ~Normed Fit Index (NFI) ~Tucker Lewis Index (TLI)	(IFI)$\geq$ .9 (CFI)$\geq$ .9 (NFI)$\geq$ .9 (TLI)$\geq$ .9
Parsimonious Fit Indices (PFI)	Used to determine the best fitting model among a competing set of models when considering the model fit relative to its complexity	~Normed Chi-Squared test($\chi2$)with its associated degree of freedom ($\chi2$/d.f) ~Parsimonious Normal Fit Index (PNFI) ~Parsimonious Comparative Fit Index (PCFI) Akaika (1987) AIC lack of-fit index	Normed χ^2 (χ^2/d.f.)$\leq$3.0 (PNFI) $\geq$ .7 (PCFI) $\geq$ .7 The smaller is better
Source: Hu and Bentler (1999); McQuitty, 2004; Sharma *et al.,* 2005; Hair *et al.,* 2006; Steiger, 2007; Shah and Goldstein, 2006; Tabachnick and Fidell, 2007;			

While conducting the CFA, the number of measurement items for each construct (i.e. at least three items), the significance of each measurement item and the criteria of overall measurement model fit (presented in Table5.5.3) were considered until a final first order measurement model with a satisfactory degree of fit was obtained. Table 5.5.4 provides a summary of the first order CFA results. 37 out of 44 items have survived from the CFA process and represent eleven constructs proposed in the initial conceptual framework. Five fit indices were used to assess the model fit for both the measurement model and the structural model developed in this research; Normed Chi-Squared ($\chi 2$/d.f), CFI, IFI, RMSEA and PCFI. The modification indices (MI) provided by AMOS were also reviewed to find ways to improve the overall fit (Hair *et al.,* 2006). MI refers to the expected improvement in the model chi-square value if the parameters were to be freely estimated (Byrne, 2010). Using the MI helps to identify potential weaknesses in the measurement model. As there was no significant and theoretically supported MI found between the variables used in the measurement model, no changes were made to the model. The results of the overall fit for the first order CFA model are reported in Table 5.5.4. Based on the recommended thresholds highlighted in Table 5.5.3, the CFA results indicate a satisfactory model fit for the first order measurement model.

It is worth noting that although both EFA and CFA models discussed above are based on the first order factor measurement model, the construction of the second order CFA model is needed to achieve the objective of this research of conceptualizing the complementarities between various types of GOM practices and evaluating its superior performance implications. The detailed discussion and application of the second order CFA model is provided in the following sub-section.

Table 5.5.4: First order CFA results

Latent Variables	Observed Variables	Standardised Factor Loading	t-value	R^2	Composite Reliability	Average Variance Extracted
Market stakeholder pressure	StP1 StP3 StP10	.811 .845 .763	__* 10.014 8.230	0.655 0.713 0.482	.85	.65
Non- market stakeholder pressure	StP2 StP7 StP8	.794 .722 .613	__* 6.769 5.877	0.628 0.414 0.318	.75	.51
EMSs	EMS1 EMS4 EMS5 EMS7	.621 .750 .861 .674	__* 6.928 7.793 6.539	0.382 0.535 0.778 0.439	.82	.54
Eco-design	EcD1 EcD2 EcD3	.824 .663 .642	__* 7.327 6.626	0.675 0.431 0.392	.76	.51
Source reduction	SRd2 SRd3 SRd4	.691 .662 .767	__* 5.150 5.494	0.447 0.425 0.471	.75	.50
External EM	ExEM1 ExEM3 ExEM4 ExEM5	.821 .780 .869 .863	__* 9.674 11.756 11.712	0.687 0.585 0.740 0.736	.90	.70
Environmental performance	EnP1 EnP2 EnP3 EnP4	.842 .844 .840 .761	__* 11.725 11.544 10.091	0.705 0.708 0.694 0.574	.89	.67
Business benefits	Sv2 Sv3 Sv4	.886 .937 .653	__* 15.125 7.169	0.799 0.900 0.358	.87	.70
Spending	Sp2 Sp3 Sp4	.671 .762 .843	__* 7.208 9.254	0.326 0.572 0.861	.80	.58
Cross-functional collaboration	CFC1 CFC2 CFC3 CFC4	.842 .916 .858 .826	__* 13.655 12.463 11.417	0.738 0.821 0.720 0.668	.92	.74
International orientation	Glb2 Glb3 Glb4	.735 .667 .836	__* 9.017 8.211	0.776 0.726 0.668	.79	.56

Notes:
-StP6, StP9, EcD5, SRd1, ExEM8 and EnP5 were deleted while conducting the CFA in order to improve the AVE and/or the overall model fit.
-Model Fit Indices (after execluding the above measurment items): Chi-square: 743.71, d.f = 499, IFI = 0.918, CFI=0.915, RMSEA = 0.060, Normed ($\chi 2$) = 1.50, PCFI = 0.767
-Paramers loading are significant at p<.05 for values greater than .60, at p<.01 for values greater than .719, N=138
__* Fixed parameter for scaling purposes

5.5.3.3 Second order CFA

In the first order factor analysis results (Table 5.5.4), there were fourfirst order EM factors (i.e. EMSs, Source Reduction, Eco-Design and External EM). The first order factor often has one unidirectional arrow away from the measurement items as illustrated in Figure 5.2B. In the first order models, the researcher assumes that the covariance between measurement items is explained with a single latent factor layer (Byrne, 2010). On the other hand, in the higher order factor analysis such as the second order CFA, it is assumed that a second order latent factor causes the first order latent factors and these first order factors cause the variance in the measurement items (Hair *et al.*, 2006). That is, in building the second order factor model, the first order latent factors are considered as the indicators for the second order factor.

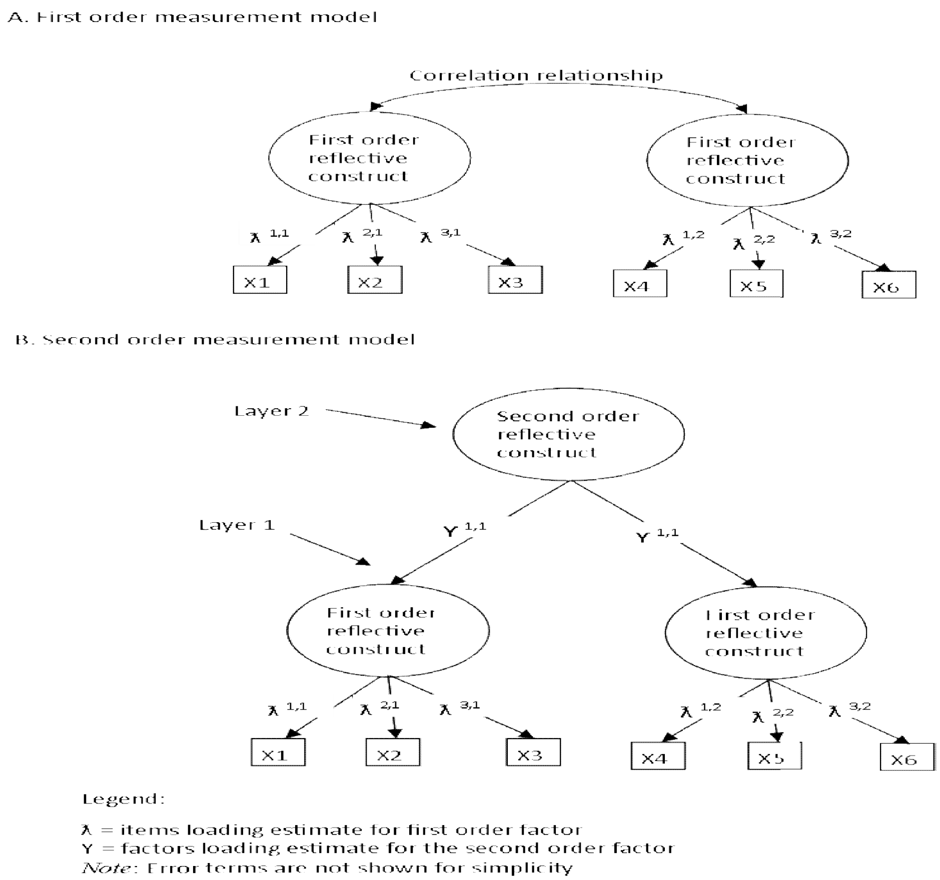


Figure 5.2B: Conducting path diagrams for first and second order measurement model (Adopted from Hair *et al.,* 2006)

Empirically, when first order factors are correlated this implies that there is a broader level of generalisation, which cannot be explained by the first order analysis (Hair *et al.,* 2006). Although factor correlation encourages the researcher to conduct the second order analysis, previous studies have emphasised the importance of the theory, not the data analysis, as the main driver for the use of the second order factor model (Hair *et al.,* 2006; Byrne, 2010).

In this research, a second order factor called “Collective GOM Competency” is proposed to be accountable for all variance and covariance that is associated with the first order environmental management factors (EMSs, Source Reduction, Eco-Design and External EM). As such, the variance and covariance of the first order factors no longer exist in the second order model as these variances are explained for by the second order factors It is worth noting that the second order factor (collective GOM) does not have its own set of measurement variables. It is connected to the measurement items used to measure the first order constructs (Byrne, 2010).

In the first order factor model, the reliability of first order constructs has been established and the measurement model showed a satisfactory fit. However, the reliability, validity and model fit of the second order model constructs need to be established in order to use it for developing the subsequent structural model (Mishra and Shah, 2009). Byrne (2010) has suggested very systematic procedures when using AMOS to construct higher order factor analysis. Accordingly, the researcher has followed the four steps discussed in Section 5.5.3.2 and the guidelines suggested by Byrne (2010) to conduct the CFA for the second order measurement model.

Table 5.5.5 presents the final CFA results of the second order measurement model (after critically reviewing the MI to find potential weaknesses in the second order measurement model). It is clear from theCFI, NFI and other fit indices reported in Table 5.5.5 that this model showed an acceptable fit to the data. The second order construct developed from the integration of the four first order factors of internally and externally focused GOM practices is illustrated in Figure 5.3. As there were no significant changes suggested by the MI, no changes were made to the model.

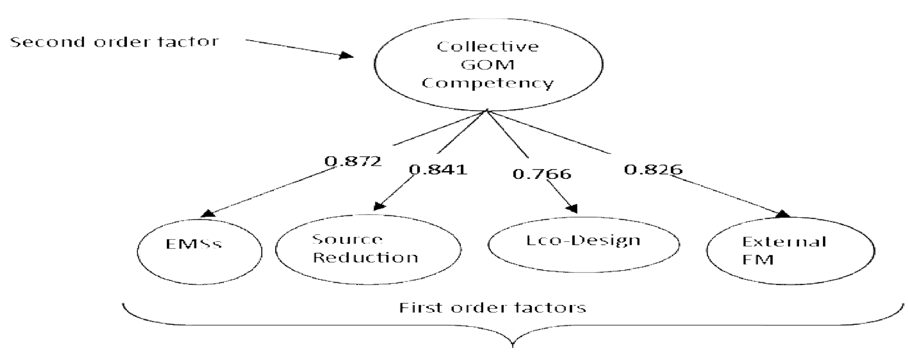


Figure 5.3: Second order construct and its indicators

As it may be obvious from the reported fit index values for the first order measurement model and the second order measurement model in Table 5.5.4 and Table 5.5.5 respectively, both first and second order models have achieved acceptable levels of fit. However, the first order model has achieved a marginally better fit in terms of the absolute fit (e.g., RMSEA), which is always the case when two nested models of different orders are compared (Hair *et al*., 2006). Two measurement models can be called nested if both contain the same number of constructs and one can be developed from changing the relationships of the other model (Byrne, 2010). In contrast, the second order model has performed better in terms of the parsimony indices (e.g. PCFI) because there are lesser predictors in the second order model and thus it consumes fewer degrees of freedom to capture the same amount of covariance

Table 5.5.5: Second order CFA results

Latent Variables	Observed Variables	Standardized loading	t-value	R^2	Composite Reliability	AVE
Market Stakeholders	StP1 StP3 StP10	.811 .845 .763	__* 9.868 8.176	0.652 0.716 0.482	.85	.65
Non- Market Stakeholders	StP2 StP7 StP8	.794 .722 .613	__* 6.655 5.770	0.649 0.431 0.309	.75	.51
Collective GOM Competency**	EMS EcD SRd ExEM	.872 .766 .841 .826	__* 4.956 4.982 6.501	0.764 0.589 0.709 0.676	.90	.68
Environmental Performance	EnP1 EnP2 EnP3 EnP4	.842 .844 .840 .761	__* 11.557 11.548 10.058	0.699 0.702 0.701 0.580	.89	.67
Business benefits	Sv2 Sv3 Sv4	.886 .937 .653	__* 15.055 6.366	0.797 0.902 0.358	.87	.70
Spending	Sp2 Sp3 Sp4	.671 .762 .843	__* 7.226 6.178	0.325 0.556 0.839	.80	.58
Environmentally oriented CFC	CFC1 CFC2 CFC3 CFC4	.842 .916 .858 .826	__* 11.406 12.550 13.445	0.735 0.805 0.733 0.726	.92	.74
International Orientation	Glb2 Glb3 Glb4	.735 .667 .836	__* 8.901 8.216	0.782 0.734 0.662	.79	.56

**GOM represent all the four environmental management practices involved in the first order model (i.e. EMS, Eco-Design, Source Reduction & External EM)

-**Model Fit Indices:** Chi-square: 794.6, d.f = 522, IFI = 0.908, CFI=0.906, RMSEA = 0.061, Normed ($\chi 2$) = 1.52, PCFI = 0.794

-Paramers loading are significant at $p<.05$ for values greater than .60, at $p<.01$ for values greater than .720, N=138

__* Fixed parameter for scaling purposes between the variables (Hair *et al.,* 2006; Tabachnick and Fidell, 2007).

Although, in general, the results of the fit indices (Table 5.5.5) revealed that the proposed second order CFA model has achieved an acceptable goodness of fit, the next task is to check the convergent and discriminant validity of all constructs.

5.5.3.4 Construct validity results

After conducting the CFA and testing for the model fit, the validity of all constructs can be tested. As pointed out in Section 5.2.2,construct validity focuses on examining whether the measurement tool (i.e. the survey and the developed measurement variables) is able to measure what is meant to be measured. This can be evaluated through discriminant and convergent validity. Previous studies have suggested that construct reliability and validity can be evaluated through several criteria, which are summarised in Table 5.5.6.

Table 5.5.6: Criteria to assess reliability and validity of measurement model

Criteria	Description	Cut-off level	Formula used
Indicator Reliability(λ_i)	λ_i is the standardized outer factor loading for indicatori	λ_i >.5	λ_i appears in AMOS outputs, no need to calculate it
Composite Reliability (CR)	CR measures the degree of internal consistency among indicators of a same construct	CR > .7	$CR = \frac{\left(\sum_i \lambda_i\right)^2}{\left(\sum_i \lambda_i\right)^2 + \left(\sum_i v[\delta_i]\right)}$ λ_i =Outer factor loading for indicator i. $v[\delta_i]$ = The error variance associated with the individual indicator i.
Average Variance Extracted (AVE)	Measure the shared variance in a construct AVE % can be used as indicator for convergent among a set of construct items	AVE > .5	$AVE = \frac{\left(\sum_i \lambda_i^2\right)}{\left(\sum_i \lambda_i^2\right) + \left(\sum_i v[\delta_i]\right)}$ λ_i =Outer factor loading for indicator i. $v[\delta_i]$ = The error variance associated with the individual indicator.
Factor loading of construct items	Size of factor loading of a set of indicators on a specific constructs. Can be used as indicator for convergent validity	High factor loading of a set of construct items indicates that they converge on some common point	
Fornell-Larcker Criterion (FLC)	Each construct should share more variance (or association) with its own indicators than with other construct that relate to a different block of indicators. FLC can be used as an indicator for *discriminant**validity***	The square root AVE for each construct should be higher than the correlations of the constructs	
Cross loading of indicators	It can be used as an indicator for *discriminant**validity***	An indicator should be highly correlated with its respective construct than with other constructs	
Source: Fornell and Larcker (1981);Westen and Rosenthal, 2003; Hair *et al.,* 2006;Tabachnik and Fidell, 2007; Henseler*et al.,* 2009			

Fornell and Larcker (1981), Westen and Rosenthal (2003), Hair *et al.,* (2006), Tabachnik and Fidell (2007) and Henseler*et al.,* (2009) have suggested that convergent validity can be established when the factor loading of each indicator on their construct is ≥0.5, Average Variance Extracted (AVE) of each construct is ≥0.5 and Composite Reliability (CR) for each construct is ≥0.7. The results presented in Table 5.5.4 for the first order model constructs and in Table 5.5.5 for the second order model constructs show that factor loading of all indicators on their constructs is ≥ 0.5 (range from 0.621 - 0.937), CR for all constructs is ≥0.7 (rangefrom 0.75 - 0.92) and AVE for all constructs is ≥0.5 (range from 0.5- 0.74). Therefore, these results suggest that a higher internal reliability exists in the constructs and that the convergent validity of all constructs under investigation has been achieved.

Regarding the establishment of the discriminant validity, Westen and Rosenthal (2003), Hair *et al.,* (2006), Tabachnik and Fidell (2007)and Henseler*et al.,* (2009) have suggested that discriminant validity can be checked using factor cross loading indices and/or Fornell-Larcker Criterion.Factor cross loading indices shows how strongly measurement variables have loaded on different constructs. Items that have cross-loaded very highly into more than one factor are considered for removal (Henley *et al.,* 2006; Henseler*et al,*2009). Fornell and Larcker (1981)have also suggested that construct discriminant validity is fulfilled when the square root AVE of the constructs is greater than the correlation of the constructs (Wong *et al.,* 2011). The correlation matrix of the constructs has been prepared by the researcher in which the square root of constructs AVE (bold in Table 5.5.7 &5.5.8) were replaced with the diagonal values of the correlation matrix of the constructs. The results reported in Table 5.5.7 and Table 5.5.8 show that the constructs under investigation have passed the Fornell-Larcker Criterion test and thus discriminant validity of the first and second order measurement models is satisfied. This confirms that the different constructs used to develop the model belong to unique and separate constructs.

Table 5.5.7: Correlation matrix and square root AVE of the constructs (first order model)

	NMrDr	MDr	EnP	Sp	Sv	SRd	EMS	EcD	ExEM	CFC	GLOBAL
NMrDr	**0.714**										
MDr	0.168*	**0.806**									
EnP	0.312**	0.409**	**0.819**								
Sp	0.013	0.320**	0.303**	**0.762**							
Sv	0.328**	0.371**	0.683**	0.239**	**0.837**						
SRd	0.169*	0.284**	0.400**	0.177**	0.319**	**0.707**					
EMS	0.188**	0.288**	0.269**	0.127*	0.246**	0.677**	**0.735**				
EcD	0.058	0.475**	0.331**	0.308**	0.350**	0.455**	0.617**	**0.714**			
ExEM	0.084	0.531**	0.359**	0.295**	0.295**	0.452**	0.635**	0.499**	**0.837**		
CFC	0.186**	0.390**	0.368**	0.161*	0.290**	0.383**	0.260**	0.246**	0.339**	**0.860**	
GLOBAL	0.295**	0.375**	0.251**	0.092	0.287**	0.219**	0.184**	0.234**	0.223**	0.270**	**0.748**

*Correlation is significant at the 0.05 level (two-tailed).
**Correlation is significant at the 0.01 level (two-tailed).

Table 5.5.8: Correlation matrix and square root AVE of the constructs (second order model)

	NMrDr	MrDr	EnP	Sp	Sv	GOM	CFC	GLOBAL
NMrDr	**0.714**							
MrDr	0.165*	**0.806**						
EnP	0.316**	0.502**	**0.819**					
Sp	0.011	0.341**	0.309**	**0.762**				
Sv	0.438**	0.370**	0.708**	0.255**	**0.837**			
GOM	0.299**	0.644**	0.557**	0.577**	0.479**	**0.825**		
CFC	0.188**	0.388**	0.368**	0.169**	0.289**	0.619**	**0.860**	
GLOBAL	0.299**	0.374**	0.242**	0.098*	0.286**	0.435**	0.269**	**0.748**

*Correlation is significant at the 0.05 level (two-tailed).
**Correlation is significant at the 0.01 level (two-tailed).

Further, results in table 5.5.7 show that, as proposed, adopting GOM practices is a higher order construct across the four first order dimensions of GOM. The table shows that the first order GOM practices (EMSs, eco-design, source reduction and external EM) are positively and significantly correlated, suggesting the presence of a higher order construct that better accounts for their variance. This indicates that increasing the values of one factor leads to increase the value of another factor (Zhu, 2004). On the other hand, correlations among these first order aspects of collective GOM are below the recommended threshold of .9 (Bagozzi *et al.,* 1991). Therefore, these four dimensions of GOM are distinct, yet they complement each other. Further discussion about the complementarity of GOM practices will be provided in Section 5.6.1.

Although the preceding EFA and CFA (or the measurement model) tests help in the development of an appropriate measurement model, these tests neither provide any evidence that different constructs can affect each other nor explain the nature of the relations between these constructs. The performance of the structural model test is needed to determine if the relationships among the constructs exist, which in turn enables one to reject or accept the theory of interest. The performance of the structural model will be examined in the next section of this chapter.

5.6 Assessment of the structural model and hypothesis testing

An acceptable measurement model was needed to link the various indicators with their underlying constructs and to assess the reliability and validity of the constructs (Hair *et al*., 2006). Once an acceptable measurement model was obtained (Section 5.5), the purified measures can now be used for the next step of the analysis. This includes specifying the exogenous and endogenous latent constructs (step 5), and performing of an independent test of the structural model (step 6). The structural model links the proposed exogenous and endogenous latent constructs with each other in order to predict the hypothesized causal relationships between these constructs. The exogenous latent constructs represent the independent constructs in the structural model with no prior causal relationships. These constructs are often caused by factors outside of the model and thus they are not explained by any other construct in the model. In the SEM path diagrams, the exogenous constructs do not have any structural path going to them (i.e. arrows going from these constructs to the dependent constructs). The endogenous constructs, on the other hand, are equivalent to the dependent constructs in the model and they are often caused by other exogenous and/or endogenous constructs in the model. Because the endogenous constructs are explained by other constructs in the model, they are represented by an arrow pointing to them. In the structural model, the exogenous constructs are correlated with each other and researchers assume that there is no dependent relationship between them. The dependent-causal relationship is only assumed between the exogenous and endogenous constructs or between two endogenous constructs. In the path diagram the correlation between the exogenous constructs is represented by a two headed arrow to indicate unanalysed associations. The dependent relationships between exogenous and endogenous constructs are represented by one headed arrow pointing from the causal exogenous constructs toward the endogenous constructs. Also, in the SEM path diagram, measured variables (indicators) are depicted by a box and the latent constructs are depicted by ovals. Figure 5.6.1is provided to clarify the differences between the exogenous and the endogenous constructs and how they are linked to each other in SEM.

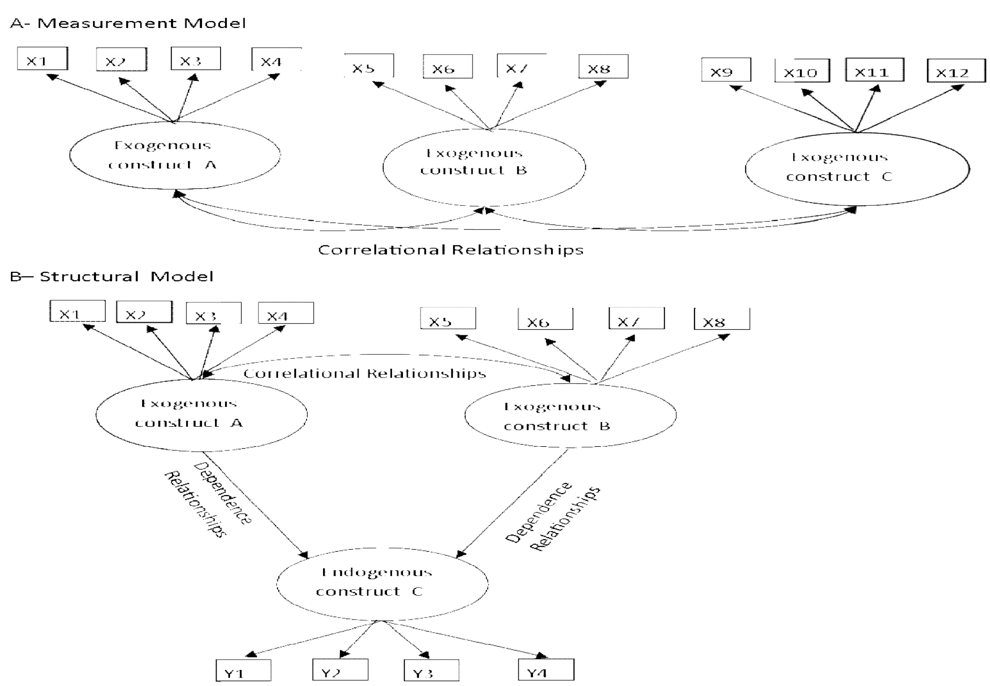


Figure 5.6.1: A simple representation of measurement and structural model relationships in SEM (Hair *et al.,* 2006: P. 716)

It has been argued that in SEM no single test of significance can be considered as the most accurate way to identify the best model given the nature of the data and the sample size (Hair *et al.*, 2006; Shah and Ward, 2007). The structural model, however, is generally assessed in terms of the overall goodness of fit and significance, direction, and size of structural path coefficients (Hair *et al.*, 2006; Shah and Ward, 2007). Each of these criteria was used to assess the hypothesised structural model of this research. This section presents the results of the structural model, which are performed in three stages. First, a discussion about the conceptualisation of the environmental management model is provided. This is done in order to provide further empirical support for the proposition of this research regarding the importance of considering the environmental practices as complementary (collective competency) (P1). Then, the hypothesized *direct* structural model, without the mediator or the moderators, is assessed. The results of this stage are associated with research hypotheses H1a, H1b, H1c, H2a and H2b, that examine the direct effects between stakeholder pressures, GOM practices and performance. Next, the *indirect* structural model, with the proposed mediators and moderators, was examined. This was done in two steps. First, the results of the mediation test are presented (related to hypotheses H3a, H3b, H4a and H4b). Second, the results of the moderation test are reported (related to hypotheses H5a, H5b and H5c. All tests of the structural models were performed using CB-SEM in the AMOS 20.0 software.

5.6.1 Conceptualisation of the environmental management model

The first objective of this research is to empirically test the complementarity theory of the environmental practices, which suggest that the performance obtained from the collective adoption of various GOM initiatives is expected to be higher than the total performance obtained from using each one of these practices separately. To achieve this objective, adopting GOM practices is modelled as a function of four first order factors that explain how much the organisation is able to develop collective GOM competency. Although the first order factors represent different environmental practices, their values change based on firm’s capability to effectively adopt various types of GOM practices simultaneously. This is stated in the following research proposition:

P1: The collective GOM competency combining four sets of GOM practices will have greater performance impacts than the total performance obtained from using each one of these practices separately.

To achieve this objective, the Zhu (2004) and Mishra and Shah (2009) approaches of empirically testing the theory of complementarity among various organizational practises was adopted. Two competing models were built and assessed in terms of their overall model fit and significance of path coefficients. The first model (Model 1) was called the *individual competency* model, which includes the direct relationships between the two groups of stakeholders, the four sets of environmental practices and the three dimensions of performance (Figure 5.6.2). The second model (Model 2) was labelled the *collective GOM competency* model (Figure 5.6.4).In model 2, the four first-order constructs of the environmental practices (EMSs, source reduction, eco-design and external environmental practices) were integrated into a second-order reflective construct to show the interdependency and the complementarity of the environmental practices. Model 2 includes the direct links between the two groups of stakeholders, collective GOM competency and the three dimensions of performance.

Concerning the assessment of the model fit, Andreason *et al.*,(1988), Hair *et al*., (2006) and Kenny (2009) argued that once an acceptable measurement model was established, the researcher then should assess the degree to which the structural model accounted for the data with one or multiple overall goodness of fit indices. Multiple fit indices were used to assess the overall goodness of fit. These include one absolute fit index (i.e. RMSEA), one or two incremental fit index (i.e. CFI, IFI), one goodness of fit index (i.e. CFI), one badness of fit index (i.e. RMSEA), one parsimonies fit index (i.e. PCFI, normed $\chi 2$ ($\chi 2$/d.f)) in addition to the $\chi 2$values with associated degree of freedom (Hair *et al*., 2006). The results of the overall model fit indices are presented in Table 5.6.1.

Table 5.6.1: Structural models goodness of fit results

Models \ indices	$\chi 2$ (df)	Normed $\chi 2$	CFI	IFI	RMSEA (90% confidence interval)	PCFI
Model 1	570.426(326)	1.750	0.882	0.879	0.074 (.064-.084)	0.758
Model 2	560.561(337)	1.663	0.90	0.90	0.069 (.059-.080)	0.794
Recommended values for indices (Hair *et al*., 2006; Shah and Goldstein, 2006)	NA	<3.0	≥.9	≥.9	<.10	≥0.70

As can be seen in Table 5.6.1, Model 1 did not achieve a good fit on CFI and IFI, but it achieved an acceptable fit on the incremental (RMSEA) and parsimonious (PCFI and Normed $\chi 2$) fit indices. On the other hand, all the fit index values of Model 2 were marginally better than those of Model 1 and they are acceptable as most of these values are either above or on the recommended threshold values. In fact, considering the number of latent variables and their corresponding indictors used in the structural model illustrated in Figure 5.6.4, such lower model fit should be expected (Baumgartner and Homburg, 1996). The significance and direction of the structural paths estimates were used as additional assessment criteria to assess the validity of Model 1 and Model 2 (Marsh and Jackson, 1999: Hair *et al.,* 2006). In this regard, Marsh and Jackson (1999) maintained that when comparing a first order factor model with a higher order factor model, evidence of supporting the higher order model is provided when the higher order model explains the pre-specified theoretical relationships better than the first order model.

In the *individual competency* model (see Figure 5.6.2), only five out of twelve direct links between the four individual sets of environmental practices and the three dimensions of performance were significant ($p<0.1$). Some of these were even negatively related to the performance dimensions, which contradict findings of the previous studies (e.g., Zhu and Sarkis, 2004) and revealan insufficient model specification. On the other hand, in the *collective GOM competency* model (see Figure 5.6.4), all of the three direct relationships between collective GOM and the three dimensions of performance were strongly significant and in the predicted directions. This is obvious from the degree of significance and the size of the coefficient estimate (i.e. the extent to which the independent variable influences the dependent variable) for each structural path. Indeed, in addition to the constructs correlations results (Table 5.5.4, Section 5.5.3.2), these results provide support for our theoretical proposition about the importance of treating various environmental practices as complementary when studying the relationship between EM practices and performance. This collective GOM competency has a greater impact on performance, which provides support for proposition 1. Accordingly, it can be concluded that the collective GOM model better explains the relationships between stakeholder pressures, the adoption of various GOM practices and firm performance. The model will be used to test H1, H2, H3, H4 and H5 proposed earlier.

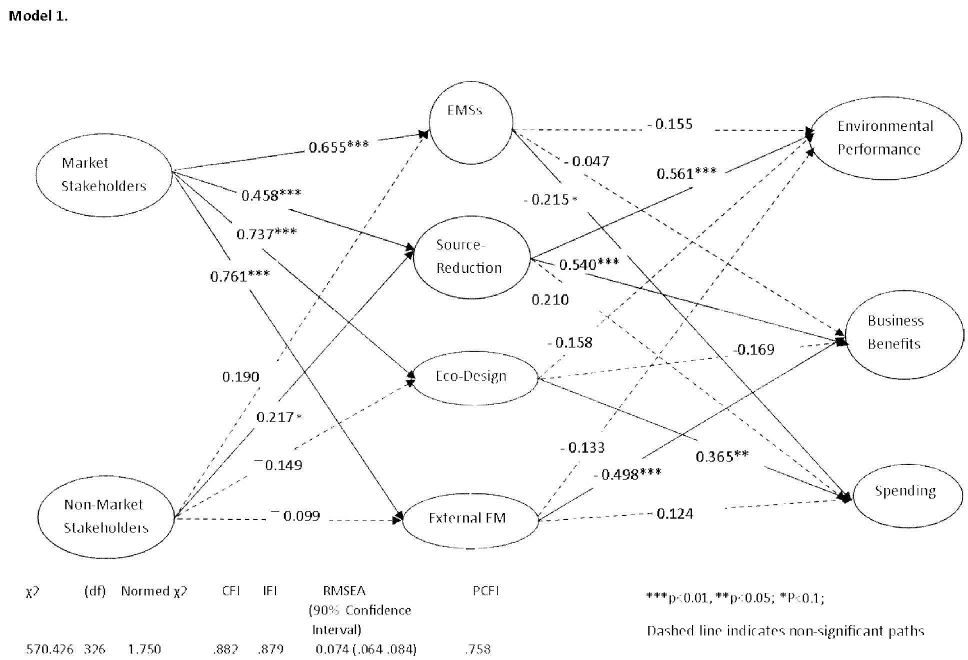


Figure 5.6.2: Individual competency model

5.6.2 Examining the direct effect

The second objective of this research is to empirically examine the extent to which the market and non-market stakeholders influence the adoption of GOM practices in the manufacturing firms (hypotheses H1a and H1b respectively). The third objective is to the examine the *direct and indirect* influences of the collective GOM competency on environmental and economic performance: 1) to examine the *direct* influence of the collective GOM competency on organizational business benefits, spending and environmental performance (hypotheses H2a, H2b and H2c respectively), 2) to examine the *indirect* effects of the collective GOM competency on the two dimensions of economic performance (business benefits and spending) via environmental performance (hypotheses H3a and H3b). In this section, the second objective and the first part of the third objective will be tested. Figure 5.6.3 present this part of the conceptual framework developed in this research. As the second part of the third objective is dealing with testing the indirect relationships between GOM and the economic performance (via environmental performance), this objective will be tested in section 5.6.3 which is dealing with the mediation test. Thus, the following hypotheses were proposed to achieve the second objective and the first part of third objective, respectively:

H1: Market stakeholder pressures (H1a) and non-market stakeholder pressures (H1b) positively influence the adoption of GOM practices by firms.

H2: A greater amount of resources and commitment allocated for the development of collective GOM practices directly leads to higher levels of environmental performance (H2a), greater business benefits(H2b), and greater levels of spending (H2c).

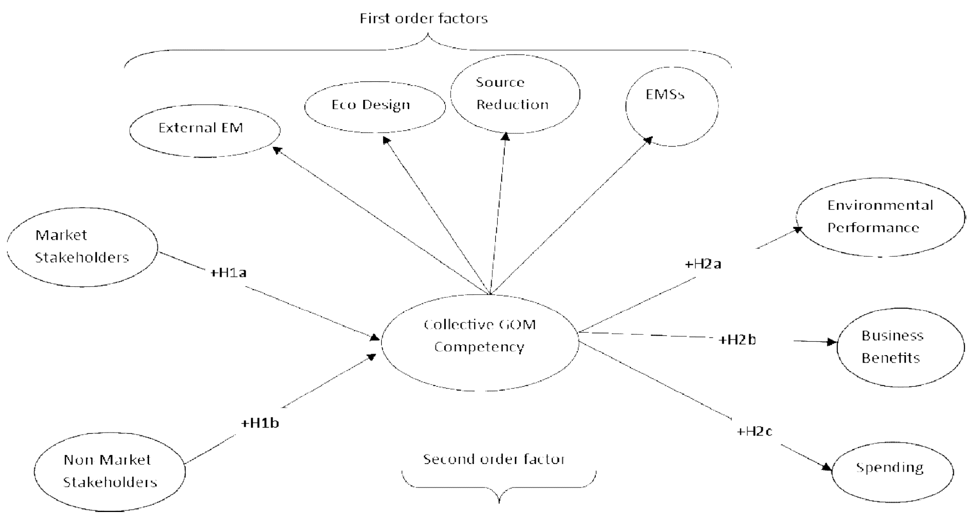


Figure 5.6.3: Second order **direct** structural model

By using the SEM, the influence of stakeholder pressures on the adoption of GOM practices and the impacts of these practices on performance can be examined simultaneously in the second order *direct* structural model (Model 2, Figure 5.6.4).

After running SEM with all of the hypothesized direct relationships between stakeholder pressures, GOM practices and performance, the goodness of fit statistics for the structural model were evaluated to provide the basis for accepting or rejecting the model. Five fit indices were used to assess the overall fit: Normed chi-square (i.e. chi-square/d.f), CFI, IFI, RMSEA and PCFI, similar to the assessment of the overall fit for the first and second order measurement models. Also, the modification indices (MI) were critically reviewed to find ways to improve the structural models overall fit. Because no significant and theoretically supported modification indices were found between the hypothesized model's constructs, except for the structural paths between the environmental performance and the two dimensions of economic performance (which will be discussed in the following section), no changes were made to the model. Figure 5.6.4 indicates that our direct structural model exhibits an acceptable level of fit, particularly for indices that reflect the parsimony (PCFI and normed $\chi2$) and for the incremental fit indices (CFC and IFI).

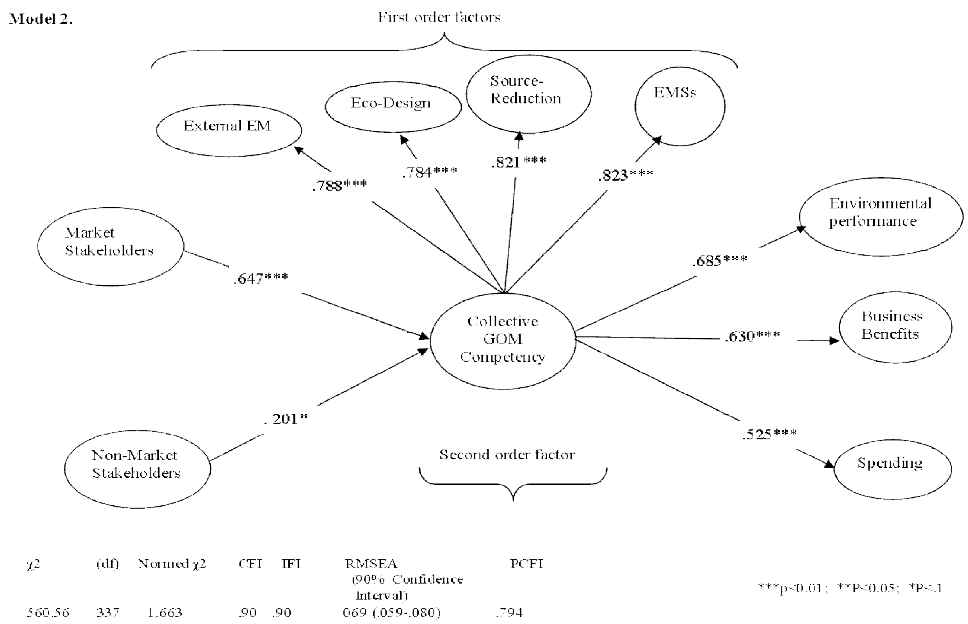


Figure 5.6.4: Collective GOM competency model

The results in Table 5.6.2 show that there are statistically significant positive relationships between the adoption of GOM practices with a) market stakeholder pressures (β =0.647, p< .01) and b) non-market stakeholder pressures(β = 0.201, p< .1) and, thus, hypotheses H1a and H1b are supported. Although the significant association between non-market stakeholder and GOM practices is low, the influence of the market stakeholders on GOM practices is strong. In fact, the results of the descriptive statistics (Table 5.4.1, Section 5.4.1) show that the respondents perceived that their firms were facing more pressure from the non-market stakeholders than from market stakeholders (mean response for market pressure is 3.15 and for non-market pressure is 3.37). This shows that the perceived pressure might not be the same as the actual driver for the development of the GOM practices. Also, the results of Table 5.6.2 reveal that there are significant positive relationships between

GOM practices and environmental performance (β =0.685, p< .01), business benefits(β =0.630, p< .01) and spending (β = 0.525, p< .01), providing support for hypotheses H2a, H2b and H2c. However, the GOM practices are more strongly related to environmental performance and business benefits than to spending, providing further support for proposition P1, emphasising the superior impact of the collective adoption of various environmental practices on organizational performance. The summary of the path coefficients is reported in Table 5.6.2

Table 5.6.2: Results of the direct effects

Hypothesis	Structural Path	Standardized estimates	t-value	Standardized error	Result
H1a	Market Stakeholder →GOM practices	**0.647** ***	4.897	0.070	Strongly Supported
H1b	Non-Market Stakeholder →GOM practices	**0.201***	1.822	0.061	Marginally Supported
H2a	GOM practices →Environmental performance	**0.685** ***	5.408	0.163	Strongly Supported
H2b	GOM practices →Benefits	**0.630** ***	5.377	0.180	Strongly Supported
H2c	GOM practices →Spending	**0.525** ***	4.288	0.195	Strongly Supported

Numbers in bold indicate the standardized coefficient estimates
*** Path is significant at p < .01, **Path is significant at p < .05,*Path is significant at P < .1

Questions related to antecedents and consequences of adopting GOM practices are fundamental to environmental operations management. Going beyond such fundamental questions might be needed, however, in order to advance the field theoretically and practically. This can be done by systematically testing the mediation and moderation effect of other factors (Koufteros and Marcoulides, 2006). The researcher carried out an investigation on the potential mediated effects of:(1) the environmental performance on the relationship between the GOM practices and business benefits and spending, (2) the mediated effect of CFC on the relationship between stakeholder pressures and the adoption of the GOM practices, and (3) the moderated effects of pollution intensity, size and international orientation on the relationship between CFC and the adoption of GOM practices. These are discussed in the following section.

5.6.3 Examining the mediation effects

Figure 5.6.5 presents the mediated effect model to test hypotheses H3 (H3a and H3b) and H4.

H3: Environmental performance is positively related with organisational economic performance (i.e. business benefits (H3a) and spending (H3b)), and it mediates the relationship between the adoption of the GOM practices and economic performance.

H4: Environmentally oriented cross-functional collaboration mediates the relationships between market stakeholder pressures (H4a) and non-market stakeholder pressures (H4b) with adoption of GOM practices.

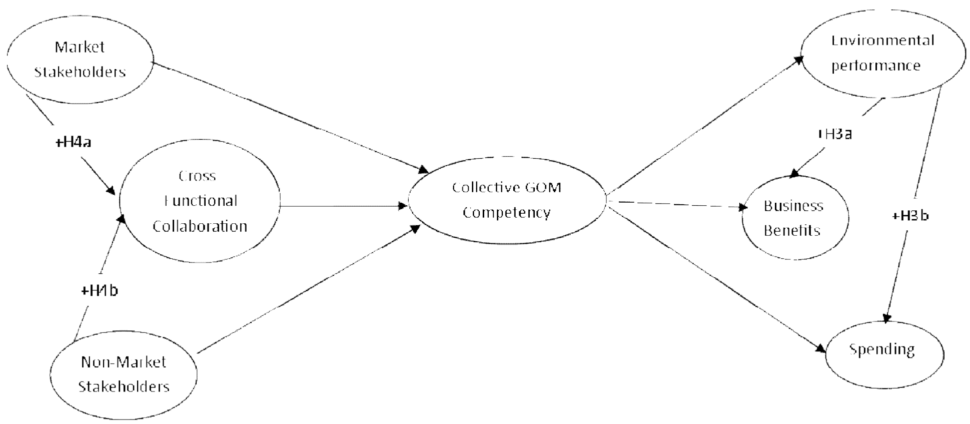


Figure 5.6.5: The mediated effect model

Mediation and moderation tests receive growing attention in the Operations Management literature (Sarkis *et al.*, 2010; Wagner, 2011). Mediation means that the influence of one or more independent variables (X) on one or more of the dependent variables (Y) goes through a third variable, named a mediator variable (M), as illustrated in Figure 5.6.6 B (Edwards and Lambert, 2007). It refers to the indirect impacts of the X on Y which goes through M (Baron and Kenny, 1986; Mackinnon *et. al*., 2002). A mediation test gives a more a precise explanation about the chains of causality between X and Y by looking for the missing factor or link in this chain (Hair *et al.,* 2006).Mediation is conceptualised with the intention of searching for the underlying reason of an outcome (Mackinnon *et. al.,* 2002). In this research this means that the effects of stakeholder pressures on the adoption of GOM practices is further mediated by the level of CFC in the firm and that the influences of adopting GOM practices on organisational business benefits and spending are mediated by the level of environmental performance a firm can achieve.

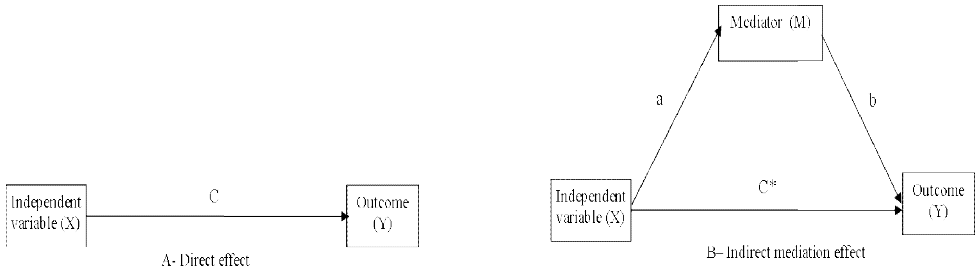


Figure 5.6.6: A simple mediated structural model

According to Baron and Kenny (1986), a variable can be considered as a mediator if the following four conditions are met. First, the independent variable (X) must be significantly related with the dependent variable (Y) before adding the mediator to the model, structural path 'c' (letters denote links and/or variables in Figure 5.6.6 A and 5.6.6 B). Second, after adding the mediator to the model, X must be significantly related to mediator (M), structural path 'a'. Third, M must be significantly related to Y, structural path 'b'. Finally, the previously significant direct relationship between X and Y must diminish or become non-significant after controlling for M. These four conditions can be tested using three multiple regressions in which the significance of path 'c' is tested first. Then, the regression model is run to test the significance of path 'a'. Finally, both X and M are used simultaneously in the third regression model as predictors for Y. Baron and Kenny (1986) have also recommended using the Sobel (1982) test to examine the significance of the mediation effect (a*b), which is calculated using the following formula:

$$Z\text{-value} = \alpha * \beta / \text{SQRT}\ (\alpha^2 * s_\alpha^2 + \beta^2 * s_\beta^2)$$

α=unstandardized coefficient of path a (figure 5.6.6) s_α= the standard error for α
β= unstandardized coefficient of path b (figure 5.6.6) s_β = the standard error for β

The mediation is confirmed if $|Z|> 1.96$ ($p<.05$). However, many of the contemporary mediation studies argue that the Sobel test is very sensitive to the sample size and has low statistical power to test the indirect effect (MacKinnon *et al.,* 2002;Kenny, 2003; Preacher and Hays, 2004; Zhao *et al.*, 2010). The bootstrapping approach introduced by Efron (1979) has increasingly been recommended and used in contemporary mediational studies as a best alternative to the more sensitive Sobel test in predicting the indirect effect (Shrout and Bolger, 2002; Zhao *et al.,* 2010). It imposes no distributional assumptions to the data (Shrout and Bolger, 2002; Zhao *et al.,* 2010). It is a statistical method used to generate sufficient amount of power to estimate the significance of the indirect effect, based on generating an empirical sampling distribution of the indirect effect ‘a*b (Preacher and Hays, 2004; Iacobucci *et al*., 2007). This is done by repeatedly resampling (e.g. more than 2000 times) with replacement the original researcher’s sample ‘N’ and computing the indirect effect from each one of these samples. When using the bootstrapping test, the significance of the indirect effect can be confirmed when the confidence interval around the coefficient estimate (β) of the indirect effect ‘a*b’ does not include zero, and thus the values of ‘a*b’ is different from zero, and when the p-value is significant.

The first condition proposed by Baron and Kenny (1986) for testing the existence of mediation effect indicates that there must be a significant direct relationship between X and Y before adding the mediator to the model. This condition reveals that the mediation effect can only be partial or full based on the extent to which the direct effect of X on Y has diminished after controlling for M. Some recent studies, however, have criticised this condition and argued that such significant direct relationship between X and Y is not required (Holmbeck, 1997; Iacobucci *et al*., 2007; MacKinnon *et al*., 2002). They emphasised that the strength of the mediation should be evaluated based on the size of the indirect effect (a*b), rather than based on the absence of the direct effect (Preach and Hayes, 2004; Zhao *et al.,* 2010). Accordingly, many of the recent mediation analysis studies suggested that mediation can take three main forms: 1) full, 2) partial, which was initially proposed by Baron and Kenny (1986), and 3) indirect-effect only (MacKinnon *et al*., 2002; Shrout & Bolger, 2002; Zhao *et al*., 2010). The full mediation exists when the direct effects 'c*' becomes non-significant after adding the mediator to the model, and the indirect effect 'a*b' is significant (Figure 5.6.7 A). The partial mediation occurs when the significance of the direct effect 'c' diminishes after adding the mediator and the indirect effect 'a*b' is significant (Figure 5.6.7 B). If the indirect effect 'a*b' is significant and the direct effects 'c' and 'c*', however, never was significant before and after adding the mediation, then there is indirect-effect only mediation (Figure 5.6.7 C). Finally, if the indirect effect 'a*b' and/or 'a', and/or 'b' is not significant, then no mediation effect exists. If the indirect effect was found to be significant, Kenny (1998) suggested to evaluate the proportion of mediation which is calculated by dividing the indirect effect ‘a*b’ by the total effect ‘a+b+c*’ or ‘c’. The proportion of mediation should increase as this measure becomes closer to 1. Such measure can be used as a theoretical informative way to measure the proportion of the effect that is mediated (Kenny, 1998; Zhao *et al.,* 2010).

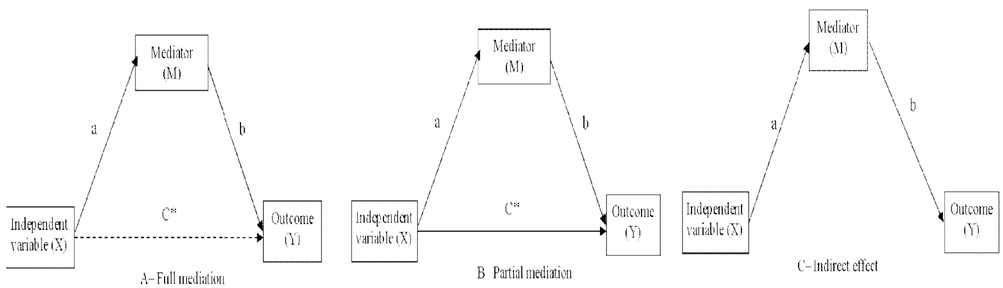


Figure 5.6.7: Basic forms of mediation

Although Baron and Kenny (1986) have tested the mediation effect using regression analysis, an increasing number of studies suggested SEM as a best alternative for testing mediated effects when several indicators to the latent variables and several exogenous and endogenous constructs are used in the model (Hair *et al*., 2006). SEM is also more powerful than regression analysis because it eliminates the measurement errors associated with the scores of the mediator variable and it allows direct and indirect effects simultaneously to be tested (Hopwood, 2007; Sarkis *et al*., 2010). However, if the mediator is a latent variable and SEM is used to test the mediation effect, Macho and Ledermann (2011) and Zhao *et al.* (2010) argued that the researcher should not compare the two model estimates (a model with mediator and a model without mediator) for the significance of path ‘c’ and ‘c*’. This is because the factor loading is expected to differ in each one of these models. Rather, the total effect ‘path c’ should be estimated using the total effect formula “ c = c* + a*b ”. The latest versions of AMOS can be used to conduct the bootstrapping test and its output window provides all measurement estimates for the direct, indirect and total effect without involving any manual calculations.

Concerning the mediation test when the model involves multiple initial variables (X) and/or multiple outcomes (Y) and/or multiple mediators (M), the researcher can test the indirect effect of each one of X on each one of Y via each one of M separately or simultaneously. However, when SEM is used, it is preferred to test the entire model, including all Xs, Ms and Ys simultaneously (Kenny *et al.,* 1998; Kenny, 2003; Preacher and Hayes, 2008). This would allow the researcher to have a more precise understanding of whether the mediation effect of one mediator is dependent on another, and whether the indirect effect of a particular X on Y is independent from the indirect effects of another X (Preacher and Hayes, 2008). Inclusion of multiple Xs and/or Ms and/or Ys into a single model can also reduce the likelihood that final results will be biased due to the omission of one or more variables (Judd and Kenny, 1981; Preacher and Hayes; 2008). In order to perform the mediation test using SEM, the following steps and guidelines were suggested (Kenny,1998; Hair *et al*., 2006; Preacher and Hayes; 2008; Zhao *et al*. 2010):

1- Run the direct model X→Y, *with all Xs and Ys but without the mediator variables*, and assess its overall fit and the significance of the direct relationship ‘c’.
2- Assuming that the direct model provides an acceptable fit and the direct effect is significant, run the indirect model X→M→Y, *with all Xs, Ms, and Ys,* and assess its overall fit.
3- Assuming that the indirect model provides an acceptable or better fit than the direct model, conduct the bootstrapping test and examine the significance of the direct effect X→M ‘path a’, direct effect M→Y ‘path b’, and indirect effect ‘a*b’.
4- Assuming that paths ‘a’ and ‘b’ are significant, the mediation effect is confirmed if the results of the bootstrapping test showed that the value of the indirect effect ‘a*b’ is different from zero and the p-value is significant.
5- Compute the proportion of the mediated effect (‘a*b’/c).

In this study, SEM was used to conduct the mediation tests using AMOS 20. The preceding five step procedure was followed to examine whether a) CFC mediates the relationships between market and non-market stakeholder pressures and the adoption of GOM practices and 2) whether environmental performance mediates the relationship between GOM practices and the two dimensions of economic performance (business benefits and spending). The structural model that includes the direct relationships between stakeholder pressures, GOM practices, and environmental performance, business benefits and spending was run in AMOS initially, as illustrated in Model 2 (Figure 5.6.4). After assessing the overall fit of Model 2, another competing model was developed in which CFC and two additional direct structural paths between the environmental performance and the two dimensions of the economic performance (i.e. 1- environmental performance →benefits, and 2- environmental performance →spending) were added to the model (Model 3, Figure 5.6.8). The new model was run in AMOS with all of the *direct* and *indirect* paths between stakeholders' pressure, CFC, GOM practices and the three dimensions of performance.

Similar to what was done in the Model 2 (Figure 5.6.4), MI of Model 3 (Figure 5.6.8) were examined to suggest any new specifications to the structural model that can improve the chi-square value. As no significant and theoretically supported MI was found between the hypothesised model constructs, no substantial improvements were expected. Thus, no new specifications were made to Model 3. The final results of the model estimation reveal that Model 3 offered an acceptable level of fit. However, this model achieved a marginally better fit compared to Model 2, which includes the direct links only. This result provides initial empirical evidence about the presence of the proposed mediated effects.

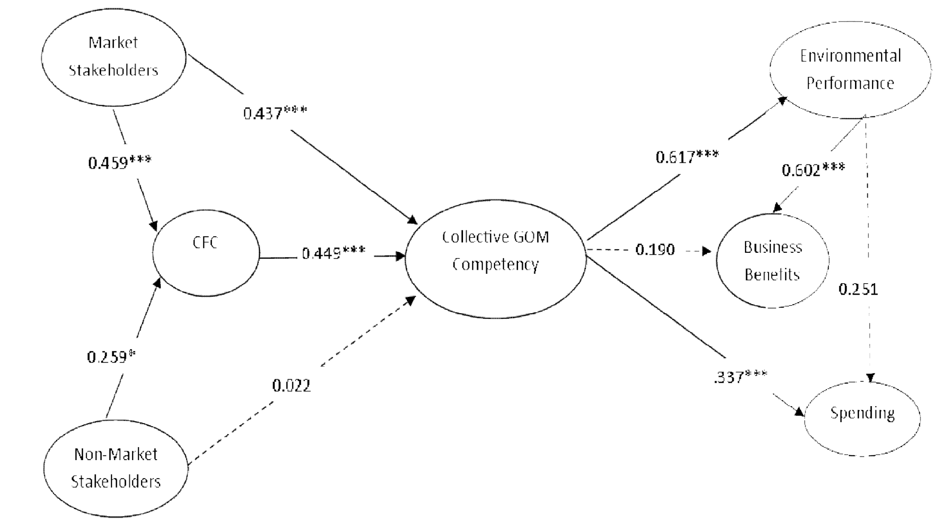
Once an acceptable model fit was achieved for model 3, the following mediation effects were assessed simultaneously:

A) -The mediation effects of CFC on the relationship between market and non-market stakeholder pressures and GOM practices.
B) -The mediation effects of environmental performance on the relationship between GOM practices and economic performance (business benefits and spending).

The 90% confidence interval of the indirect effects was obtained with 2000 bootstrapping resamples (Preacher and Hayes, 2008). The results of SEM for testing the mediation effects are presented in Table 5.6.3 and displayed in Figure 5.6.8. These results confirm the mediating role of CFC on the relationship between both market and non-market stakeholder pressures and GOM practices. While CFC partially mediates the relationship between market stakeholder pressures and GOM practices, there is only indirect mediation between non-market stakeholder pressures and GOM practices via CFC, providing support for H4a and H4b respectively. The highly mediating effect of CFC on the relationship between non-market stakeholder pressures and GOM practices is obvious from the proportion of the indirect effect between non-market stakeholder pressures and GOM practices (84.2%) compared to that of the indirect effect of market stakeholder pressures on the GOM practices (32.5%). Furthermore, the direct model explained 50% of the variance in the GOM (R^2 for GOM= 0.50), while the mediated model explained more than 60% of the variance in the GOM (R^2 for GOM= 0.612). All of these results provide sufficient evidence that the direct relationships between stakeholders pressures and the adoption of GOM practices is better explained through the mediation effect of environmentally oriented CFC and thus CFC is considered as a mediator in these relationships.

The results in Table 5.6.3 also reveal that environmental performance fully mediates the relationship between the collective GOMpractices and business benefits, indicating support for H3a. The full mediating effect of environmental performance is further supported with the proportion of the indirect effect (66.1%) of the total effect and with the improvement in the R^2 forbusiness benefits (49%). However, the mediation effect of environmental performance on the relationship between the collective GOM practices and spending was not confirmed, and thus H3b was not supported

Model 3.



χ2	(df)	Normed χ2	CFI	IFI	RMSEA (90% Confidence Interval)	PCFI
689.733	445	1.550	.904	.906	063 (.054-.070)	.811

***p<0.01; **P<0.05; *P<.1
Dashed line indicates non significant paths

Figure 5.6.8: The mediated structural model

Table 5.6.3: Results of the mediation effect of CFC and environmental performance

Hypothesis	Structural Path	Path 'a' (Stakeholder →CFC)	Path 'b' (CFC→ GOM)	Indirect Beta Path 'a*b' (Upper CI- Lower CI)	Total effect Path 'C' Stakeholder→GOM w/o mediation	Direct effect Path 'C*' Stakeholder→GOM with mediation	Mediation type observed	Proportion of mediation	Result
A- Results of the mediation effects of CFC on the relationship between GOM practices and market and non-market stakeholder pressures									
H4a	[¥]MS→CFC →GOM practices	0.459***	0.449***	0.206*** CI (0.365 -0 .099)	0.634*** ($R^{2 \text{ for GOM}}$=0.50)	0.437*** ($R^{2 \text{ for GOM}}$=0.612)	Partial	0.325 (32.5%)	Supported
H4b	No.MS→CFC →GOM practices	0.259**	0.449***	0.117* (p=.011) CI (0.265 - 0.075)	0.139 (p>.1) ($R^{2 \text{ for GOM}}$=0.50)	0.022 (p>.1) ($R^{2 \text{ for GOM}}$=0.612)	Indirect effect only	0.842 (84.2%)	Supported
B- Results of the mediation effects of environmental performance on the relationship between GOM and business benefits and spending									
Hypothesis	Structural Path	Path 'a' (GOM →Env.Perf)	Path 'b' (Env.P→B enefits / Spending)	Indirect Beta Path 'a*b' (Upper CI- Lower CI)	Total effect Path 'C' GIM→Benefits / Spending w/o mediation	Direct effect Path 'C*' GIM→Benefits / Spending with mediation	Mediation type observed	Proportion of mediation	Result
H3a	GOM practices → Env. Performance →Benefits	0.617***	0.602***	0.371*** CI (0.544 - 0.239)	0.561*** ($R^{2 \text{ for benefits}}$=0.35)	0.190 (p>.1) ($R^{2 \text{ for benefits}}$=0.49)	Full	0.661 (66.1%)	Supported
H3b	GOM practices →Env. Performance → Spending	0.617***	0.251[ns] (p>.1)	0.155 (p>.1) CI (0.327- - 0.023)	0.491*** ($R^{2 \text{ for spend}}$=0.40)	0.337*** ($R^{2 \text{ for spend}}$=0.40)	No mediation (direct only)	N/A	Not Supported

***** p< .01; **p < 0.05; *p < 0.1; ns=not significant,based on 2,000 bootstraps, [¥] MS=Market Stakeholders, No.MS=Non-Market Stakeholders**

5.6.4 Examining the moderated mediation effects

The current research is also interested in examining whether the mediated effect of CFC on the relationship between stakeholder pressures and GOM practices is moderated by three characteristics of the firm (degree of pollution intensity, size, and degree of international orientation). That is, this research aims to combine the mediation and moderation effects in a single study by examining whether the effectiveness of the CFC is contingent on the above firm characteristics. The performance of such complex conditional mediation analysis involves assessing the influence of a moderator on the mediation effect. A brief review of simple moderation test and the methods used to examine its presence is presented in the next section.

The moderation effect:

The moderation test examines how the relationship between an independent variable (X) and a dependent variable (Y) changes, in terms of size and direction, as a function of a moderating variable (Z) (Baron and Kenny, 1986). For example, if Z is proposed as a moderator variable on the relationship between X and Y, then for different values of Z, the sign and/or the strength of the X→Y relationship may differ (Figure 5.6.9).

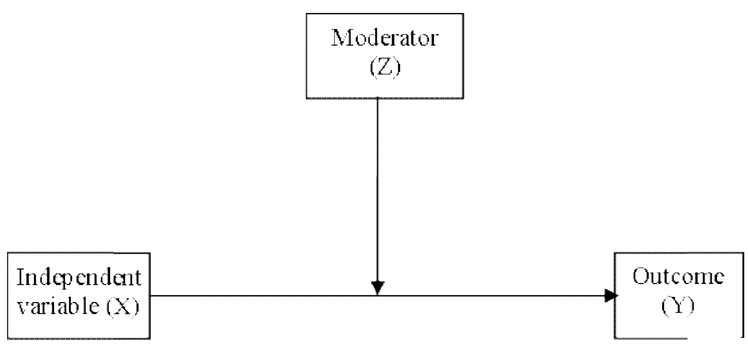


Figure 5.6.9: Basic moderation model

The moderation test is very important in social sciences and organisational studies (Koufteros and Marcoulides, 2006). It can offer a more precise explanation about the nature of the causal relationships between X and Y by providing further explanation of how and under what conditions the influence of X on Y varies depending on the level of Z (Baron and Kenny, 1986). A moderation test can generally take two forms: 1) the multi-grouping moderation, and 2) the interaction moderation. In the multi-grouping approach, Z is often a categorical variable (e.g. gender) and the researcher tends to split the dataset based on the levels of Z. In the interaction approach, on the other hand, Z is often a continuous variable (e.g. age) and the researcher tends to use the whole dataset in order to test the moderation effects (Hair *et al.*, 2006). In the multi-grouping approach, after creating the sub-grouping models based on the levels of the moderator, the moderation is often tested by assessing the significance of factor loading differences among subgroups (Byrne, 2010; Wong *et al.,* 2011). On the other hand, in order to test the moderation effect using the interaction moderation approach, an interaction construct needs to be created that includes the products of the observed variables used to develop the original independent (X) and moderating (Z) constructs of interest (Figure 5.6.10) . The moderator is treated as another predictor to the outcome (Y) and is expected to interact with X in such a way that influences the value of Y. In both multi-grouping and interaction approaches, the moderator is used to explore how the causal relationships between the X and Y changes based on the levels of the Z (i.e. become weaker, stronger or even changing the signs of the main effects) (Hair *et al.*, 2006).

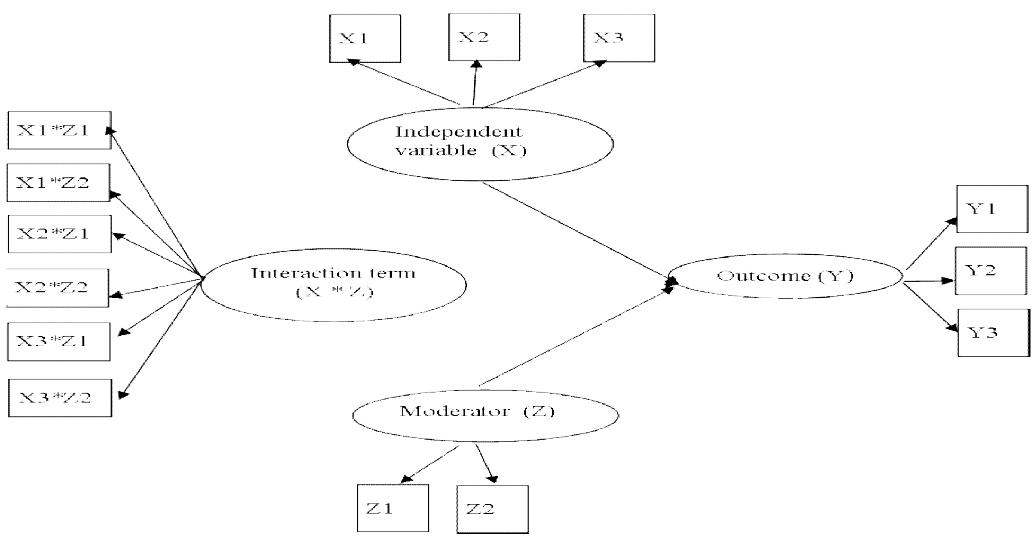


Figure 5.6.10: Basic interaction moderation model

These forms of moderation are used interchangeably and the literature makes no significant differences between these (Holmbeck, 1997; Iacobucci *et al.,* 2007). Although the multi-grouping moderation and the interaction moderation differ in terms of methods used (Baron and Kenny, 1986), the way these are interpreted is almost similar (Holmbeck, 1997). Researchers often treat the interaction term like a multi-group and often it results in using the same approach as in the multi-grouping (e.g. low versus high size, income, age) (Iacobucci *et al*., 2007). For example, Wong *et al*. (2011) tested the contingency effects of environmental uncertainty (EU) on the relationships between supply chain integration and operational performance using the multi-grouping approach in a total sample of 151 of Thailand's automotive manufacturing firms. In their study, EU was conceptualised as a latent variable measured using four indicators and the subgroups were formed using the median of the composite score of the EU (high, n=75: low, n=75). The same approach was also used in other operations management studies (e.g. Wagner, 2011), organization management studies (e.g. Voci and Hewstone, 2003) and strategic marketing studies (e.g. Auh and Menguc, 2005). When SEM is used and either X, Y or Z is a latent variable, the moderated effect can be better tested using the multi-grouping procedure (Rigdon *et al.,* 1998; Edwards and Lambert, 2007). This is largely due to the complexity of estimating an interaction term with a continuous latent variable in SEM (Schumacker, 2002; Marsh *et al.,* 2004; Hair *et al*, 2006). Also, if the continuous moderator variable can be categorised in a way that makes sense and logical groups can be justified then the multi-grouping approach is recommended for performing the moderation test (Hair, *et. al.,* 2006). In this case, researchers tend to use the median of the composite score of the continuous moderator to split the data set and create logical groups (Muller *et al.,* 2005; Byrne, 2010; Wong *et al.,* 2011).

Moderation effects can be tested using multiple regression or SEM (Hair *et al.,* 2006). SEM is preferred to test the moderation effect when more than one indicator is used to measure the latent variable and when the relationships between multiple exogenous and endogenous latent variables are tested (Hair *et al.,* 2006; Hopwood, 2007; Tabachnick and Fidell, 2007). Moreover, the information provided by SEM regarding the overall model fit after controlling for the measurement errors, makes it the preferred method (Holmbeck, 1997; Marsh *et al*., 2004; Hair *et al.,* 2006). Because, in this study, latent variables are measured using multiple variables, relationships between multiple exogenous and endogenous constructs are examined, and logical groups are justified, the multi-grouping SEM approach is utilised to test the moderation effect.

The moderated mediation effect:

Thus far, the research has focused on testing 1) the direct and indirect effects of stakeholder pressures on adopting GOM practices via CFC and, 2) the direct and indirect effect of GOM practices on economic performance via environmental performance. In the current part the association between CFC and GOMpractices is expected to vary based on the pollution intensity, size, and degree of international orientation of the firm. That is, the effectiveness of CFC on GOMpractices is stronger in some contexts (i.e. highly polluting firms, large size firms and highly internationalized firms) compared to others. The following hypotheses were proposed:

H5: Firm characteristics (pollution intensity (H5a), size (H5b) and international orientation (H5c)) moderate the relationship between CFC and the adoption of GOM practices.

H5a: The firm's pollution intensity moderates the relationship between CFC and the adoption GOM practices.

H5b: Firm size moderates the relationship between CFC and the adoption GOM practices.

H5c: Firm degree of international orientation moderates the relationship between CFC and the adoption GOM practices.

Research in GOM rarely combines mediation and moderation in a single study (Wagner, 2011), which is a common practice in other disciplines such as Psychology (Muller *et al.,* 2005; Iacobucci *et al.,* 2007; Edwards and Lambert, 2007). Combining mediation and moderation effects in a single study can take two forms: (1) mediated moderation, (2) moderated mediation. In the first situation, the focus is to investigate if the effect of the independent variable (X) on the mediator (M) depends to a large extent on the level of a moderator (Z) (Baron and Kenny, 1986; Edwards and Lambert, 2007). That is, the interaction between X and Z can affect M which, in turn, affects Y (Muller *et al.,* 2005). On the other hand, the second situation examines if the mediation model holds across multiple groups, according to the levels of Z (Baron and

Kenny, 1986; Mackinnon, 2008). As highlighted earlier, the current research focuses on examining whether the mediated effect of CFC on the relationship between the stakeholder pressures and GOM practices varies depending on the characteristics of the firm, which is moderated mediation effect (Baron and Kenny, 1986). Moderated mediation analysis attempts to provide empirical explanation of both how and when a particular effect happens (Preacher *et al.*, 2007). Moderated mediation analysis happens when the strength of the mediation effect is believed to be contingent on the level of another variable (i.e. a moderator). In path analytical terms, Baron and Kenny, (1986) and Mackinnon (2008) maintained that testing the *mediated moderation* is about investigating the moderation effects of Z on path 'a', while testing the *moderated mediation* is about exploring the moderating effects of Z on path 'b' (Figure 5.6.11).

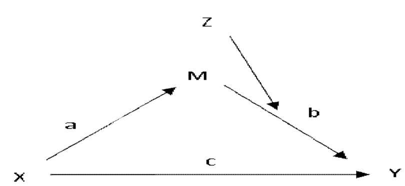


Figure 5.6.11: Simple moderated mediation effects

Edwards and Lambert (2007) have presented a general analytical framework for combining mediation and moderation in a single study. They argued that researchers have used three general approaches to tackle this issue. The first approach is called the 'piecemeal approach', in which the mediation effect and the moderation effect are tested separately, and then the outcomes of these individual tests are interpreted jointly to show the joint effects of mediation and moderation on the relationships between the X and Y. The second approach is called the 'moderated causal steps approach', which essentially uses Baron and Kenny (1986) causal steps procedure for testing the mediation effect before and after controlling for the moderator. The third approach is called the 'subgroup approach', in which the total sample of the study is divided into subgroups based on the levels of Z and then the mediation effect is tested within each subgroup (Wegener and Fabrigar, 2000). The subgroup approach is the most widely used approach and it has been recommended when the research is focused on examining the moderated mediation in the context of SEM (Rigdon *et al.,*1998; Muller *et al.,* 2005; Edwards and Lambert, 2007).

Each one of these approaches has its merits and can be used in different contexts. The researcher's selection of a particular analytical approach to be adopted in his/her study will depend mainly on the nature of the mediated and moderated effects under investigation and whether the analysis is about the moderated mediation or mediated moderation effect (Edwards and Lambert, 2007).In the current research, the 'subgroup approach' with the help of the bootstrapping approach is adopted. Because this approach splits the dataset based on the level of the moderator, its main drawback is that it tends to reduce the statistical power needed to predict the significant indirect effect within each subgroup. To avoid the problem of lower statistical power, the bootstrapping approach has been recommended (Edwards and Lambert, 2007; Preacher *et al.,* 2007) to generate sufficient amount of power needed to predict the indirect effect within each subgroup (Shrout and Bolger, 2002; Muller *et al*., 2005).

The analysis begins with the establishment of the mediation effect for each sub-group. Then an additional examination of whether the mediating process that describes the relationship between X and Y via M is moderated by the different values of a moderator variable (Baron and Kenny, 1986; Muller *et al.,* 2005; Preacher *et al.,* 2007). In order to conclude that the mediation effect is moderated, the significance of the factor loading differences among the subgroups should be tested (Edwards and Lambert, 2007; Muller *et al*., 2005). Figure5.6.12 is provided to clarify the steps involved in the moderated mediation tests using the sub-group SEM approach.

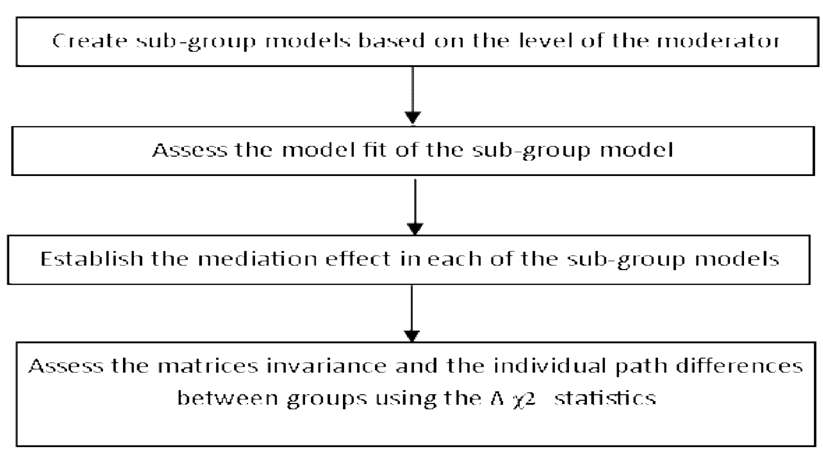


Figure 5.6.12: Steps for multi-grouping SEM moderated mediation analysis (adopted from Hair *et al.,* 2006 and Wagner, 2011)

Results of the moderated mediation test

To test the moderation effect of pollution intensity, firm size and international orientation on the relationship between CFC and GOM practices (H5a-H5c), a multi-grouping SEM approach in AMOS was used. This approach has also been used in other GOM studies (e.g. Wagner, 2011; Wong *et al.,* 2012). A two group model was created for each moderator. Pollution intensity (PI) was proxied by the industry category, as suggested by previous studies (e.g. Bowen *et al.*, 2001a; Zeng, 2010a). For the purpose of this research, firms were classified into highly polluting (coded= 1, n=85) and light polluting (coded=2, n=53) using the classification of OMECA(Table 5.6.4). The actual number of full-time employees measured the firm size. The sample was divided into large firms (coded=1, n=69) and medium firms (coded=2, n=69) based on the median of this value (median=145, with a maximum of 5000 and a minimum of 20 employees). The number of the full time employees for each company was obtained from reports of the Omani Ministry of Commerce and Industry. The international orientation (IO) of the firm was measured with three items that describe the importance of considering the international environmental regulations and international market requirements (see table 4.2.9). All items were rated on a 5 point Likert scale. The IO groups were based on the median of its composite score (median=3.83).The sample was divided into high internationally oriented firm (coded=1, n=69) and low internationally oriented firms (coded=2, n=69).

Table 5.6.4: Categories of polluting industries (Source: NCSI, 2006)

Pollution intensity	Main company activity	Frequency	%
Light	Food & beverage	8	5.8
N=53	Wood & wood products	1	.7
	Publishing activities, printing, photocopying	4	2.9
	Textiles	3	2.2
	Leather & saddles	2	1.4
	Medical & optical equipment and machinery	1	.7
	Basic metals	12	8.7
	Fabricated metals products	22	15.9
High	Refined oil & liquid natural gas	5	3.6
N=85	Chemical products	23	16.7
	Plastic products	19	13.8
	Non-metallic mineral products	13	9.4
	Paper & paper products	1	.7
	Electronic appliances & electronic machines	14	10.1
	Manufacturing of machines & equipment	10	7.2
	Total	138	100.0

After creating a two group model for each moderator, multi-group AMOS (Byrne, 2010) was performed to investigate the group differences based on the level of the moderator (Wong *et al.*, 2012). Initially, using the full structural model presented in Figure 5.6.8, the overall model fit for each of the models was assessed. Results in Table 5.6.5 (i.e. rows in grey) show that none of the full structural models achieved a satisfactory level of fit. This was largely due to the complexity of these models considering the relatively small sample size used to estimate them (Hair *et al.,* 2006; Henseler *et al.,* 2009). Accordingly, only the mediated part of the structural model (stakeholder pressures→CFC→GOM practices) was used to conduct the subsequent moderation tests (Figure 5.6.13). Although adding the performance part of the model into the moderation analysis may provide more insights about the implications of the moderate mediation effects on the performance of the firm, focusing on the mediated part of the model is sufficient to test the fifth objective of this research. Table 5.6.5 (i.e. rows in white) summarises the results of the model fit for different subgroup models when only the mediated part was used. It is clear that the three sub-group models achieved an acceptable level of fit. It is worth noting that the model fit for the sub-group models is based on estimating the same structural model across both groups simultaneously, rather than separately. The fit now shows how accurately the measurement model reproduces the observed covariance matrix for both groups, and thus one key set of fit indices is provided for the overall two-grouping model (Hair *et al.,* 2006).

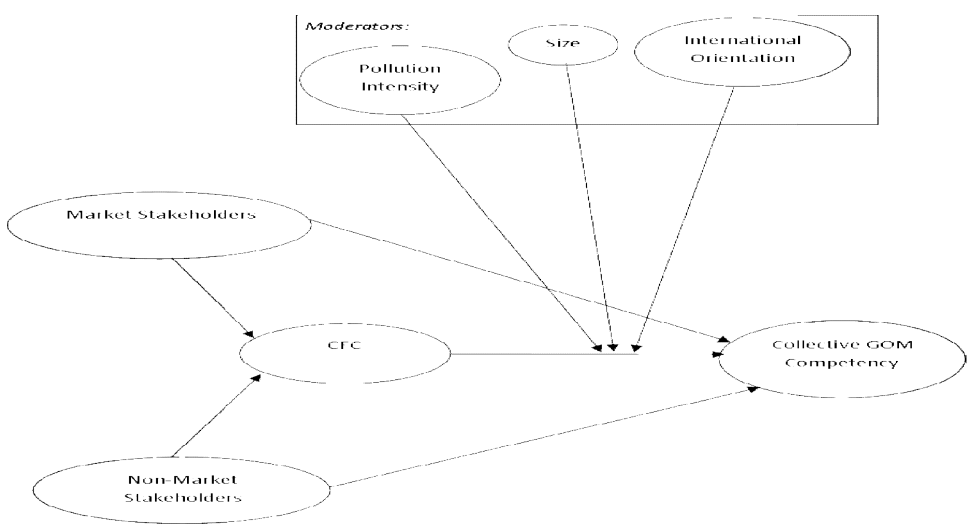


Figure 5.6.13: The contingent mediated model

Table 5.6.5: Moderated model fit summary

Moderator	Model/Indices	$\chi2$ (df)	Normed $\chi2$	CFI	IFI	RMSEA (90% confidence interval)	PCFI	AIC
	Recommended	**NA**	**<3.0**	**≥0.9**	**≥0.9**	**<0.08 (0.00-0.08)**	**≥0.70**	**The lower the better**
Pollution	Overall	1141.907 (720)	1.586	0.824	0.830	0.066(0.058-0.073)	0.730	1441.907
	Mediated part	422.593 (318)	1.329	0.922	0.925	0.049(0.036-0.060)	0.771	626.593
Size	Overall	1112.395 (720)	1.545	0.826	0.833	0.063 (0.056-0.070)	0.732	1412.395
	Mediated part	416.225 (318)	1.309	0.923	0.926	0.048 (0.034-0.060)	0.772	620.225
International orientation	Overall	1110.270 (720)	1.542	0.815	0.822	0.063 (0.056-0.070)	0.722	1410.270
	Mediated part	425.251 (318)	1.337	0.908	0.913	0.050(0.036-0.062)	0.760	629.251

Once an acceptable model fit was achieved for the three sub-group models, the next step is to establish the mediation independently in each sub-group model before testing the moderation effect (Baron and Kenny, 1986; Edward and Lambert, 2007). The direct, indirect and total effects of stakeholder pressures and CFC on GOM practices were calculated for each subgroup using procedures presented in section 5.6.3. The results of the mediation effects of CFC on the relationship between stakeholder pressures and GOM practices for high polluting versus light polluting firms, large size versus medium size firms and for highly internationally oriented versus less internationally oriented firms are summarized in Table 5.6.6 and presented in Figures5.6.14, 5.6.15 and 6.6.16respectively. A significant indirect effect was shown in the mediated models of the different groups. Although this indirect effect varies from partial, full to indirect effect only, the results reveal that in all sub-group models the stakeholder pressures indirectly predicted the adoption of GOM practices through CFC in both highly polluting and lightly polluting firms, large size and medium size firms and high internationally oriented and less internationally oriented firms. All sub-group models have explained good levels of variance in the adoption of GOM practices (i.e. R^2 ranges between 0.772 and 0.612) and CFC (i.e. R^2 ranged between 0.446 and 0.242) (Hair *et al.,* 2006, Henseler *et al.,* 2009). Therefore, the mediation effect of CFC on the relationship between stakeholder pressures and GOM practices was confirmed in all sub-group models.

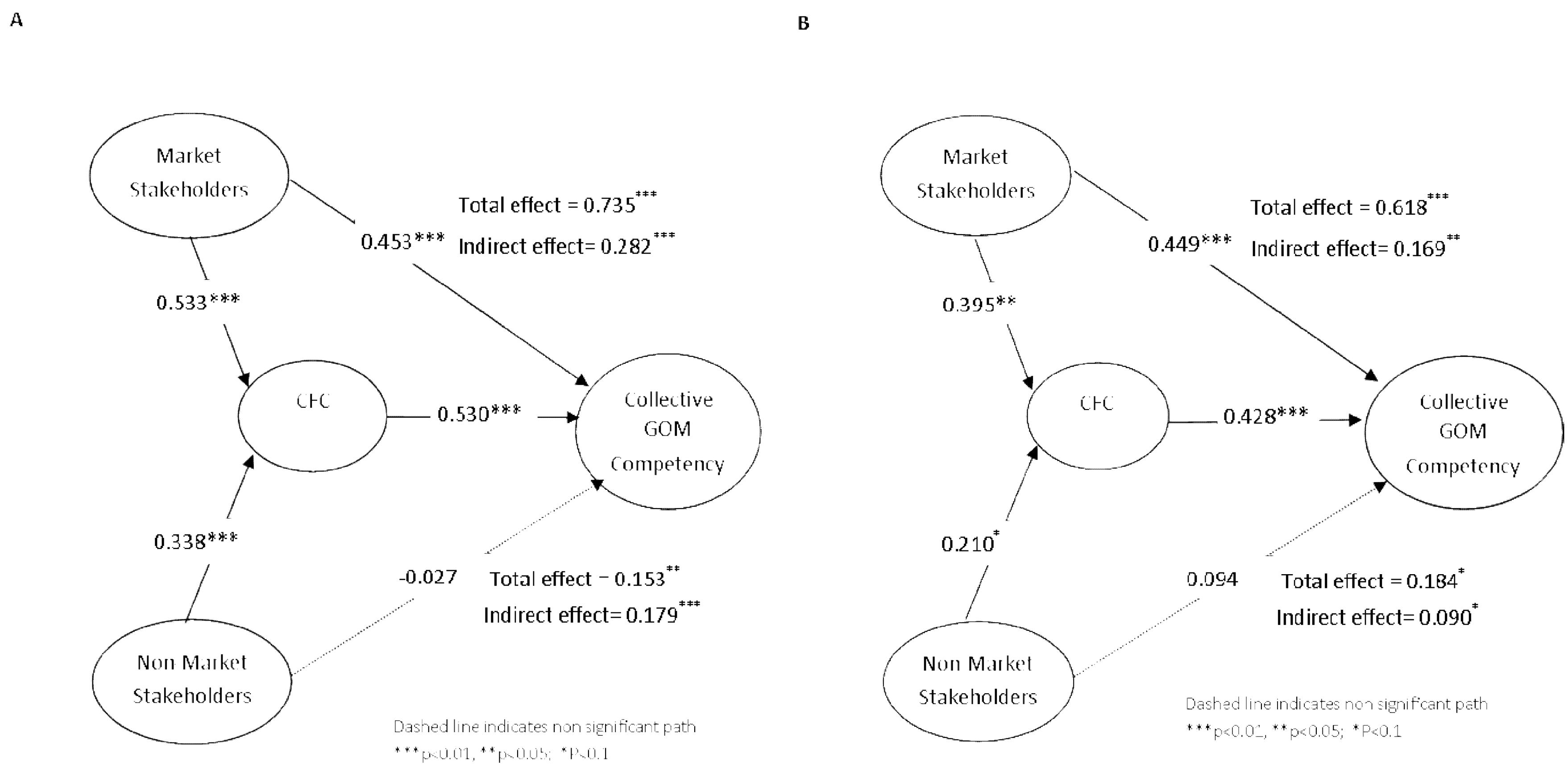


Figure 5.6.14: Mediation effect for high polluting (A) and lightly polluting (B) firms

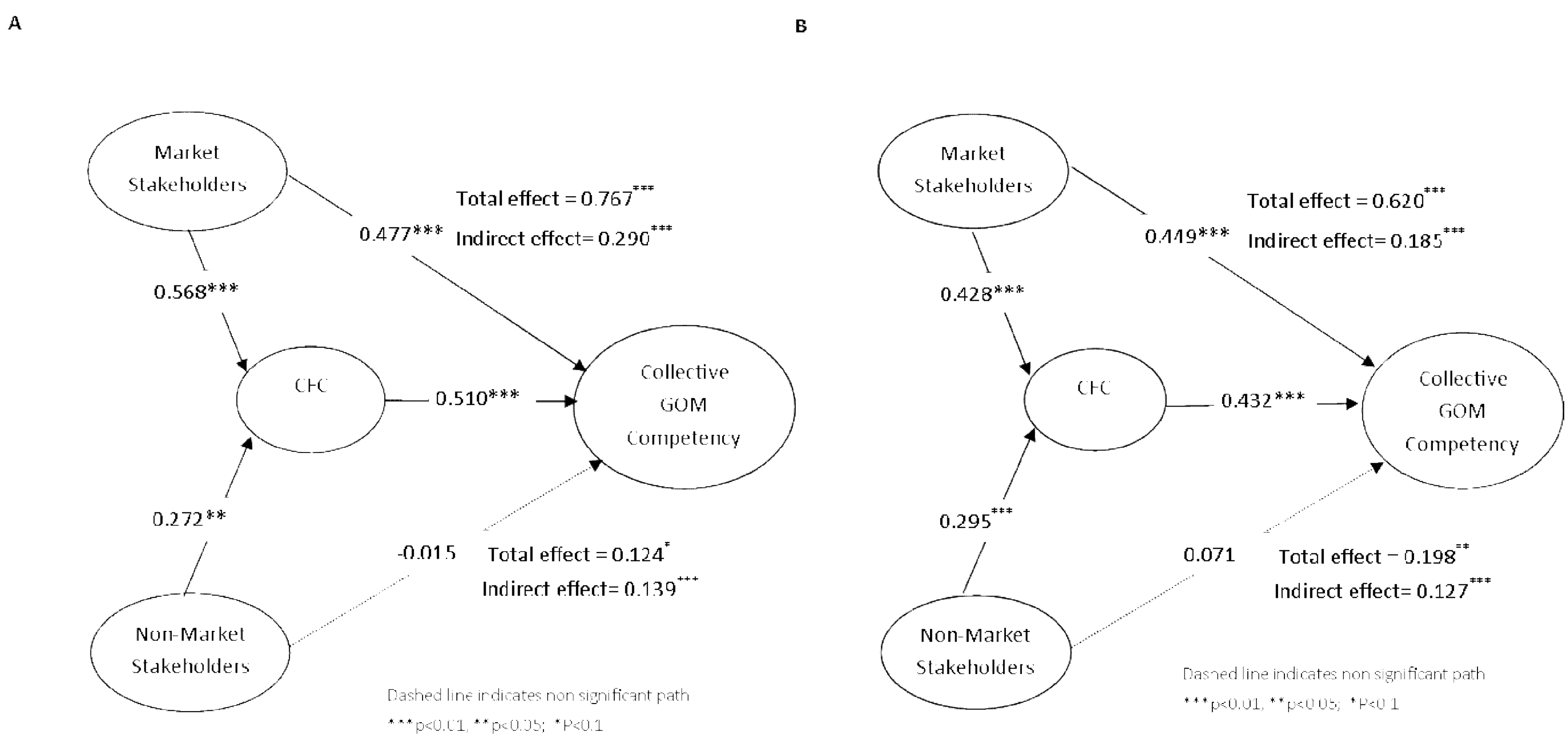


Figure 5.6.15: Mediation effect for large (A) and medium (B) firms

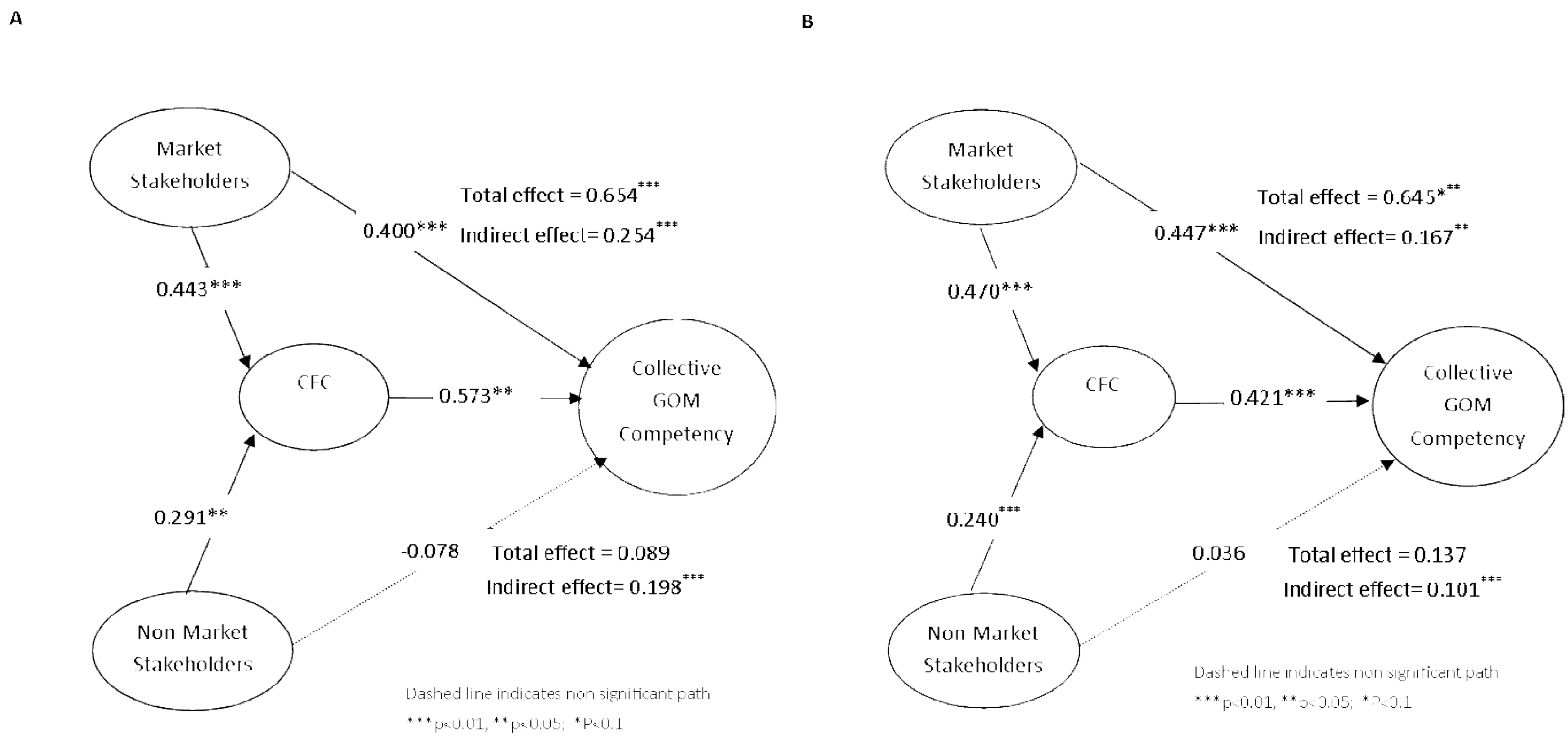


Figure 5.6.16: Mediation effect for high (A) and low (B) internationally oriented firms

Table 5.6.6: Multi-grouping mediation results

Moderator	Level	R^2	Structural Path	Path 'a' (Stakeholder →CFC)	Path 'b' (CFC→ GOM)	Indirect effect 'a*b' (Lower-Upper Bounds)	Total effect Path 'C' Sakeholder→GOM w/o mediation	Direct effect Path 'C*' →GOM with mediation	Med. Type
Pollution intensity (PI)	High	GOM=0.772	¥MS→CFC →GOM	0.533***	0.530***	0.282*** (0.203 - 0.381)	0.735***	0.453***	Partial
	N=85	CFC=0.515	No.MS→CFC →GOM	0.338***	0.530***	0.179*** (0.101 - 0.301)	0.153**	-0.027^{ns}	Full
	Light	GOM=0.612	MS→CFC →GOM	0.395**	0.428***	0.169** (0.051 - 0.317)	0.618***	0.449***	Partial
	N=53	CFC=0.242	No.MS→CFC →GOM	0.210*	0.428**	0.090* (0.014 - 0.188)	0.184*	0.094^{ns}	Full
Firm Size	Large	GOM=0.779	MS→CFC →GOM	0.568**	0.510**	0.290*** (0.177 - 0.430)	0.767***	0.477***	Partial
	N=69	CFC=0.446	No.MS→CFC →GOM	0.272**	0.510***	0.139*** (0.036 - 0.269)	0.124*	-0.015^{ns}	Full
	Medium	GOM=0.626	MS→CFC →GOM	0.428***	0.432***	0.185*** (0.079 - 0.334)	0.620***	0.435***	Partial
	N=69	CFC=0.354	No.MS→CFC →GOM	0.295***	0.432***	0.127*** (0.036 - 0.270)	0.198**	0.071^{ns}	Full
International orientation (IO)	High	GOM=0.685	MS→CFC →GOM	0.443***	0.573***	0.254*** (0.160 - 0.357)	0.654***	0.400***	Partial
	N=69	CFC=0.308	No.MS→CFC →GOM	0.291**	0.573***	0.198*** (0.047 - 0.277)	0.089^{ns}	-0.078 ^{ns}	Indirect only
	Low	GOM=0.618	MS→CFC →GOM	0.470***	0.421***	0.167** (0.102 - 0.324)	0.645***	0.447***	Partial
	N=69	CFC=0.300	No.MS→CFC →GOM	0.240**	0.421***	0.101** (0.034 - 0.220)	0.137 ^{ns}	0.036^{ns}	Indirect only

***** p< .01, **p < 0.05; *p < 0.1, ns=not significant,based on 2,000 bootstrap**, ¥MS=Market Stakeholders, No.MS=Non-Market Stakeholders

After establishing the mediation effect in each sub-group model, a two-grouping SEM was used to test the moderation effects, in which the two groups represent two levels of the proposed moderators (Byrne, 2010). The procedure used for testing the moderation effect when the multi-group approach is used involves using the same structure of the SEM model with different subgroups (Hair *et al.,* 2006). In order to establish the moderation effect, metric invariance of the sub-groups needed to be evaluated before assessing the individual path differences (Tabachnick and Fidell, 2007, Wagner, 2011). Metric invariance implies that the different groups of respondents have used and interpreted the scales used to develop the structural model under investigation in the same way, so that there is no variation between groups (Hair *et al.,* 2006). Metric invariance provides the researcher with an indication of whether we are measuring the same construct in the same way in different groups.

To establish the moderation effect of a particular moderator using the two-group SEM approach, one should provide enough statistical evidence for rejecting the metric invariance (Byrne, 2010; Hair *et al.,* 2006). The analysis begins by assessing the model fit of the two-group baseline model, in which the structural parameters are allowed to be estimated freely in both groups. In other words, in the baseline model the relationships between constructs are allowed to be different across the two groups. Then, the model fit of an alternative fully constrained model is assessed, in which the structural parameters are constrained to be equal in both groups (Wong *et al.,* 2011). This process will result in assigning the same value for the structural parameters in each of the two group samples.

The significance of change in$\chi 2$ difference ($\Delta\chi 2$) between the baseline model and the fully constrained model is often used to evaluate the model fit difference between them and to evaluate the metric invariance (Hair *et al.,* 2006; Tabachnick and Fidell, 2007; Wagner, 2011; Wong *et al.,* 2012). The significance of $\Delta\chi 2$ and the model fit comparison between the baseline model and the fully constrained model would allow the researcher to assess whether the constraint significantly harmed the model fit or not (Auh and Menguc, 2005; Wong *et al.,* 2011). The moderation would be initially supported if the $\Delta\chi 2$is significant, revealing that metric invariance between the two groups is rejected. Next, in order to provide further support for the presence of the moderation effect in the two samples, one should assess the differences in sign and strength of the parameter estimates between the two groups (Hair *et al*., 2006; Tabachnick and Fidell, 2007). The moderation effect on the individual path would be further supported if the factor loading on that path is significantly different between groups (Hair *et al*., 2006). The individual path differences can be also assessed using the procedures of evaluating the significance of $\Delta\chi2$described earlier. However, in the individual path differences test, the significance of $\Delta\chi2$is tested by examining the effects of adding the factor loading equivalence constraint of that particular path on the fit of the baseline model (Hair *et al*., 2006; Byrne, 2010). Constraining the factor-loading estimate of a particular path in the first sample to be equal those in the second sample would provide the researcher with an indication of whether adding that constraint significantly affected the statistics of $\chi2$.

One of the primary aims of this study is the investigation of the invariance among sub-group structural models that were developed based on the level of the three proposed moderators and, more specifically, on the structural paths that link the CFC with the GOM practices. The analysis of metric invariance and the individual path differences between the groups were performed in version AMOS 20.0. The multi-group analyses were performed using the procedures of Δ $\chi2$ test. Table 5.6.7 presents the results of the multi-grouping invariance and path differences analysis for each moderator.

Concerning pollution intensity of the firm as a moderator, the results of panel A in Table 5.6.7 show that there are no significant differences in $\chi2$ test ($\Delta\chi2 = 26.4$, $p>.1$) between the baseline model and the fully constrained model, suggesting invariance of the model under high and low pollution intensity. Also, when testing the equality of the individual path that links the CFC with GOM practices between the high and light pollution intensity groups, the results of panel A in Table 5.6.7 revealed that this relationship is invariant in terms of its strength under high and light pollution intensity ($\Delta\chi2 = 1.60$, $p>.1$). All these results indicate that the metric and individual path invariance cannot be rejected when the pollution intensity is considered as a moderator, suggesting that H5a is not supported.

Next, the above metric and individual path invariance analysis were repeated for the size of the firms as a moderator. The results of panel B in Table 5.6.7 revealed that there are no significant differences in χ2test ($\Delta\chi2$ = 20.77, p>.1) between the baseline model and the fully constrained model, suggesting invariance of the model under large and medium size of firm. Also, when testing the equality of the CFC→GOM link between the high and medium size groups, the results of panel B in Table 5.6.7 revealed that this relationship is invariant in terms of its strength under large and medium size ($\Delta\chi2$ = 0.065, p>.1). These results suggest that H5b is not supported.

Finally, concerning the international orientation of the firm as a moderator, a significant χ2 difference (Δ χ2 = 35.5, p<.05) was found between the baseline model and the fully constrained model (Panel C, Table 5.6.7). The results indicate that the model varies under high and low international orientation, and thus metric invariance is rejected. Then, the equality of the CFC→GOM path under high and low internationally oriented groups was tested. The results of panel C, Table 5.6.7 further showed that strengths of the CFC→GOM association is significantly different (Δ χ2 = 4.5, p<.05) under high and low internationally oriented groups, and thus, H5c is supported.

To sum up, although the multi-group mediation results (Table 5.6.6) show that CFC→GOM practices relationship is stronger for firms with highly visible environmental impacts (i.e. highly polluting, large size, and highly internationalized), results of the multi-group moderation analysis (Table 5.6.7) show that this relationship is significantly stronger only in the case of high versus less internationalised firms. Taken together, these results reveal that firm characteristics are not always considered as a moderator on CFC→GOM relationship and that hypothesis H5 is only partially supported.

5.7 Conclusion

This chapter presented the procedures and results of the quantitative (survey) data analysis. It included five main sections. Section 5.1 discussed the responses obtained from the survey: 138 usable responses were returned, representing a 24% response rate. Section 5.2 highlighted the process of transcribing the data from the questionnaires to SPSS. After entering the data into the SPSS, the data were purified from the influence of missing values, outliers and any sources of bias that were discussed in Section 5.3. In Section 5.4 preliminary descriptive statistics were conducted to have a better understating of the collected data. In Section 5.5, the assessment of the measurement model was conducted by the mean of reliability and validity tests using EFA and CFA. The results showed that the constructs are reliable and valid. Also, the CFA results showed that the first and second order measurement models had acceptable goodness of fit results. After establishing acceptable first and second order measurement models, the assessment of the structural model and hypotheses testing were conducted in Section 5.6. This was discussed in three main parts. The first part was related to the validation of the collective GOM competency construct. The second part of the analysis focused on the direct association between market and non-market stakeholder pressures, GOM practices and organisational business benefits, spending and environmental performance. The third part of the analysis was concerned with the test of the mediation and moderation effects of other factors on the relationships between stakeholder pressures, GOMpractices and performance of the firm.

Table 5.6.7: Results of the multi-group (moderation) analysis

Moderator	**Model description /Indices**	$\chi 2$ (df)	Normed $\chi 2$	CFI	IFI	RMSEA (90% confidence interval)	PCFI	AIC	$\Delta\chi^2$	Δdf	χ^2difference test	Hypotheses
Panel A: Pollution Intensity	Baseline model	422.6 (318)	1.329	.922	.925	.049(.036-.061)	.771	626.6	26.4	21	Insignificant	
	Constrained model	449.02 (339)	1.325	.917	.920	.049(.036-.061)	.819	611.02				
	Constrained path CFC→GOM	424.19 (319)	1.330	.921	.925	.049(.036-.061)	.773	626.19	1.60	1	Insignificant	H4a not supported
Panel B: Size	Baseline model	416.23 (318)	1.309	.923	.926	.048(.034-.060)	.772	620.23	20.77	21	Insignificant	
	Constrained model	437.0 (339)	1.289	.923	.925	.046(.032-.058)	.823	599				
	Constrained path CFC→GOM	416.88(319)	1.307	.923	.926	.047(.034-.060)	.775	618.88	.065	1	Insignificant	H4b not supported
Panel C: International orientation	Baseline model	425.25(318)	1.337	.908	.913	.050(.036-.062)	.760	629.25	35.5	21	.025**	
	Constrained model	460.72(339)	1.359	.896	.900	.051(.039-.063)	.799	622.72				
	Constrained path CFC→GOM	429.75(319)	1.347	.905	.910	.051(.037-.062)	.760	631.75	4.5	1	.034**	H4c supported

***** p< .01, **p < 0.05; *p < 0.1**

CHAPTER 6 EMPIRICAL CASE STUDY ANALYSIS

6.1 Introduction

Chapter six highlights the key findings from the empirical case studies that were conducted to further validate and better explain the quantitative findings from Chapter 5. It aims to determine the roles of stakeholders and other environmental drivers that influence the adoption of GOM practices in Omani manufacturing firms, and to examine how environmentally oriented CFC facilitates the process of translating the environmental concerns of stakeholders into action. Subsequently, the collective adoption of various environmental practices was tested in terms of its impacts on environmental and economic performance. Interesting remarks about issues that emerged from the interviews arealso presented in different sections of this chapter. It is important to note that as this research aims to provide more generalisable evidence, more attention was given to the cross case analysis. This chapter is organised as follows. In Section 6.2, an overview of the data collection process and description of the case companies are provided. The key findings of the case studies are presented in Section 6.3. Overall conclusions of the case studies analysis are highlighted in Section 6.4.

6.2 Description of case companies and data collection processes

The case study approach is suitable for gaining an in-depth understanding of relatively complex processes (Yin, 2003)such as the adoption of GOM practices (Wu and Pagell, 2011). In this research, a multiple case design was adopted to further support the quantitative findings. The selected case companies are located in different places within Oman. Firm size and industry diversity were considered during case selection to ensure that important differences between industries were observed (Yin, 2003). Participants were sought through the Omani Ministry of Environment and Climate Affairs (i.e. these are leading Omani companies in terms of their environmental performance). Of the 20 companies contacted via e-mail and phone, five companies agreed to participate in this research. Of these five companies; one (OilCo) also participated in the survey, while the remaining four

(PowerCo, PaintCo, AluminiumCo andPlasticCo) were among the non-respondents. Table 6.1.1 provides a description of the case companies. In order to encourage more openness from the participants, anonymity was assured and the actual names of the participants and/or their companies are not mentioned. All case companies have more than seven years of operations in Oman. The confidentiality restrictions limited the researcher's ability to elaborate more on the unique context of each company, which is another reason for focusing more on cross case analysis.

The data were collected through semi-structural interviews with at least one senior manager in each company. Some secondary data were also collected from multiple sources such OMECA and the websites of the case companies, which helped to ensure triangulation (Yin, 2003). The participants included four HSE managers, two production and operations managers, one quality manager and one general manager. The transcripts were reviewed by the participants except for PowerCo and PlasticCo where the participants preferred not to do so due to time constraints. The interviews were conducted during April 2013 and each interview lasted for around 1 hour. The interview questions (Table 6.1.2) were formulated and structured based on the developed conceptual framework. All interviews were recorded (except the interviews with OilCo in which field notes were taken) and then transcribed by the author in order to facilitate the subsequent analysis. The transcripts were used to identify common and/or different patterns across cases. The smallest company has around 420 full-time employees and the largest firm around 5000 employees. Four of the companies (OilCo, AluminiumCo, PowerCo and PaintCo) are operating in international markets (export and/or import); the fifth company is operating only in the domestic market (i.e. PlasticCo). Also, four of the companies are ISO14001 certified, while the fifth company is in the process of certifying its EMS. Including an ISO14001 certificate as a criterion for selecting the case companies has enabled the researcher to control for the possible effects of such certificates on the proposed relationships between constructs under investigation.

Table 6.1.1: Description of cases companies

Industry	Chemical	Electronic Appliances	Metals	Plastic	Others
Case	PaintCo	PowerCo	AluminiumCo	PlasticCo	OilCo
Description	A leading international paints, coating and powder coating manufacturer with annual turnover of £ 9.2 bn.	One of the largest power application producers in the Middle East	A leading Aluminium smelter company with a production capacity of 375,000 metric tons/year of prime aluminium	The largest producer of plastic products in Oman (mainly for construction and infrastructure development sectors)	One of the leading producers of oil and gas in the region
Number of interviewees	1	2	2	1	2
Number of employees	8740 (globally), 450(locally)	420	1200	820	5000
Years in business	> 85 years (global), >18 years (Oman)	>22 years (Oman)	>7 years (Oman)	>39 years (Oman)	>43 years
Operating in international market (export/import) ?	Yes, less than 5% of the production is exported to East Asia. Raw materials (>80%) are imported from different Asian, European and American counties.	Yes, export more than 85% of its products to Middle East, Europe, East Asia and South Asia. Raw materials are mainly imported from Europe, U.S and Malaysia	Yes, most of its production exported to Europe and East Asia. Raw materials are mainly imported from Australia and China	No, produce only for domestic market and less than 2% of raw materials (chemicals) is imported from China	Yes, most of its production is exported to outside Asian and European counties. It only imports the main production equipment from Europe
Availability of environmental policy?	Yes, on company website -ISO 14001 certified company	Yes, on company website - ISO 14001 certified company	Yes, on company website -In the process of certifying it EMSs	Yes, on company website -ISO 14001 certified company	Yes, on company website -ISO 14001 certified company
Main focus of the environmental strategy?	-Reducing toxicity and volatile organic components (VOCs) -Reducing the hazardous materials -Reducing electricity and water consumption -Recycle and reuse whenever possible to reduce the waste	-Reduction of CO2 emission -Energy control -Efficient consumption of natural resources -Internal waste management whenever possible	-Emission control -Waste and effluents management (i.e. eliminating the waste at the source and increasing recycling & re-using opportunities) -Energy and water consumption	-Effective and efficient waste management -Recycling of waste internally whenever possible -Efficient energy consumption -Control all type of emission	-Continuous improvement in emission control through the entire production process -Effective and efficient usage of energy, water and other materials -Recycling and reusing the production waste whenever possible

Table 6.1.2: List of interview questions

A. General questions:

1. What is the total number of full time employees in your company?
2. How important are environmental issues to your company?
3. Do you have a written environmental management program/strategy in your company? What is the main focus of this program?

B. Drivers of environmental management and stakeholder pressures:

1. What is the primary driver for your environmental activities and practices?
2. Who are the main key stakeholders of you company?
3. How important are they in influencing your company environmental decisions and investments?
4. Of these stakeholders, which affect your company environmental decisions the most? How? Why are these stakeholders more powerful than others?

C. Environmental management practices:

1. Please can you describe what your company does to reduce the environmental impacts of its operations on the natural environment and on the quality of human life, specifically in terms of supply chain and production activities? What are the main reasons for implementing these activities?
2. What are the primary components of your company's environmental programs?
3. What is the impact of environmental concerns on manufacturing?
4. What waste streams are generated that your firm tries to control/regulate?
5. Have any processes been redesigned to reduce waste? What drove these changes?
6. Are environmental problems considered while designing the products of your company? Why?
7. How is solid waste handled?
8. How do environmental concerns impact the*transportation* selection and/or distribution methods? What is the main factor that drove your decision?
9. Is there any environmental effort your company does in the area of greening the product*packaging*? Why were these initiatives implemented?
10. How do environmental issues affect purchasing decisions? Are environmental criteria used to evaluate potential suppliers? If yes, why were these criteria imposed on your suppliers?
11. Are suppliers and customers included in your environmental programs? In what way? What is the main reason for including your customers and suppliers in your environmental programs?

D. Environmentally oriented cross-functional collaboration:

1. Are the environmental management activities company-wide? Which departments are more involved/concerned with the environmental issues? How frequently do these departments meet and coordinate?
2. How important is this cross-functional cooperation in progressing your company overall environmental programs and activities? How is CFC implemented in your company?
3. What are the main drivers for developing environmentally oriented CFC in your company?
4. What has your company done to enhance the role of the CFC to effectively implement its environmental programs?

E. Performance:

1. How successful have your company's environmental activities and practices been and how do you measure their success?
2. What are the major *environmental* outcomes of your company's environmental

initiatives? 3. What are the major *economic* outcomes (i.e. positive and negative outcomes) of your company environmental initiatives?

Source: Walton *et al.*, (1998) and Carter and Dresner (2001), and some questions were newly added to fit with the objectives of this research

6.3 Analysis of the case studies findings

The empirical findings from the case studies are reported in several sections. Section 6.3.1 highlights the findings regarding the main drivers/pressures the case companies perceived for adopting environmental practices. Section 6.3.2 examines the type of environmental practices adopted. Performance implications of adopting GOM practices are discussed in Section 6.3.3. Section 6.3.4 highlights the role of CFC. Concluding remarks about the overall findings are summarized in Section 6.4.

The observations regarding the environmental drivers/pressures, practices adopted and performance implications of the environmental management from the case studies are reported in Table 6.2, 6.3 and 6.4 respectively. This has enabled the researcher to identify the most dominant pressures, practices and performance of the environmental management and to compare observations across cases. Examples of specific pressures, practices and performance for each case company are also provided. In general, the analysis of the case studies shows that most of the items identified from the literature to develop the conceptual framework were observed in the case companies. New items have also been observed which are highlighted in the following sections. The results provide general support for the findings of the quantitative data analysis reported in Chapter 5, revealing that in general stakeholder pressures are related to the adoption of environmental practices and that the adoption of these practices influence the environmental and economic performance of the firm. It also reveals that CFC is considered as an important enabler in the process of transferring the environmental concerns of various groups of stakeholders into action. This confirms the mediating effect of the CFC on the relationship between stakeholder pressures and the adoption of GOMpractices as suggested by the results of the survey analysis.

6.3.1 Perceived drivers of adopting GOM practices

Firms are facing increasing environmental pressures from different sources (Delmas and Toffel, 2008), which encourage and sometime force them to adopt various environmental practices in order to improve their environmental capabilities (Sarkis *et al.,* 2010). Among these forces are stakeholder pressures, which are subdivided in the current research into market and non-market pressures (Baron, 2000). Several market and non-market stakeholder pressures were reported by the case companies, which show the variety of *perceived* pressures/drivers across the five case companies. For example, Table 6.2 shows that PaintCo has perceived the highest pressures to be from market stakeholders, while OilCo perceived the highest pressures to be from non-market stakeholders. Shareholders and customers pressures were perceived as the most important source of market pressure on firms to reduce their environmental impacts. This is particularly true for AluminiumCo, PowerCo and PaintCo. The willingness to use environmental management as a way to reduce the cost of production was also highlighted by all case companies, but it was of a particular importance for PlasticCo. Only PowerCo, has recognised the influence of suppliers on their environmental initiatives. On the other hand, the government environmental agencies were considered the most important source of non-market stakeholder pressure followed by the requirements of the local community by all case companies. The role of NGOs in influencing the enterprise environmental activities was only reported by OilCo. Market and non-market pressures not highlighted by the case companies but identified in the literature were pressure from the media (Stevens *et al*., 2005).

The results of Table 6.2 reveal that in general both market and non-market stakeholders were perceived as drivers for the adoption of environmental practices by all of the case companies but the influence of non-market stakeholders was perceived to be stronger than pressure of market stakeholders for most of the companies. This is clear from the frequency in which participants have highly rated pressures of different stakeholders. For example, while shareholders pressure were rated in the top of the perceived drivers for AluminiumCo and

PowerCo, the influence of the non-market stakeholder such as the local and international legislative requirements was perceived to be stronger for OilCo, PlasticCo and PaintCo.

In the interviews, most of the companies highlighted the managerial support they receive from the local government, but all of them have also emphasised the monitoring role by government agencies of the environmental activities of their firms: "*we have to meet the environmental standards specified by the government in order to receive an environmental permit to operate within the Sultanate*"… "*you know, ministry inspectors are always visiting our facilities to ensure that we meet the new environmental standards*", according to the representative of PlasticCo. In order to enhance their reputation and to gain maximum support from the government agencies, OilCo, AuminiumCo and PaintCo have established a cooperative relationship with the government agencies by conducting regular knowledge sharing sessions and establishing joint environmental projects that can help in resolving several environmental challenges facing the Omani manufacturing sector in general. This indicates that the government is using both the monitoring as well as the collaborative approach of greening the environmental activities of the manufacturing firms.

Table 6.2: Perceived drivers/pressures of environmental management for case companies *

OilCo	AluminiumCo	PlasticCo	PowerCo	PaintCo
-Compliance with the local and international legislative requirements -Shareholders -Commitment to local community -Cost reduction -Employees -NGOs (e.g., Environment Society of Oman)	-Shareholders -Customers -Local government (to obtain the environmental permit) -Commitment to local community -Employees -Competitors environmental activities -Cost reduction	-Local Government -Shareholders -Cost reduction -Local community -Willingness to enhance the green image of its products	-Shareholders -Customers, especially the European and American customers -International regulations -Suppliers -Government (to obtain the environmental permit) -Commitment to local community -Employees	-International regulations (EU regulations in particular) -Customers -Mother company environmental standards -Investors/Shareholders -Willingness to enhance international reputation and image -Commitment to local community -Competitors environmental activities -Improve efficiency -Cost reduction

*Drivers/pressures are ranked in decreasing order of influencing the environmental investment of the company

6.3.2 Adoption of GOM practices

Respect for the environment is a core value at all case companies. All case companies have adopted various environmental practices that go beyond the local regulatory requirements. Their environmental programs encompass different activities from sourcing raw materials to the usage of the final product. Some companies have even incorporated reverse logistics as part of their environmental programs (e.g. PowerCo and PaintCo) in order to improve their environmental capabilities and ensure minimum harm is caused by their operations. The adoption of various environmental practices and the *actual drivers* for adopting these practices are discussed in detail. The actual drivers were mainly assessed using the participants' comments and some official documents provided by the case companies as evidence for the environmental practices they adopt. That is, during the interviews the interviewer had requested the participants to provide some supporting documents, whenever possible, for most of the environmental practices adopted by their companies. Some case companies were more open to share their experience in environmental management compared to others, and thus the amount of detail provided for each case company in the following sections varies depending on the amount of data obtained for each case company.

The results in Table 6.3 show that all case companies used various internal and external types of environmental practices. This reveals that companies tend to consider collective, rather than a single, type of environmental practice when responding to environmental pressures from various forces. The role of EMSs in improving the environmental capabilities of the firm has been acknowledged by all case companies. The environmental activities related to EMSs ranged from reactive activities such as installing pollution control equipment for monitoring the level of air and water emission to more proactive activities such as providing training to employees on various environmental management areas and adopting advanced techniques of inventory management to avoid obsolete inventory. While all case companies have adopted some sort of formal EMS, not all companies have attempted to certify their environmental programs. The main driver for certifying the environmental programs at PowerCo and PaintCo were customer requirements, especially from industrial customers. In this regard, one of PowerCo representatives has clearly stated that *"obtaining ISO14001 has become a must for most of our European customers"*. The increasing customer environmental requirements were also seen as the main reason for the plan of AluminiumCo to certify their EMS in the near future. OilCo and PlasticCo believe that obtaining ISO14001 can help them to have a more systematic way of managing and dealing with various environmental challenges and to establish good relations with the local government agencies, which were considered as the main reasons for certifying their environmental programs. All certified case companies emphasised that ISO14001 encouraged their firms to be more active in terms of environmental management and to have continuous improvement inareas related to pollution reduction.

Table 6.3: Examples of operational environmental practices adopted by the case companies

Case	Environmental practices/projects adopted
OilCo	-Established an integrated impact assessment system to ensure highest levels of environmental performance are achieved -Internal water and air emission treatment -Upgrading most of the production facilities to reduce emission and improve the level of efficiency -Recycling and re-using most of the production waste -Monitoring the environmental performance of most of its suppliers -Established collaborative relationships with the key suppliers (e.g., joint training and knowledge sharing sessions) -Encouraging innovative solutions from the employees -Establishing collaborative relationships with the local and international research centers to find new innovative approaches for greening its operations
AluminiumCo	-Controlling the dross and recycling the entire material back to the production (one of the few smelters worldwide attempted this initiative due to its complexity) -Internal recycling of purge products (a mix of both, carbon, cast iron and aluminium) -Designing the product and production process in a way that enable easy segregation of hazardous waste with the aim of reducing the waste quantity (e.g., source segregation through colour coding) -Recycling all plastic bags and plastic containers -Optimising printing with the objective of reducing environmental impact and costs -Establishing joint communication sessions and workshops every six months with key suppliers to achieve zero harm to the environment -Requesting all suppliers to provide materials that meet the local and international environmental standards -For non-recyclable waste, it has invested heavily to improve its storage facilities
PaintCo	-Replacing the solvent-based paints with a water-based paints that resulted in low toxicity and volatile organic compounds -In the process of producing 100% free hazardous products by 2014 -Internal recycling and reuse of production wastes -Established smart packaging solutions (i.e. offering different size of products based on customers’ requirements) -Working together with suppliers to find more environmentally responsible materials -The suppliers of the main materials must be an ISO14001 certified company -Company green concepts illustrated in its policy and incorporated within all new products -Recently redesigned paints mixing process to eliminate environmental impacts and wastes -Reusing the industrial solvents -Packaging materials are 100% reusable/recyclable (e.g. carton and metal cans)

PowerCo	-Redesigned the production process to ensure that most of the production waste (e.g. water and plastic) is recycled internally -Main suppliers must be ISO14001 certified companies, and for others a detailed environmental performance must be provided to be selected as a supplier -Replaced the diesel operated forklifts to battery operated forklifts -Conducting regular training sessions with customers (i.e. industrial customers) on the best environmental practices on how to handle the purchased products and how to dispose the product at the end of its life cycle -Establishing cooperative relationships with suppliers to find more environmentally friendly alternative materials/components for the current hazardous materials
PlasticCo	-Designed most of its products in a way that reduce the need for packaging (e.g., adding more flexible and durable materials) -Continuous maintenance and upgrade, when needed, of the production facilities and equipment -Reducing the amount imported materials with local materials, which tend to have higher environmental standards but some time are bit expensive compared to the imported materials -Implementing JIT principles to avoid obsolete inventory -Continuous training of employees, internally, on various environmental areas -Producing products that can be recycled with minimum treatment efforts (>90% of its products are recyclable) -Recycling and re-use of wasted water internally -Requesting suppliers to provide environmental details about the materials purchased and provide customers with written details about the environmental considerations of the products provided -Recently redesigned part of its production processes to ensure minimum impacts on the environment -Using capacitor banks to reduce energy losses

Furthermore, it was noticed that all case companies have adopted environmental activities related to source-reduction and eco-design. Most of the source-reduction practices were related to the elimination of the harmful materials from their final products and the use of proper waste management systems. In particular, the case companies have given considerable attention to EMSs and opportunities for recycling most of the production waste either internally or externally. On the other hand, the eco-design initiatives focus on re-designing part or all of the company products and/or the production processes in a way that enable minimum emissions.

For example, over the past five years, PaintCo has increased its focus on waste management activities to ensure proper separation of hazardous and non-hazardous waste throughout the entire PLC. The growing interest of investors, the opportunities for cost reduction, willingness to enhance the green image of the firm and its products and the growing legislative requirements were the main drivers for the adoption of these waste management practices at PaintCo. For PaintCo, the main production wastes consist of packaging such as plastics, paper and metal. The company's national return scheme has helped in reselling and recovering the cost of most of these materials. In terms of packaging, due to customers' requirements, PaintCo has introduced the idea of smart pack solutions, which offer the customer different sizes of the paint cans tailored to smaller maintenance jobs. This has helped to reduce the waste at the end of the product usage, reduce the warehousing cost, save customer and company money and improve the environmental performance throughout the entire supply chain. The main air emissions at PaintCo are linked to the production of solvent-based paints that include solvents and a small amount of dust. Over the past years, the company was able to achieve dramatic reductions in air emission by installing a very sophisticated filtering system and developing highly innovative water-based paints. Furthermore, water emissions from PaintCo are mainly related to the cleaning of production equipment. In 2012, the company was able to reduce the level of water emission by 16% compared to 2011 by establishing an internal water treatment center. This center helped PaintCo to recycle and reuse the wastewater internally whenever possible. The cost of energy is substantial at PaintCo. To improve its energy consumption the company has substituted electricity with natural gas in most of its production facilities, which helped to reduce the level of carbon dioxide (CO_2) by 75 %. The company aims to reduce the consumption of electricity by 3% annually. All of these environmental programs have helped to improve the green image of the company and increase the satisfaction of its shareholders.

At AluminiumCo, enhancing the company's green image in the local and international markets and potential for reducing the cost of production have encouraged the company to increase its environmental expenditures by 13.3% in 2011($4.5 million) compared to 2010 ($3.9million). This has enabled the firm to exceed the local and international environmental standards imposed on the Aluminium industry. To achieve its environmental goals, controls have been put in place to eliminate whenever possible or reduce the negative impacts of the products and/or production processes. For example, the main contributor to greenhouse gases (e.g. CO_2) at AluminiumCo is the power generation and consumption in the power plant and the reduction cells. In 2010, the company installed state of the art emission control equipment and technologies, which resulted in a decrease of CO_2 emissions by 18% by the end of 2011. These technologies include replacement of the traditional methods used for CO_2 emission reduction in the aluminium industry (i.e. low sulphur coke) with a more efficient and cost effective technology called 'seawater scrubbing'. Seawater is sprayed on electrolysis fumes, which transformsSO_2 into sulphates. The company has also used special tanker trucks and a dedicated road to deliver raw materials and hot metals from/to the AluminiumCo smelter site. These transportation modes enable the firm to improve the level of efficiency, reduce the level of noise and air emissions, reduce the cost of fuel consumption and reduce environmental accidents. The majority of water usage at AluminiumCo is for cooling in the power plant and casthouse. In 2010, the company achieved 100% internal treatment of the sewage water and re-used the water for irrigation. In fact, like for the other case companies, waste management represents an important element in AluminiumCo's environmental policy. Because the production of aluminium results in a variety of liquid and solid waste, the company developed appropriate procedures to identify and separate hazardous from non-hazardous waste. In 2011, the company was able to reduce the amount of waste generated from its operations by 38% compared to 2010.

Waste management is also one of the fundamental practices in PowerCo's environmental program. The company gives considerable attention to energy control and consumption of natural resources (e.g., water and other raw materials). In 2009, PowerCo decided to replace the diesel-operated forklifts by battery-operated forklifts and redesigned most of the production process to ensure that waste was recycled internally. This was encouraged by shareholders' interest to use the green initiatives as a way to enhance the level of efficiency and reduce the total cost of production. Because of these changes, the company is now able to recycle more than 60% of its production waste and recover some of the cost of these waste materials. Furthermore, the growing pressure from customers, especially the European and American customers, was the main driver for PowerCo management to increase its attention to R&D and to establish cooperative relationships with research centers to design products with minimum levels of harmful materials/components.

The growing production cost and the firm's willingness to improve the level of resource usage were the ultimate drivers for OilCo to start eco-design and source-reduction initiatives. The Reed Beds Farm project is an example of how the cost pressure for maintaining the old facilities and oil fields drive the environmental initiatives. As the oil fields reach the maturity stage, the increasing salty and highly contaminated water production resulting from the oil extraction process is one of the common challenges in the oil production industry. Traditionally, most of the oil producers tend to treat and/or dispose the wastewater by re-injecting it into the ground using high-pressure injection, which is a very expensive and energy intensive technique. OilCo's continued research has shown that the Reed Beds tend to naturally absorb oil and other contaminations, and thus are capable of cost effectively handling the waste water contaminations. OilCo established one of the largest reed plants in the world. The project has offered many opportunities for re-using water, reducing the deep-water disposal costs and the associated energy and resource consumption. Like other case companies, OilCo has also given considerable attention to recycling practices. Most of the solid wastes at OilCo (e.g. steel, wood, plastic and paper) are sold to local contractors for recycling, which helps the firm to recover the cost of most of the materials. Due to the aging problem of some of its oilfield, OilCo is facing the challenge of the growing cost for controlling air emissions from these fields. To deal with this problem, the company has to go through continuous maintenance routines, which can provide a short-term solution for this problem and tends to be cheaper than the long-term solutions. This implies that regulatory environmental standards encouraged OilCo to implement short-term pollution control, rather than pollution prevention practices. However, the shareholders /investors' willingness to reduce the cost of production was the main driver for the company to establish long-term environmental initiatives such as the Reed Beds Farm project and other waste recycling activities.

PlasticCo is also implementing various operational environmental activities such as designing products in a way that reduce the need for packaging and that can make it recyclable with minimum treatment efforts by using more environmentally friendly raw materials. PlasticCo is also adopting various waste management activities that enable the company to meet the environmental standards imposed by the local government and recover some of the cost of the waste materials. For example, the company is using capacitor banks to reduce energy losses. To achieve further reduction in liquid waste, the company is implementing JIT principles to avoid any obsolete inventory. Recently, the company decided to stop its production for one of its main products and make major changes in the raw materials used. This was largely due to the requirement from the local government, prompted because one of the main materials used to produce this product was found to be harmful for the environment and for the quality of human life. Accordingly, the company is currently making major changes into the materials and design of this product.

When considering external environmental practices, it was noticed during the interviews that all case companies have adopted some sort of monitoring approach for greening the activities of the supply chain members (i.e. customer and/or suppliers). For example, all participants mentioned that they tend to provide customers with detailed environmental information related to the product and provide suppliers with written environmental requirements for the materials/components they purchase. At PaintCo, obtaining ISO 14001 is considered an essential criterion for supplier selection. OilCo, PaintCo, AluminiumCo and PowerCo have also realized the critical value of establishing a collaborative relationship with suppliers to improve their environmental capability. These four companies tend to work closely with their key suppliers to resolve any emerging environmental related problems, especially issues related to the substitution of the harmful materials, components or equipment with more environmentally friendly ones. These collaborative relationships were mainly established with the key suppliers in order to ensure that the final products meet the customers' environmental requirements and that minimum harm is caused by the company products and/or production process on the environment. Only PowerCo, has maintained that they are ready to invest in training their customers on the best practices to handle and dispose the purchased products at the end of the life-cycle. This implies that the case companies perceive greater value of working with suppliers than with customers. This also indicates that manufacturing firms tend to use both monitoring and collaborative approaches for greening the activities of the supply chain members and that they tend establish more collaborative relationships with the key suppliers rather than their customers (Vachon and Klassen, 2006; Vachon, 2007). It also shows that customer environmental requirements and the firm's willingness to reduce the environmental risks associated with the activities of their supply chain members were the main reasons for establishing the collaborative relationships with the supply chain members.

The above discussion reveals that, in general, the case companies tend to consider collective, rather than a single, type of environmental practice when responding to environmental pressures of various forces. This supports the complementarity of environmental practices, which was also supported by the findings of the quantitative data analysis. Omani companies pay more attention to the adoption of EMSs, opportunities for recycling and re-using the production wastes and on monitoring environmental activities of their supply chain members. Furthermore, the analysis shows that although different forces encouraged the case companies to develop various environmental initiatives, in reality the influence of the market drivers (e.g. shareholders/investors, customers and cost pressure) appears to be stronger than the influence of the non-market drivers. For example, customer requirements drove PaintCo to introduce the water-based paints and to launch the smart pack solution. Also, investors'/shareholders' interest to reduce the total cost of production encouraged PaintCo and other case companies to start most of the recycling and re-using practices. For PaintCo, customer requirements were the main reason for obtaining ISO14001 certification, as was the case for PowerCo. Also, the customer environmental preferences in different countries were the main reason for most of the environmental solutions offered by PowerCo. Furthermore, it was the firm's willingness to improve the level of efficiency and reduce the total cost of production that encouraged AluminiumCo to use special tanker trucks and a dedicated road to deliver raw materials and hot metals from/to the AluminiumCo smelter site and to start most of its waste management activities. It was the company's willingness to reduce the total cost of production and enhance the value of shareholders that drove OilCo to establish the Reed Beds Farms project. However, when reviewing the environmental documents that were provided by the case companies, it was noticed that the majority of the environmental activities adopted to meet the legislative and local community requirements were mainly related to the adoption of pollution control activities. These activities enable the companies to meet the minimum environmental standards in their respective industries, which in turn facilitated the process of obtaining an environmental permit from OMECA to operate within the Sultanate.

The analysis of the actual drivers that encouraged the case companies to develop green projects shows that companies tend to respond to non-market drivers by implementing basic and short-term pollution control practices. However, the actual driver for the development of the long-term pollution prevention activities was the pressure from different market forces, especially the customer and shareholder requirements. This was evident in most of the cases when participants were asked about the actual drivers for implementing each of the environmental practices and from the documents they provided. This provides support for the findings of the quantitative data analysis (Section 5.6) revealing that the perceived pressures for environmental management might not be the same as the actual pressures that drive the development of GOM practices, and that the pressure of the market forces is stronger than that of the non-market forces.

6.3.3 Performance implications of adopting GOM practices

Although different environmental and economic indicators were used at different companies to assess their performance, all participants have maintained that: 1) growing investment in environmental management results in improved environmental performance, 2) the long-term positive economic impacts of environmental management is greater than its short-term benefits, 3) the improvement of the efficiency and reduction in the cost of production are the main outcome of environmental management, and 4) the negative economic impacts of environmental management are mainly related to short-term, unavoidable operational expenses.

Participants from all case companies have strongly recognized the positive influence of GOM practices on the environmental performance of their firm. However, from the interviews it was noticed that all case companies are using both the local and international environmental standards (i.e. European standards in particular) as indicators for their environmental performance. This shows the growing influence of international environmental regulations on individual firms operating in Oman. Another possible reason may be that all case companies are well-established in terms of environmental management, and that they are among the leading companies in Oman in terms of the environmental performance. Exceeding the local requirements and matching the highly strict international standards might help them to further enhance their reputations in the local and international markets.

Moving to the economic implications of adopting GOM practices, it has been noticed that the positive and negative economic implications of environmental management vary among the case companies. For example, some of the companies (OilCo and PlasticCo) are looking at environmental management as a challenge that has to be dealt with more than as a chance for new market opportunities. In Table 6.4, the negative economic implications of environmental management highlighted by the case companies include: an increase in the cost of training, an increase in the cost of purchasing more environmentally friendly materials and an increase in the cost of maintaining and upgrading the old production facilities. The growing expenses for maintaining old facilities were observed mainly in OilCo and PlasticCo. The management of OilCo has only recently realised the potential economic advantages of environmental management after launching the reed beds project. This resulted in an increase in the volume of oil and gas production and reduced the costs of re-injecting waste water from the oil extraction processes. These positive economic implications of environmental management have encouraged the company to increase its investment in environmental management over the last two years. For PlasticCo, the positive impacts of environmental management were mainly related to the enhancement of the firm's reputation and the reduction in production cost. For PowerCo, AluminiumCo, and PlasticCo designing products with higher environmental standards has improved their reputation, enhanced the quality of their products, increased customer satisfaction and created opportunities to enter new markets. PaintCo also realised the same advantages.

When considering the potential influences of environmental management on increasing the sales of the company products, it was observed that this influence differs depending on the type of products offered by the company and the market in which it operates. For example, PowerCo, PaintCo and AluminiumCo representatives explained how the increasing environmental requirements in different counties are likely to increase the demand for the green solutions their company offer. However, OilCo highlighted how the nature of supply and demand in the oil and gas industry reveals that increasing environmental initiatives are unlikely to influence the demand for its products. Furthermore, PlasticCo emphasised that because of the green nature of most of the materials used in the production, its strong brand in the region, and the already growing demand, any extra environmental investment is unlikely to further increase the demand. These results revealed that when using sales increase as an indicator to measure the positive economic outcomes of GOM practices, organisational contingencies such as industry characteristics should be considered.

Table 6.4: Performance implications of environmental management programs

	PaintCo	AluminiumCo	PowerCo	OilCo	PlasticCo
Environmental performance implications of overall EM strategies	Exceeded thelocal*and international** standards of air, water and noise emissions Reducing the environmental risks	-Exceeded the local*and international standards of air, water and noise emissions -One of the best performers in terms of CO2 emission in Oman* -Dramatic reduction in hazardous materials	-Exceeded the local and international standards of air, water and noise emissions -First Omani company to be awarded as a best environmental performer from the Omani Ministry of Environment (2006) -Huge reduction of environmental incidents (violations)	-Exceeded the local standards of air, water and noise emissions. -Awarded as a best Industrial Water Project of the Year (Global Water Awards, 2011)	Exceeded the local standards of air, water and noise emissions.
Positive economic performance implications of overall EM strategies	-Enhancing market competitiveness and image -Enhancing long-term financial performance -Improving the quality of the product -Improving efficiency -Reducing cost of water and energy consumptions -Reducing the cost of production, especially with products that use titanium dioxide in their production (in 2012 the company started to produce products with lower amount of	-Improving efficiency -Recovering cost of recycled materials (reduce cost of production) -Improved quality of the product -Enhancing the local and international reputation of the company -Gaining more chances to enter new markets	-Improving firm reputation, image and gain more market shares -Improved overall quality of the product -Improving environmental performance has improved the long-term economic performance of the company especially in increasing the company share price, reducing the costs of environmental penalties and gaining more opportunities to enter new markets -Improvement in the resource usage by 45% from 2008-2012	-Improving firm reputation -Reducing overall production cost -Increased the volume of oil & gas production -Improving resource usage (assessed by the company internal integrated impact assessment report)	-Improved quality of the product -Enhancing the image of the company -Reducing cost of resource usage (e.g., water, plastic and electricity)

	titanium dioxide which tends to be very expensive and use a large amount of energy) -Increasing the overall product value for the customer (i.e. the water-based products introduced by the company helped to reduce the cost of maintenance and fuel usage especially for the ship builders customers)				
Negative economic performance implications of overall EM strategies	-Increasing cost of purchasing environmentally friendly materials (not for all materials) -Increasing training costs -Increasing R & D expenses	-Increasing training costs -Increasing the cost of overall environmental investments	-Increasing training costs -Increasing cost of overall environmental investments -Increasing cost of purchasing more environmentally responsible materials	-Increasing cost of overall environmental investment -Increasing cost of maintain the production facilities	-Increasing cost of overall environmental investment -Increasing cost of maintaining the production facilities -Increasing training costs

*This variable was assessed using secondary data (environmental performance reports) from the Omani Ministry of Environment & Climate Affairs.

**This variable was assessed using the internal impact assessment reports of the case companies, where a column was added to benchmark the international standards recommended by their international affiliations, shareholders and customers.

All interviewees reported that the improvement in environmental performance resulting from the adoption of emission control practices have enabled their firm to obtain an environmental permit to operate within the Sultanate, reduced the cost of non-compliance liabilities, reduced the economic risks of shutting down part or all of their facilities, reduced the cost of waste disposal and reduced the total cost of production. The positive influences of environmental performance on the economic performance of the firm were observed more with companies that focused on source-reduction and eco-design practices. For example, for PaintCo, introducing new innovative green practices such as replacing the solvent-based products with water-based products resulted in reducing the amount of titanium dioxide in the production, which is usually very expensive and consumes a large amount of energy in the production. By eliminating titanium dioxide in the production, PaintCo was able to reduce the emissions, save money and other production resources. Furthermore, introducing the idea of the smart pack solution enabled PaintCo to improve its environmental performance, reduce emissions, reduce production waste and reduce energy usage in the production of large cans of paint while improving the level of efficiency and increasing production volumes. In addition, for OilCo, establishing the reed beds project has enabled the firm to reduce the amount of emission and wasted resources generated from the re-injection process of the contaminated water into the ground, which in turn allowed the firm to increase the amount of oil and gas production and reduce the total cost of production. For PowerCo the improvement in environmental performance and the announcement of new environmental initiatives helped to increase the share price of the company and enhanced the value to the shareholders. This implies that continuous improvement in environmental performance enabled these companies to gain more economic advantages. However, the analysis of the empirical case studies showed that the main implications of GOM practices and the improvement in environmental performance were in the reduction of total production costs, enhancement in the level of efficiency and improvement in the overall quality of the product. The last two operational performance indicators were not considered in the survey designed for this research but were highlighted in the literature (e.g. Melnyk *et al*., 2003; Wagner 2011; Zhang *et al.,* 2012). This shows that, in addition to the economic performance indicators, firms are increasingly considering the operational performance (e.g. quality, productivity, efficiency, lead-time, and flexibility) as important indicators for the positive outcomes of GOM practices. This may offer opportunities for future research to investigate the impacts of adopting GOM practices on different elements of the operational performance of the firm.

6.3.4 Role of cross-functional collaboration

Another issue this research is investigating is whether environmental management is company-wide and whether firms use CFC as a facilitator in the process of adopting various environmental practices. As reported in Table 6.5, all case companies have mentioned that environmental management is not the responsibility of a specific department, but that all or most of the internal departments have a responsibility to help the firm achieve its environmental objectives. It shows that in all cases a multi-functional team, composed of at least two senior managers, is assigned to deal with environmental concerns. When asked about the main reason for developing CFC, representatives of the case companies indicated different drivers/advantages but all of them have realized that CFC is an effective and efficient way to deal with various environmental challenges. The dominant drivers for developing and using CFC across the case companies are presented in Table 6.5 and include:

- Ensure continuous sustainable development
- Effectively dealing with and responding to growing stakeholders' requirements
- Enhance the effectiveness of the environmental initiatives
- Enhance the efficiency of resources allocated for the environmental management
- Ensure mutual understanding of responsibilities regarding the environmental challenges and performance

During the interviews, it was noticed that the amount of resources and commitment allocated for the development of environmentally oriented CFC vary among the case companies. CFC was of critical importance for companies that have a strong dependency on the international markets. For example, AluminiumCO and PowerCo have observed the highest advantages from the development of CFC, while PlasticCo has observed the lowest. For AlumiumCo, CFC is an enabler to better respond to global environmental challenges and opportunities and to contribute to excellence in trade records. For PlasticCo, CFC is only used as a way to reduce the resources and efforts needed to respond to different environmental problems. Moreover, it was also observed that firms vary in terms of forms (e.g. cross-functional team, cross-departmental communication and information sharing, integrating the environmental management issues within the strategic agenda of other core functions within the firm) to which CFC is applied, which is more likely influence the benefits obtained from the development of CFC.

The data provided in Table 6.5 suggest that PowerCo, PaintCo and AlumimiumCo are likely to be more active in the development of CFC mainly because of the international expansion of their operations. These companies have clearly expressed their willingness to increase their investment to further develop CFC within their firms. For example, a representative from AluminiumCo indicated that, *"we intend to spend more efforts during the coming year to improve the role of internal communication and joint problem solving"* to help the firm achieve its current and future environmental objectives. Also, PowerCo and PaintCo have observed different environmental standards and requirements in different countries and they consider these differences as a chance to promote their green products and to enter new markets. For these companies there is a need to continuously predict and effectively respond to the growing environmental requirements of customers and other stakeholders in different countries to enhance the company reputation and gain new opportunities to enter new markets. This might encourage them to direct great attention to the expected value of developing internal CFC. A participant from PowerCo explained how the changes in environmental preferences of international customers encourage the firm to work as a whole unit to effectively respond to these demands, commenting "*we cannot* *survive in the international markets without effective communication and collaboration”*.

OilCo has also shown a great level of interest in the development of CFC. The growing importance of CFC at OilCo is mainly due to the huge diversity and complexity of the company operations. Representatives of OilCo have argued that oil and gas companies are striving to improve their environmental performance to reduce environmental risks and violations. However, lack of effective communication and collaboration still occurs resulting in an increase in costs of environmental accidents. Like other oil and gas production companies, oil and gas exploration at OilCo involves several project teams and departments and some of these teams/departments are based onshore while others are based offshore. OilCo is also dealing with more than 200 suppliers (local and international suppliers) to supply a variety of equipment and services needed at different oil fields. Dealing with diverse operations and various functional teams with different levels of understanding about environmental issues and in multiple locations are considered as among the main challenges that OilCo is facing. The company is increasing its efforts to develop CFC in order to reduce the economic impact of any environmental risks and enhance the effectiveness and efficiency of resources allocated for the development of various green initiatives. In particular, OilCo is giving considerable attention to developing environmentally oriented cross-functional skills of the team and department leaders. This implies that the main driver for OilCo to develop CFC is the opportunity to reduce the economic risks associated with environmental violations of its huge and diverse operations.

In addition, during the interviews it was observed that firms vary in terms of forms (e.g. cross-functional team, cross-departmental communication and information sharing, integrating the environmental management issues within the strategic agenda of other core functions within the firm) to which CFC is applied. For example, the data in Table 6.5 shows that PaintCo, PowerCo and OilCo have reported the highest number of CFC forms, while PlasticCo has reported the lowest forms. However, the most dominant forms of implementing CFC for environmental management are those related to the establishment of cross-functional team and the integration of environmental issues within the strategic agenda of other core functional areas, highlighting the importance of these two forms for effective implementation of CFC. This might have been encouraged by the availability of ISO 14001 in these firms, as it was found that such certificate normally encourages the establishment of these CFC forms (Melnyke *et al.,* 2003; Sorufe, 2003). The variations in forms of implementing CFC show the amount of resources and commitment allocated to the development of this capability across the five case companies, which is likely to influence the benefits obtained from CFC. The main common feature between firms that reported the highest number of CFC forms is that they are all highly internationalised and their operations involves high degree of complexity. This may show the importance of considering firm contingencies when studying the impact of GOM practices on performance.

The above results show that all case companies consider CFC as an important enabler for the effective adoption of GOM practices that can better meet the requirements of various environmental drivers. However, the results suggest that highly internationalised firms and firms with diverse and complex operations are expected to be more active in the development of CFC, and thus are more likely to benefit from the development of this capability.

A number of significant concerns with regards to how CFC for environmental management can be enhanced were highlighted by the participants. These include the issue of the reward system (Zhu *et al*., 2008a) within the firm for encouraging employees of different departments to be more active and innovative in establishing environmentally oriented collaborative relationships with each other, which was highlighted by a representative from AluminiumCo. At the same time, one issue that was also raised by the representatives of OilCo concerns the role of the leadership characteristics (Clark, 1992) and management support and commitment (Wu *et al*., 2012) in enhancing the role of CFC for the effective adoption of GOM practices, something that PaintCo has already realised.

Table 6.5: Role of the cross-functional collaboration

Case	Is the EM a companywide? How is CFC implemented?	Main responsible person for handling the EM?	Why is environmentally oriented CFC important (i.e. advantages/drivers)?
PaintCo	Yes, all departments have the responsibility to help the firm achieve its environmental objectives and reduce environmental problems. -Promoting individual and collective commitment among employees to develop the best environmental practices within the company and industry is one of the main goals of the PaintCo, which is listed as one of its main environmental principles. -Cross-functional team was established to collectively resolve environmental challenges and achieve environmental goals -Integrating the environmental management issues within the strategic agenda of other core functions within the firm -Cross-departmental communication and information sharing through traditional and non-traditional ways of communication (e.g. phone and e-mail) -Conducting joint environmentally oriented planning and problem solving sessions and workshops	HSE manager, General Manager, Quality Manager and Production Manager	-Effective and efficient way of dealing with the environmental challenges -Ensure smooth achievement of the firm's daily environmental objectives -Ensure mutual understanding of responsibilities regarding environmental challenges and performance
AluminiumCo	Yes, all departments have the responsibility to help the firm achieve its environmental objectives and reduce environmental problems. -All departments have to submit an environmental achievement report (quarterly). It launched a quarterly internal report to show the environmental achievements of each department within the firm. All managers and employees are trained to effectively implement CFC. -Cross-functional team was established to collectively resolve environmental challenges and achieve environmental goals -Integrating the environmental management issues within the strategic agenda of other core functions within the firm -Cross-departmental communication and information sharing through traditional and non-traditional ways of communication (e.g. phone and e-mail)	HSE manager, Operations Manager and Procurement Manager and Laboratory Manager	-To ensure continuous sustainable development -To better respond to global environmental challenges and opportunities -Contribute to firm excellent trade records -To reduce resource and efforts needed for achieving environmental objectives

PowerCo	Yes, all departments have the responsibility to help the firm achieve its environmental objectives and reduce environmental problems. -The company hired a specialised environmental engineer to ensure that the environmental management is companywide. -An internal environmental committee (managers of different departments) has been formed to collectively deal with and resolve the emerging environmental problems/challenges. -Cross-functional team/committee (managers of different departments) was established to collectively deal with and resolve the emerging environmental problems/challenges and achieve environmental goals -Integrating the environmental management issues within the strategic agenda of other core functions within the firm -Cross-departmental communication and information sharing through traditional and non-traditional ways of communication (e.g. phone and e-mail) -Conducting joint environmentally oriented planning and problem solving sessions and workshops	HSE manager, Quality Manager, Production Manager and Administration Manager	-Effective way to deal with the continuous expansion of company business, and the increasing stakeholders environmental requirements (especially the European and American customers). -Improve efficiency in resource usage to effectively achieve the firm environmental goads. -Ensure mutual understanding of responsibilities regarding the environmental challenges and performance - Improving the quality of environmentally oriented decision-making
OilCo	Yes, all departments have the responsibility to help the firm achieve its environmental objectives and reduce environmental problems. It believes that zero harm can only be achieved by engaging others and changing the behaviors of all employees. Also, it believes that the achievement of CFC will mainly depend on selecting the right leader for the team/department. -Cross-functional team was established to collectively resolve environmental challenges and achieve environmental goals -Integrating the environmental management issues within the strategic agenda of other core functions within the firm -Cross-departmental communication and information sharing through traditional and non-traditional ways of communication (e.g. phone and e-mil) -Conducting joint environmentally oriented planning and problem solving sessions and workshops	A multi-functional team managed as a single integrated process consists of HSE manger, project manager, manager of the geometrics department, legal affairs manager, contracts and procurement manager	-Enhance the effectiveness of the environmental initiatives -Improve the efficiency of resources allocated for environmental management, especially when considering the diversity and complexity of the company operations
PlasticCo	Yes, all departments have the responsibility to help the firm achieve its environmental objectives and reduce environmental problems. -Cross-functional team was established to collectively resolve environmental challenges and achieve environmental goals -Integrating the environmental management issues within the strategic agenda of other core functions within the firm	Maintenance and Environmental Management Manager and Assistant General Manager	-Reduce the resources and efforts needed to deal with emerging environmental problems

6.4 Conclusion

This chapter presented the findings of the empirical case study analysis which investigated the interrelationships between antecedents and consequences of GOM practices. The empirical findings were assessed in several sections. The first part of the analysis focused on examining the influence of market and non-market forces on the adoption of GOM practices as perceived by the participants. The analysis presented in Section 6.3.2 examined the type of environmental practices adopted by the case companies when responding to various environmental drivers. It also examined the actual drivers for adopting various GOM practices. The actual drivers were assessed using the participants' comments regarding their firms' decision to implement certain environmental activities and initiatives. It was also assessed by reviewing some official documents provided by the participants. The analysis in Section 6.3.3 dealt with evaluating the impacts of GOM practices on organisational environmental and economic performance. Finally, section 6.3.4 examined whether CFC is considered as an important facilitator in the process of translating the environmental concerns of various market and non-market forces into action.

CHAPTER 7 DISCUSSION

7.1 Introduction

This chapter summarises the analysis results in relation to research questions, objectives and hypotheses. It begins with an overview of the research objectives and model development (Section 7.2). Then, it discusses the findings of this research in relation to the existing literature regarding the conceptualisation of the environmental management model (Section 7.3.1), the main drivers of adopting GOM practices (Section 7.3.2), the consequences of GOM practices (Section7.3.3), the mediating effect of CFC (Section 7.3.4) and the moderating effect of firm characteristics on the relationship between CFC and GOM practices (Section 7.3.5).

7.2 Research objectives and model development

This study examined the antecedents and consequences of GOM practices within Omani manufacturing enterprises. An extensive review of the literature was conducted (in Chapter 2) to develop an integrated model that incorporated: 1) the collective conceptualisation of environmental practices, 2) the direct and indirect relationships between market and non-market stakeholder pressures, environmentally oriented CFC and GOM and 3) the direct and indirect relationships between GOM practices and organisational business benefits, spending and environmental performance.

In Chapter 2, using the stakeholder theory of the firm, stakeholder pressures were considered as the main drivers for the adoption of operational environmental practices (Sarkis *et al.*, 2010). Also, using the RBV of the firm, the environmental practices were expected to influence the environmental and economic performance. However, the literature did not provide a clear explanation on how different groups of stakeholders influence the adoption of operational environmental practices and how these practices influence the economic performance of the firm. This is partially due to the variations in conceptualising stakeholder pressures, environmental practices and enterprise performance and the way these factors interact with each other in previous studies. Because this research was conducted with the intention of understanding the influence of stakeholder pressures on environmental management initiatives and the implications of these practices on the performance of the firm from an operations management perspective, joint operational environmental management, strategic management and economic literature review might help to provide a better understanding of these issues.

After an extensive review of the literature in Chapter 2, Baron's (1995) conceptualisation of stakeholder groups (i.e. market and non-market) was viewed as the most relevant conceptualisation of stakeholders for this research. This was because Baron's (1995) classification was based on the extent to which the stakeholder creates value for the firm's operations (Baron, 1995; Cummings and Doha, 2000), which is closely related to the main principles of operations and supply chain management. Thus, stakeholders were conceptualised as two distinct groups: 1) market stakeholders and 2) non-market stakeholders. Both market and non-market stakeholder groups were expected to influence the adoption of GOM practices. Also, using the Complementarity Theory (Milgrom and Robert, 1995), the environmental practices were conceptualised as a 'collective', rather than as an individual, competency called 'collective GOM competency'. The collective competency was expected to have greater influence on the performance of the firm compared to these practices being used individually. Moreover, the dynamic capability aspects of RBV suggest that a firm will develop internal capabilities that allow it to allocate resources in a way that enables the firm to align itself with the external environment (Helfat and Peteraf, 2003). Using this rationale, it was believed that the influence of the stakeholder pressures on GOM practices is further mediated by the development of an environmentally oriented CFC. CFC was believed to be an important factor that can help the company to build the required environmental practices that better match the environmental requirements of various groups of stakeholders. Furthermore, based on the contingency perspective of the firm (Lawrence and Lorsch, 1967), the effectiveness of CFC in enabling the firm to build the required environmental practices was believed to vary depending on firm specific characteristics (e.g. pollution intensity, size and international orientation). These specific characteristics of the firm are expected to moderate the relationship between CFC and GOM practices. Finally, after evaluating the literature about the implications of GOM practices on organisational performance, it was realised that previous studies were not only interested in examining the influence of GOM on environmental performance and the positive aspects of the economic performance (e.g. market share and profit margin), but also on the negative aspects of the economic performance (e.g. increased expenses and cost of production). In order to incorporate both dimensions of the economic performance, it was found that economic performance should be conceptualised as two distinct constructs as suggested by Zhu and Sarkis (2004), rather than using a single construct (e.g. Gonzalez-Benito and Gonzalez-Benito, 2005) or multiple constructs to measure only the positive aspects of the economic performance (e.g. Menguc and Ozanne, 2005; Wagner, 2005; Molina-Azorin *et al*., 2009b). However, as discussed in section 3.2.4 (Chapter3), it was believed that GOM practices will have both direct and indirect (via the environmental performance) influences on the organisational business benefits and spending, instead of only direct influence as proposed by Zhu and Sarkis (2004). Environmental performance was believed to be a mediator between the adoption of GOM practices and organisational business benefits and spending.

Five research objectives were formulated:

1- To empirically test the superiority of the complementarity model of GOM practices in explaining the relationship between stakeholder pressures, GOM practices and performance of the firm, and to examine the influence of the collective adoption of GOM practices on improving organisational performance (P1).
2- To empirically examine the effects of two groups of stakeholders (market and non-market stakeholders) on the adoption of GOM practices by firms (H1a and H1b).
3- To empirically examine the direct effects of collective GOM practices on environmental performance (H2a), business benefits (H2b) and spending (H2c), and its indirect, mediated, effects on organisational business benefits (H3a) and spending (H3b) via environmental performance.

4- To empirically investigate the mediating effect of environmentally oriented cross-functional collaboration on the relationship between stakeholder pressures and the adoption of GOM practices (H4a and H4b).
5- To empirically investigate the moderating effects of three firm specific characteristics (pollution intensity, size and international orientation) on the relationship between CFC and the development of GOM practices (H5a, H5b and H5c).

The results of this research provide new theoretical and practical insights to the literature, which will be discussed in Section 8.2 of Chapter 8. The results of the data analysis are discussed in detail in the following section. Table 7.1 provides a summary of the final outcomes of the proposition and hypotheses tests.

Table 7.1: Summary of hypotheses tests

Related to Objective	**Proposition**	**Description**	**Result**
1	P1	The collective GOM competency has superior influence on performance than individual GOM competencies	Accepted
	Hypothesis	**Structural path**	**Result**
2	H1a	Market stakeholders→ GOM practices	Accepted
2	H1b	Non-Market stakeholders→ GOM practices	Accepted
3	H2a	GOM → Environmental performance	Accepted
3	H2b	GOM →Benefits	Accepted
3	H2c	GOM → Spending	Accepted
3	H3a	Environmental performance →Benefits	Accepted
3	H3b	Environmental performance →Spending	Not Accepted
4	H4a	Market stakeholders→CFC→GOM	Accepted
4	H4b	Non-Market stakeholders→CFC→GOM practices	Accepted
5	H5a	Moderation of size on: CFC → GOM practices	Not Accepted
5	H5b	Moderation of pollution intensity on: CFC → GOM practices	Not Accepted
5	H5c	Moderation of international orientation on: CFC → GOM practices	Accepted

7.3 Interpretation of the results

7.3.1 Conceptualisation of the GOM model

Identifying and managing environmental impacts throughout the entire supply chain has received increased attention in the operations management research (Zhu *et al.* 2012). Vachon and Klassen (2006& 2008), Vachon (2007), and others have attempted to identify the structure of environmental management in the supply chain by determining the implications of greening the activities of supply chain members on the performance of manufacturing firms. Furthermore, business environmental models that focus on examining the potential economic advantages of greening the internal operations of the firm have been studied in more detail (e.g.Min and Galle, 2001; Melnyk *et al*., 2003; Schoenherr and Srinivas, 2013). However, early studies did not reach consensus on how GOM activities influence the performance of the firm (Seuring and Muller, 2008; Zeng *et al.,* 2010a). This is partially because previous studies have used numerous types of environmental practices and have examined the influence of each of these practices on performance in isolation from each other, ignoring the interdependences that may exist between these practices (Zhu *et al*., 2008c &2012). Previous studies have treated various types of environmental practices as substitute, rather than complementary, to each other. Gaps continue to exist in our understanding of the possible influence of GOM practices on the performance of the firm. In order to have a cohesive understanding of the potential influence of GOM on the performance of the firm, this research attempted to conceptualise the environmental management practices as ‘a collective’, rather than ‘an individual’, competency. The collective view of environmental management was based on the complementary and simultaneous adoption of four sets of environmental practices: 1) EMSs, 2) Eco-design, 3) Source-reduction and 4) External environmental practices. This was done in order to provide an answer to the first research question:

RQ1-*Does the complementarity model of the adoption of GOM practices better explain the links between drivers, practices and performance of GOM compared to the individual adoption of GOM practices model and does the collective competency of various GOM practices have a greater impact on organizational performance compared to individual competencies?*

By integrating four distinct yet interrelated sets of environmental practices into a second order construct, this research found empirical evidence of the superiority of the second order construct (Proposition 1). These results were also supported by the findings of the empirical case study analysis, which showed that all case companies consider collective, rather than a single, type of environmental initiatives when responding to environmental pressures of market and non-market forces. Furthermore, in the interviews it was noticed that participants were emphasising the positive impact of their overall environmental programs, rather than the impact of a single activity. A recent study by Zhu *et al.* (2012) provided support for the finding of this study by showing the importance of coordinating various types of environmental practices in order to achieve good levels of environmental and economic performance. However, Zhu *et al*. (2012) emphasised the role of the sequential, rather than the collective, adoption of GOM practices.

The superiority of the collective GOM competency model indicates that the examination of the influence of environmental drivers on the environmental practices and the influence of the latter on the performance of firms may be better understood when various environmental management initiatives are considered in a single study and treated as a single construct. Also, it reveals that the benefits obtained from the simultaneous adoption of various environmental initiatives exceed the total value obtained from adopting each one of these practices separately, which supports the complementarity theory of an organization's activities and resources (Milgrom and Robert 1995). Moreover, the superiority of the collective GOM competency is somehow consistent with the coordination theory in the supply chain management research (Flynn *et al.,* 2010; Wong *et al.,* 2011), which posits that interdependencies exist among various organisation activities and should be handled properly (Matone and Crowston, 1994).These findings also provide support to Shah and Ward's (2003) arguments that, in the sense of the RBV, the individual resource and/or operational practice cannot be considered as a valuable capability. Instead, a bundle of resources and /or practices can be a source of competitive advantage, which is developed inside the company and cannot be easily copied by competitors.

7.3.2 Stakeholder pressures and GOM practices

Stakeholder pressures were considered as an important antecedent to the adoption of environmental practices. Stakeholders were classified into two distinct groups (i.e. market and non-market). This was done with the intention of providing an answer to the second research question:

RQ2- *To what extent do market stakeholder pressures influence the firm to adopt various GOM practices compared to non-market stakeholder pressures?*

The results of SEM found support for Hypothesis 1, revealing that in general stakeholder pressures positively relate to the adoption of GOM practices. The results show that both market and non-market stakeholder groups positively influence GOM practices, supporting H1a (strongly supported, $p<.01$) and H1b (marginally supported, $p<.1$). This would support previous findings (e.g. Kassinis and Vafeas, 2006; Rueda-Manzanares *et al.,* 2008; Sarkis *et al.,* 2010; Wagner, 2011) emphasising the importance of considering stakeholder pressures as one of the main drivers for the adoption of operational environmental practices. These results enhance the stakeholder theory which explains environmental behaviour as a response to stakeholder expectations, demands and preferences (Sharma and Henriques, 2005). The Resource-Dependence Theory (Pfeffer and Salancik, 1978) suggests that firms depend on other factors from their environment (e.g. its stakeholders), to obtain the resources needed for their operations and long-term survival. This theoretical rationale of the resource-dependence theory explains the positive interrelationship between stakeholder pressures and the firm's environmental proactiveness.

However, by classifying stakeholders into two distinct groups, this study found that the influence of market stakeholders is stronger than that of non-market stakeholders. This implies that not all stakeholders are equally important. The results suggest that firms will expand more effort and resources for the development of various environmental practices when they face more pressure from market stakeholder groups than from non-market stakeholder groups. Mitchell et *al.,* (1997) and Steven *et al.,* (2005) maintained that the conflict of interests in stakeholder demands encourage the firm to establish priorities among the demands of different stakeholder groups. Stakeholder priority in relation to enterprise environmental investments will depend on various factors, including their characteristics and the dependency associated with them (Kassinis and Vafeas, 2006).

The results of this study confirmed that firms will give priority to the demands of market stakeholders. These results are consistent, to some extent, with those reported by some previous operational environmental management studies. For example, Wagner (2011) found that, in general, environmental requirements of the internal shareholders and external supply chain members play a major role in the development of internally integrative environmental plans. Furthermore, according to Vachon and Klassen (2006), most of the environmental projects of the manufacturing firms that take a long-term perspective are associated with the customers and other supply chain environmental requirements. Porter and Van Der Linde (1995) also found that shareholders and environmentally sensitive customers are the main drivers for the adoption of pollution prevention initiatives. Usually the market stakeholders such as customers, suppliers and employees are considered as the main contributors to the firm's operations (Backer, 2007) and responding to their environmental demands is expected to provide the manufacturing firm with better market opportunities (Hillman and Keim,2001). However, pressures by non-market stakeholders are often considered as a threat (Backer, 2007; Sarkis *et al*., 2010). Firms will respond to their demands in order to avoid the risk of damaging their public image or their relationships with the market stakeholders. According to Hillman and Keim (2001), adopting environmental initiatives that do not directly meet the demands of primary stakeholder (e.g. customers and suppliers) is unlikely to add new value for the firm.Firms tend to adopt more advanced environmental practices when they perceive stakeholder pressures as a source of market opportunity or competitive advantage. Firms will expand minimum environmental effort if these pressures are perceived as threats (Sharma, 2000). These findings show the impact of classifying stakeholders based on the value-chain perspective.

By doing so, it provides insights into how firms prioritise environmental demands related to the need to provide more environmentally friendly products and production processes.

Although the results of this study have empirically supported the influence of the stakeholder pressures on GOM practices, it also found that theperception of managers about the source of the environmental pressure has indeed influenced their firms' environmental investment decisions. The results of the descriptive statistics (Table 5.4.1, Chapter 5, Section 5.4.1) showed that the major source of environmental pressure was from the non-market stakeholder groups (mean= 3.37) rather than from the market stakeholders (mean=3.15). The SEM results show, however, that in reality the main reason for adopting operational environmental practices was the pressure imposed by market stakeholders group. This implies that although companies might be receiving higher pressures from various groups of stakeholders, it is not necessarily so that firms will transform these pressures into action. Rather, managers' perception about the importance of the source of the pressure plays a significant role in determining their organisations' environmental decisions. That is, the perception about the potential advantages of adopting GOM practices that fit with the requirements of a certain group of stakeholders is a fundamental factor in influencing the strategic response of their firms to such environmental demands. These results are consistent with previous studies in the existing strategic management literature (e.g. Buysse and Verbeke, 2003; Delmas and Toffel, 2004; Garcés-Ayerbe *et al.,* 2012) suggesting that managers' perceptions play a major role in explaining organisational environmental behaviour. However, previous GOM studies did not provide a clear explanation into whether it is the stakeholder pressure or managers' perception that shapes the operational environmental choices and strategies. In this research, by integrating findings of previous environmental management and strategic management studies, it was confirmed that the main factor for establishing priorities between demands of stakeholder groups is the managers' perception of how important these stakeholder groups are for their firms' long-term survival.

These results are also supported by the findings from the case study interviews. For example, it was realised that most of the respondents agreed that the adoption of advance environmental practices by their firms would increase as the stakeholders' requests for more environmental friendly products and production processes increase. In fact, analysis showed that firms respond to market stakeholder requirements by establishing long-term pollution prevention initiatives and developing internal capabilities that enable them to better anticipate the future environmental demands of market stakeholders. However, the majority of the firms have achieved the minimum environmental requirements from the non-market stakeholders. The pressure from this segment encouraged firms to only adopt short-term pollution control solutions, which may partially explain the strong association between GOM practices with market stakeholder pressures.

This mismatch between pressures felt and actual pressures might explain the high association between GOM practices and spending. Firms are considering the environmental penalties as part of the normal business expenses and this will not lead them to stop their business. Ignoring and underestimating the environmental demands of non-market stakeholders may reduce the potential business benefits associated with the development of various green practices. These findings indicate that non-market stakeholder pressures in the form of penalties are less likely to encourage the adoption of green practices. This suggests that other forms of governmental environmental incentives and support (e.g. technical support) might be needed to encourage firms to implement GOM practices.

Based on the above findings, it can be concluded that whilst specific environmental projects initiated by the firms are driven from the requirements of non-markets stakeholders, more pressure from market stakeholders would lead to the adoption of greener practices. Furthermore, although the results of this study have empirically supported the influence of the stakeholder pressures on adopting GOM practices, it also found that this influence varies based on the source of the pressures and how do managers perceive these pressures.

7.3.3 Influence of the collective GOM competency on performance

Another objective of this research was to work toward a more detailed understanding of the possible direct and indirect influences of GOM practices on organisational business benefits and spending. This objective was encouraged by the mixed results in previous empirical studies (Zeng *et al.*, 2010a; Dixton-Fowler *et al*., 2013). It stemmed also from the argument in some recent studies emphasising the possibility that there is no direct relationship between environmental initiatives of enterprises and their economic performance. Rather, a third factor might cause these relationships, which needs to be further investigated (Wagner, 2011; Dixton-Fowler *et al*., 2013). In this research, environmental performance of the firm was proposed as a mediator for the relationship between GOM practices and organisational business benefits and spending. The relationship between GOM practices and organizational business benefits and spending were conceptualised to be directly and indirectly (via environmental performance) related to each other. This was done in order to provide an answer to the third research question:

RQ 3: *What are the direct and indirect relationships between GOM practices and environmental performance, business benefits and spending of the firm?*

The main reason for adopting GOM practices lies in their ability to improve environmental performance (Hart, 1995; Schoenherr and Srinivas, 2013). The results of this research show this association and reveal that the adoption of GOM practices would positively influence the environmental performance of the firm. This result is largely consistent with those reported by previous studies (e.g. Melnyk *et al*., 2003; Vachon and Klassen, 2008; Zhu *et al*., 2012). Furthermore, the direct effect tests (Table5.6.2) show that the adoption of GOM practices has significant and positive impacts on organisational business benefits and spending. However, the positive direct influence of GOM practices on organisational business benefits is stronger, which is also consistent with the results obtained by Zhu and Sarkis (2004). The results suggest that the increasing costs of GOM practices is a barrier to adopting more green practices (Wagner *et al.,* 2001), but it also shows that it pays to be green and that good economic advantages exist for manufacturing firms that adopt collective GOM practices.

The positive and negative economic implications of the collective adoption of various environmental practices were also realised from the case study analysis. Despite the superior impact of the collective GOM competency on performance of the firm as perceived by the case companies, the results revealed that few firms were able to exploit this capability when developing their environmental management plans. The majority of the manufacturing enterprises did not give enough attention to the idea of developing truly collective environmental management programs that consider the contribution of various environmental activities as equally important. For example, Omani companies are giving more attention to effective and efficient waste management, EMSs and monitoring the environmental activities of their supply chain members. The majority of the case companies have not considered developing environmentally oriented collaborative relationships with their customers, establishing a product life-cycle assessment or using more green sources of energy. This may partially explain the high association between GOM practices and organisational spending. In fact, these findings are also supported by the results of the descriptive statistics (Table 5.4.1), which show that Omani manufacturing firms did not achieve a good balance between the adoption of internal and external environmental practices. The results show that they have adopted internal environmental practices (i.e. EMSs, eco-design and source-reduction) on a greater scale (mean for EMS=4.01, for eco-design=3.69 and for source-reduction=3.47) compared to external environmental practices (mean =3.27). As a result, these firms were not able to grasp the full potential of their environmental management initiatives.

This research also aimed to investigate the indirect (mediated) effects of GOM practices on the organisational business benefits and spending via environmental performance. As hypothesised, the results of the indirect, mediation effects (Table 5.6.3) showed that higher environmental performance of environmental initiatives would lead to higher levels of organisational business benefits. The significant association of environmental performance and business benefits reflected this result. The level of environmental performance that a firm can achieve is an important condition to the level of business gains it can obtain. This finding is consistent to those obtained by previous studies suggesting a positive relationship between the environmental performance and organizational business benefits such as the ability to achieve cost competitiveness (Yang *et al.,* 2010& 2011) and greater reduction in material usage and energy consumption (Vachon and Klassen, 2008; Zhu *et al.,* 2013). However, in this research, a non-significant relationship was found between environmental performance and business benefits. This indicates that the collective GOM competency and spending are only directly related with each other. This implies that the level of organisational spending will automatically increase when the investment in developing GOM practices increases, regardless of the level of environmental performance a firm is able to achieve. This might reveal that selecting and developing the right portfolio of both internally and externally focused environmental technologies might be needed to reduce organisational environmental spending. One possible reason for the lack of a direct effect of collective GOM competency and the business benefits is that the simultaneous development of various GOM practices may require high levels of investment. At the same time, it enables the firm to reduce economic losses due to environmental penalties associated with the operations of the firm or the activities of its supply chain members and to gain saving advantages from the reduction of resources and energy usage. Furthermore, it may have resulted from the fact that firms in developing countries such as Oman are still at the early stages of adopting GOM practices (Zhu *et al.,* 2005) such as those related to source reduction (average mean=3.12), eco-design (average mean =3.54) and external EM (average mean =3.42). Thus, it might take some time until manufacturers realise more direct economic benefits while the costs of start-up investment keeps declining. This may suggest that achieving positive economic outcomes in the short term is difficult, but these benefits can be obtained in the long-terms (Bowen *et al.,* 2001a) after achieving superior levels of environmental performance. Overall, these results suggest that the environmental performance is considered as a mediating variable for the relationship between the adoption of GOM practices and organisational business benefits, but not for the relationship between GOM practices and organisational spending.

The indirect influence of collective GOM practices on organisational business benefits was also supported by the findings of the case studies in which all participants acknowledged that several economic advantages were obtained by improving environmental performance. Some advantages included a reduction in the cost of non-compliance liabilities, enhancement of the firm's reputation and relationships with the local government and with the local community, a reduction of production cost and a reduction in costs of waste disposal. The case companies gave considerable attention tothe development of waste minimisation activities mainly for economic, but not for environmental reasons. This was because production waste is considered as an important source of economic losses (Lai and Cheng, 2009). Implementing waste minimisation activities enabled the case companies to reduce the levels of solid waste disposal, reduce the level of water emissions, reduce the energy consumption, and reduce the production waste. No evidence was found from the interviews that the enhancement of environmental performance would lead to higher or lower spending. The results of the interviews suggested that the level of environmental spending would directly increase as the level of the investment in the development of various environmental initiatives increases.

Mixed findings were reported by previous empirical studies on the relationships between environmental initiatives and economic performance (Molina-Azorin *et al.,* 2009a; Zeng *et al*., 2010a).This suggests that the actual causal relationship between these factors is still unknown (Bansal, 2005; Cronin *et al.,* 2011). This research has empirically established a positive indirect relationship between collective adoption of GOM practices and organisational business benefits, and a positive direct relationship between GOM practices and spending. This offers a different understanding of the causal relationship between these constructs, which in turn may provide a partial explanation for the mixed findings in previous studies.

7.3.4 Mediation of cross-functional collaboration

CFC is considered as a mediator in the relationship between the stakeholder pressures and GOM practices. This was done in order to provide an answer for the fourth research question:

RQ4- *Does CFC mediate the relationship between stakeholder pressures and the adoption of GOM practices?*

The results of the mediation tests confirmed that CFC mediates the association of stakeholder pressures and the adoption of GOM practices, indicating that this relationship is further enhanced when CFC is considered, supporting H4. In particular, adding CFC to the model revealed that the willingness to adopt GOM practices in response to environmental demands of stakeholders has increased. This can be seen from the increase in the R^2 (.612) in the mediated model compared to R^2 (.50) in the direct effect model. This result was also supported by the case studies, which revealed that all case companies have considered CFC as an important enabler in the process of effective adoption of GOM practices.

The SEM results show that CFC has a different mediating effect on the relationship between stakeholder pressures and GOM practices depending on the source of the pressure. CFC was found to fully mediate the relationship between non-market-stakeholder pressures and adoption of GOM practices, supporting H4a. This suggests that environmental demands by this group of stakeholders cannot be fully understood and translated into practice without the development of CFC. On the other hand, the results also showed that CFC partially mediates the relationship between market stakeholder pressures and GOM practices, providing support for H4b. Although the partial mediated effect of CFC on the relationship between market stakeholder pressures and GOM practices suggests that the firm can fulfil the environmental demands of market stakeholders without developing CFC, it revealed that environmental requirements of this group of stakeholders can be better understood and translated into action if CFC is in place. CFC can enable the firm to better achieve the task of effective stakeholder management by integrating information related to stakeholder environmental requirements from different functional areas within the firm. CFC opens multiple channels to receive the environmental stakeholder demands and enables the organisation to interact with its stakeholders and process their requirements in a collective and cohesive manner. By doing so, CFC is expected to help the organisation to better understand the requirements of various groups of stakeholders. In general, the development of CFC increases the chances that environmental concerns from various stakeholders will be integrated into the firm's environmental decisions.

The findings regarding the importance of CFC in enhancing environmental efforts is also highlighted in the literature. For example, Handfield *et al*., (1997) posited that proactive environmental companies tend to react to environmental challenges from various sources as a whole system that includes all organisation members. Also, Carter*et al.,* (2000) highlighted that internal cross-functional cooperation for green purchasing contributes to environmental initiatives of designing products for reuse, recycling or disassembly. Moreover, Melnyk *et al*, (2003) maintained that CFC motivates environmental initiatives and programs throughout the entire PLC, including the acquisition of raw materials, production and distribution process. Furthermore, Lenvis and Gretsakis (2001) suggested that success of effective environmental strategies requires a good level of inter-departmental coordination within the company. When considering the scarcity of organisational resources on one hand, and the conflicting interests of stakeholders on the other hand, Rueda-Manzanares *et al*., (2008) argued that firms need to develop specific capabilities to effectively manage these conflicting pressures. The results of this study reinforce the importance of CFC in enhancing the company's ability to successfully undertake various environmental initiatives and effectively manage stakeholder demands. It also emphasizes the importance of considering CFC as a critical mediator in this relationship. This is an important contribution to the existing GOM literature because much of the current studies on stakeholder pressures and the adoption of green practices have assumed a direct relationship between these two constructs, which resulted in incomplete and an unclear understanding in these relationships. Also, investigating the influence of external factors on the development and deployment of internal-organisational capabilities has rarely been discussed in the literature (Rueda-Manzanares *et al.,* 2008). Sarkis *et al.*'s (2010) work was an exception, and they noticed that the relationship between stakeholder pressures and the adoption of green practices is mediated by the level of training in the firm. Our findings support Sarkis *et al.*,'s (2010) arguments that organisational critical resources and capabilities mediate the relationship between environmental stakeholder concerns and the firm's development of various environmental practices. However, previous studies did not consider CFC as an important mediator between these two constructs. The results of this research confirmed that CFC is a critical capability that can improve the competitiveness of firms by enabling them to effectively balance stakeholder pressures and the organisations' scarce resources.

7.3.5 Moderation of organisational characteristics

The results of the mediation test revealed that the growing environmental stakeholders' demands and the growing complexity of adopting environmental practices encouraged the manufacturing companies to develop an environmentally oriented CFC capability that enables them to effectively deal with these challenges and/or opportunities. This study also investigates whether the effectiveness of the CFC differs (or contingent)for different levels of firm's visibility (i.e. visibility of the firm's operations to a wider range of stakeholders). The visibility levels were measured in terms of three specific characteristics of the firm (size, pollution intensity and international orientation). This was done by testing the proposed contingency mediated model, depicted in Figure 5.6.13.

Relying on the contingency perspective of the firm (Argon-Correa and Sharma, 2003), the presence of CFC was believed to be more important for firms with highly visible environmental impacts in order to effectively manage the increasing stakeholder demands and to cope with the multi-functional nature of the environmental management practices. That is, when the visibility of the firm increases the demand for and benefits associated with more effective inter-functional communication, collaboration and information sharing is expected to increase. The CFC—GOM practices relationship was conceptualised to be moderated by three firm specific characteristics: pollution intensity (H5a), size (H5b), and international orientation (H5c). This was done in order to provide an answer for the fifth research question:

RQ5- Do firm characteristics (pollution intensity, size and international orientation) moderate the relationship between CFC and GOM practices?

Although results of the multi-grouping mediation in SEM showed that the value of the relationship between CFC and GOM practices was greater for highly visible firms (high pollution, large size and high international orientation), the results of the moderation tests revealed that these differences are not statistically significant except for the highly internationalised firms. Thus, H5a and H5b are not supported but H5c is supported. This implies that whilst the size and pollution intensity of the firm are important influencers of environmental proactivity (Dixton-Fowler *et al*., 2013), they do not act as important drivers for enhancing the effectiveness of CFC in GOM implementation. Among the proposed firm characteristics, the firm's international orientation was found to be an important moderating factor that influences the effectiveness of CFC, revealing partial support for H5. An almost similar conclusion was obtained from the case study analysis, which showed that the highly internationalised firms are more likely to be active in the development of CFC. Potential market opportunities resulting from the adoption of GOM practices encouraged these firms to develop an organisational capability of CFC that enables them to better understand and incorporate environmental concerns of various groups of stakeholders into the firm's environmental strategy.

These results are somewhat supported by the literature. For example, regarding the moderating effect of the international orientation of the firm, the results imply that highly internationalised firms are more likely to benefit from the deployment of CFC. The more stringent environmental regulations and the greater positive economic implications of environmental management might have encouraged or even forced international firms to give more attention to the development of CFC. The strategic management literature has acknowledged that due to the more distinct and stringent environmental standards and regulations international firms are facing, these firms have made and are willing to make extensive investment in the development of internal capabilities to improve their proactivity (Christmann, 2004) in order to gain more chances to enter new markets (Montiel and Husted, 2010). The advantages of environmental management to international firms' performance and market competitiveness have also been highlighted in the literature. For instance, Porter, (1991), Nehrt, (1998) and Zhu *et al* (2007), among others, found that adoption of advanced environmental practices in response to stakeholder pressures presented the international firms with opportunities for gaining new market shares and obtaining an international competitive advantage. International firms in general and multi-national corporations in particular tend to adopt environmental strategies that assure better outcomes and exceed the stakeholder requirements (Christmann and Taylor, 2001; Christmann, 2004; Montiel and Husted, 2010; Pagell *et al.,* 2013). On the other hand, Bansal and Roth (2000) found that imitating the competitors' environmental strategies is the most dominant approach used by the domestic firms to maintain their legitimacy.

As highlighted earlier, the results revealed that manufacturing firms do not benefit more from CFC when their size is large and/or they are operating within highly polluting industries. A possible explanation for these unexpected results might be that higher stakeholder pressures on large size and/or highly polluting firms restrain the positive effects of CFC. Although CFC is needed under higher stakeholder pressures (large size and/or high pollution) to effectively adopt GOM practices, the actual effect of CFC might be diminished. Another possible explanation for these non-significant moderation results might be provided by the visibility argument of enterprise environmental activities (Brammer and Millington, 2006). According to this argument, when size and pollution intensity of the firm increase, the higher is the visibility of firm's operations to a wider range of stakeholders and the higher is the risk of environmental activities (Wagner, 2011). This implies that higher stakeholder pressures forced these firms to be concerned about reducing the environmental risks of their operations, but not about maximising the market opportunities of their environmental activities. This, in turn, makes CFC less effective under these conditions. These arguments are partially supported by findings of previous studies. For example, Wagner (2007 and 2011) found that firm size largely matters for risk avoidance aspects rather than for market opportunities aspects. Furthermore, in highly polluting industries, managers tend to have less ability to influence the environmental performance given the nature of the business (Berrone and Gomez-Mejia, 2009) and firms attempt to legitimise their operations by adopting specific norms for environmental conduct in order to protect the collective reputation of the industry (King and Lenox, 2000). In other words, when managers of these firms do not see any further market opportunities of adopting more advanced environmental practices that exceed the norm of the industry or exceed the requirements of their stakeholders, they are less motivated to invest in developing internal capabilities to improve their level of proactivity. Also, Erfle and McMillan (1990) found that in the context of the petroleum industry, the more visible firms had lower positive economic outcomes from their environmental initiatives than less visible firms. On the other hand, for smaller size and lesser polluting firms, stakeholder pressures to adopt environmental initiatives are lower. In this case, managers may have developed CFC to both respond to stakeholder pressures and gain additional competitive advantage.

Taken together, the above moderation results show that the effectiveness of the organisational capability such as CFC on the adoption of GOM practices does not always depend on firm characteristics. The result proved that the effectiveness of CFC is moderated by the level of enterprise international orientation. This suggests that the need for higher levels of CFC for environmental management becomes more important for obtaining market opportunities, but not for risk avoidance. Therefore, if market advantages are the main factor for the development of CFC, the effective implementation of GOM practices should accordingly be influenced more. These findings are important to the literature because they provide an insight into the conditions under which manufacturing firms are able to reap maximum advantages of CFC. Accordingly, these findings call for more attention to the importance of contingencies to be considered when studying the relationship between internal resources and capabilities, and organisational environmental activities.

7.4 Conclusion

This chapter has presented a detailed discussion of the empirical findings of this research in relation to the existing literature. It highlighted the new insights this research offered toward a better and different understanding of the possible interrelationship between the stakeholder pressures, CFC, GOM practices and organisational performance. The findings show that in general stakeholder pressures are positively related to adoption of GOM practices and that GOM practises are positively related to organizational performance. It also shows that CFC mediates the relationship between stakeholder pressure and GOM practices. Finally, the findings confirmed that the effectiveness of the CFC on GOM practices does not always depend on the organisational characteristics.

CHAPTER 8 CONCLUSION

8.1 Introduction

This study has provided several theoretical and practical contributions in the field of GOM. The findings of this study have particularly improved our understanding about the influence of stakeholder pressures and organisational enabling capabilities (CFC) on the adoption of GOM practices and the implications of these practices on the performance of manufacturing firms. This chapter aims to highlight the contributions and limitations of this research, and it will be presented in three main sections. The theoretical and practical implications are discussed in Section 8.2. Next, the research limitations and some recommendation for future research are summarised in Section 8.3. Finally, Section 8.4 draws an overall conclusion of this research.

8.2 Research Contributions

8.2.1 Theoretical implications

This study has contributed to the growing body of knowledge that is related to corporate environmental practices. As was highlighted in Section 2.7, prior studies have not provided a well-accepted and integrated EM model that can be used to better understand the interrelationships between EM drivers, practices and performance. Previous studies have examined the relationships between these factors in relative isolation from one another. Furthermore, the majority of previous studies have used regression analysis, rather than SEM, as the main technique for testing hypotheses (Molina-Azorin *et al.,* 2009a & 2009b). However, regression analysis is less powerful in providing a holistic picture and more reliable results on how multiple exogenous and endogenous latent factors interrelate with each other compared to SEM (Hair *et al,* 2006). Against this backdrop and with the purpose of helping to develop a cohesive body of literature related to the antecedents and consequences of adopting GOM practices, this research attempted to develop a model that links and simultaneously examines the relationships between stakeholder pressures, internal capabilities, practices and performance related to the firm's EM using the SEM technique. As a result, there are five general theoretical contributions of this study:

1) The collective versus the individual GOM competency model

It has been argued that a lack of consensus regarding the meaning of GOM can be viewed as one of the main challenges for the development of the field (Sarkis, 2006; Srivastava, 2007; Seuring and Muller, 2008). This problem may be due to the absence of conceptual agreement on how various EM drivers influence the adoption of GOM practices and how GOM practices influence environmental and economic performance of the firm. Developing such integrated framework is essential to promote a common understanding about the interrelationships between these factors. Early contributions were made based on using limited and various sets of GOM practices and examining the drivers and performance outcomes of these practices by considering various GOM practices as individual competencies. In this research, a conceptualisation of GOM practices that is based on the complementarity theory perspective was used. By conceptualising the adoption of GOM practices as a second order construct, we found support for our proposition of considering GOM as collective competency. By doing so, this study contributes to the existing literature by uncovering the need to integrate various GOM practices to arrive at a clear understanding of the interrelationship between stakeholder pressures, practices and performance of EM that is not subject to the variation of the environmental practices used in different studies. Moreover, examining the complementary interdependencies among various environmental practices enabled this research to contribute to knowledge by providing different views into 'better management of GOM complexities' (Zhu *et al.,* 2012: 1378). The results of this research showed that the complementarity model is better in explaining the interrelationships between drivers, enablers, practices and performance of GOM. These findings are useful to extend the complementarity theory beyond product innovation and new product development to new areas within supply chain management in general and GOM in particular.

2) Antecedents of adopting GOM practices: Stakeholder pressures and CFC

This research contributed to the literature by providing empirical evidence on factors that are likely to influence environmental commitment of firms. In particular, this research provides insights into the role of various groups of stakeholders on the adoption of GOM practices. As noticed in Section 2.1, most of the previous GOM studies did not consider the differences between various stakeholder groups from an operations management (value added) perspective and some of these have conceptualised stakeholder pressures as a single construct. The way in which stakeholder pressures were conceptualised in these studies resulted in ambiguous conclusions regarding the possible influence of various groups of stakeholders on the development of GOM practices. Characteristics of stakeholders are related to varying levels of environmental investment by firms (Kassinis and Vafeas, 2006). This implies that variations in stakeholders' influence on the adoption of GOM practices should be considered when studying the relationships between these two factors. Stakeholders were classified into market and non-market groups using both operations management and market perspectives that are based on building long-term trusted relationships with stakeholders who can create value to a firm's operations and can enhance the level of its efficiency. The findings have empirically shown that both market and non-market stakeholder groups can influence the adoption of GOM practices and can be considered as important antecedents of GOM practices. However, the results of SEM and case studies showed that the influence of market stakeholders on GOM efforts is stronger than that of non-market stakeholders. Hence, this research reinforces the arguments of previous studies on the role of stakeholder pressures (Rueda-Manzanares *et al.*, 2008; Sarkis *et al.*, 2010; Driessen *et al.*, 2013), and emphasises the need to consider the differences that exist between stakeholders from a value added perspective. In addition, a critical evaluation of the results of the descriptive statistics, the infernal statistics (e.g. SEM) and the case study analysis revealed that the relationship between stakeholder pressures and GOM practices is influenced by the managers' perception of the potential market opportunities associated with the development of GOM practices. In doing so, this research provides insight into how firms prioritise stakeholder demands.

This research contributes to GOM and the dynamic dimensions of the RBV literature by providing empirical insights into the role of organisational internal dynamic capabilities that are likely to enhance stakeholders' management and the adoption of GOM practices. The heterogeneity of stakeholder environmental requirements requires a firm to develop specific capabilities to manage these pressures (Jawahar and McLaughlin, 2001; Rueda-Manzanares *et al*., 2008). The results of both the quantitative and qualitative data analysis confirmed that environmentally oriented CFC is considered as a critical mediator between stakeholder pressures and GOM practices. The results also showed that the development of CFC would result in increasing the likelihood of adopting GOM activities. This means that CFC is considered as an important internal enabling factor that helps the firm to better identify and manage stakeholder environmental demands and facilitate effective adoption of GOM practices. CFC provides multiple channels within the firm to interact with stakeholders and receive their environmental demands, which in turn can be expected to enhance the firm's ability to develop more cohesive and advanced strategies. Hence, this work extends the previous work on the need to consider internal firm resources and capabilities as facilitators for effective stakeholder management and GOM practices (Rueda-Manzanares *et al.*, 2008; Sarkis *et al.,* 2010) and emphasizes the mediating role of CFC in this relationship.

Using the contingency approach, this research also contributes to the existing GOM literature by providing empirical insight into the moderating impacts of three firm characteristics (pollution intensity, size, and international orientation) on the association between CFC and GOM practices. Of the three proposed moderators, only the firm's international orientation is considered as a significant moderator on this relationship. The contingency approach indicated that the effectiveness of CFC is more related to development of GOM practices in the contexts of highly internationalised firms than others. These results may suggest that the development of CFC is more important for gaining market opportunities than for risk avoidance. Previous contingency studies (Donaldson, 2001; Argon-Correa and Sharma, 2003; and Flynn *et al*., 2010) suggest that the environment in which the firm operates shapes its operations, processes and structure in order to maximise its performance. The findings of this research emphasise the need to consider the influence of internal and external contingencies when studying the relationships between internal capabilities and the adoption of GOM practices to better understand how and under what conditions the effectiveness of internal organisational capabilities such as CFC for adopting GOM practices may be enhanced.

The above findings enrich the understating of interrelationships between external factors, internal capabilities and practices related to the development of GOM practices. This is because, as of yet, no empirical analysis was conducted to investigate the role of stakeholder pressures on GOM practices and simultaneously incorporate the moderation and mediation effects on these relationships*. By doing so, this research contributes to the existing literature by providing new and differentiated insights on the possible interrelationships between stakeholder pressure and GOM practices that account for the mediating effect of internal capabilities and the moderating effects of firm characteristics on these relationships.

3) The collective GOM competency and its direct and indirect performance implications

There have been numerous studies conducted to investigate the potential influence of environmental initiatives on the economic performance of the firm, but the results are inconclusive, highlighting the complexity of linking the two (Linton *et al*., 2007; Dixton-Fowler *et al.,* 2013). Deficiencies exist in our understanding of the possible economic advantages of environmental practices (Zeng *et al.*, 2010a; Yang *et al.*, 2011). This research was conducted with the aim of contributing to the growing body of GOM literature by providing a different insight into the questions of whether or not it pays to be green. Many of the existing studies have conceptualised economic performance as a single construct, and assessed the direct relationships between individual sets of

*Wagner (2011) has addressed this issue of simultaneous consideration of the moderation and mediation effect when examining the relationship between the environmental practices and the economic performance.

GOM practices and performance of the firm. To avoid these limitations, this study conceptualised GOM practices as a collective competency and employed both the direct and indirect relationships between the collective GOM competency and economic performance. Economic performance was conceptualised as two constructs: business benefits and spending.

Consistent with other complementarity studies (e.g. Zhu, 2004; Cassiman and Veugelers, 2006; Mishra and Shah, 2009), this study empirically showed that complementarities of GOM practices have greater positive impacts on the firm’s environmental and economic performance. Hence, this research extends the contributions of the existing interdependencies research in GOM practices (e.g. Wong *et al.,* 2012 and Zhu *et al.,* 2012 & 2013) and reveals the superior performance implications of the complementarity of GOM practices. This was done by demonstrating that the values obtained from the complementarity of various GOM practices are greater than those obtained from an isolated adoption of these practices. Complementarity of GOM efforts facilitates better integration among existing elements and parties of GOM. This enables achieving higher returns by capitalising on the advantages from the collaboration of existing practices rather than extending the scope of GOM investments.

As hypothesised, the findings of both SEM and case study analysis proved that the collective GOM competency is significantly related to environmental performance. Furthermore, the results showed that the collective GOM competency is directly related to spending, but no indirect relationships exist between these two constructs. However, the results also reveal that there is no direct relationship between the collective GOM competency and business benefits. These factors are indirectly related with each other via environmental performance.

To sum up, the findings of this study reinforce the positive association of environmental management and economic performance as reported in some previous studies (e.g., Melnyk *et al*., 2003; Zhu and Sarkis, 2004; Molina-Azorin *et al.,* 2009a). However, this study revealed that the link between the environmental practices and positive economic performance is not direct. It is mediated by the level of environmental performance. These results show that it pays to be green, but the positive economic outcomes of adopting GOM practices can only be achieved if a superior level of environmental performance was achieved initially. This is a critical contribution to the existing GOM literature because much effort has been made to examine the relationship between environmental practices and economic performance but no consensus has been achieved on how these factors are interrelated (Ambec and Lanoie, 2008; Zeng *et al*., 2010a). This research provided evidence that the inconsistencies in previous results could be partially caused by how the models conceptualise the relationship between environmental management and performance. The use of the collective GOM competency and the simultaneous consideration of both the direct the mediated effects in this study give a more realistic picture of the impacts of environmental practices on economic performance. In doing so, the findings of this study enriched the existing literature by providing a different understanding of the on-going debate regarding how it pays to be green.

8.2.2 Practical contributions

The integrated model and multidimensional-reflective approach to adopt environmental practices used in this research have enhanced our understanding in the following ways:

1) Evaluating the influence of market and non-market stakeholders on the adoption of green practices.
2) Evaluating the influence of the collective adoption of various types of environmental practices on organisational performance.
3) Evaluating the role of the CFC capability on the effective adoption of the environmental practices.

Each of these managerial implications is now discussed in detail.

8.2.2.1 Stakeholder pressures and the adoption of GOM practices

Environmental violations and the lack of environmentally responsible products and production processes in manufacturing firms have become increasingly visible and influenced by the perception of various groups of stakeholders (Delmas and Toffel, 2004; Garcés-Ayerbe *et al.,* 2012). While the requirements of some stakeholders are highly influential and require immediate action by the firm, this is not necessarily true with the demand of other groups of stakeholders (Mitchell *et al.,* 1997). To address the issue of how firms prioritise the environmental demands of various stakeholders, the current research investigates the influence of two distinct groups of stakeholders (market and non-market stakeholders).

Certain groups of stakeholders have become more sensitive to environmental management in SCM activities. The managerial challenge is to find out how different stakeholders perceive environmentally friendly companies, products and production processes and develop the environmental practices and capabilities needed to meet their expectations accordingly. The firms' environmental behaviours may offer significant opportunities to increase customers', shareholders', employees' and other stakeholders' loyalty, which is critical for long-term survival (Freeman, 1984). The findings of this study provide managers with empirical evidence that both market and non-market stakeholders are sensitive to environmental problems in the firm's SCM activities but market stakeholders are more sensitive to these problems. At the same time, the findings also revealed that the market opportunities and business values expected from building strong relationships with market stakeholders encouraged firms to devote more resources to ensure that this segment of stakeholders receive what they expect.

While the results suggest that market stakeholders can widely influence the environmental decisions of the firm, firms should also carefully consider the possible negative consequences of incorrectly applying the stakeholder requirements. If the firm has the ability to accurately identify the requirements of a specific group of stakeholders and has the capabilities to develop the environmental practices required by this group of stakeholders, then the firm can benefit from these initiatives by communicating these with this group of stakeholders. On the other hand, if the firm lacks the tools and resources needed to clearly identify and meet the requirements of a specific group of stakeholders, the firm's efforts to communicate and create awareness about its environmental initiatives might result in negative implications on its business performance. This is because stakeholder perceptions of the environmental commitment of a specific firm are mainly related to the ability of the firm to carefully identify and develop the required environmental practices and initiatives, and communicate these initiatives back to stakeholders (Kirchoff *et al.,* 2011). Further, although more business opportunities can be expected from satisfying the requirements of market stakeholders, underestimating the requirements of the non-market stakeholders could lead to bad consequences for the firm's reputation and negatively influencing its overall business performance. This implies that requirements of both market and non-market stakeholders should be considered by manufacturers. The results of this study illustrated that this can be achieved by developing an integrated environmental program that enables the firm to respond to requirements of various stakeholders more effectively. Thus, the development of a collective GOM competency should be considered by managers to better achieve the business and environmental objectives of their firm and at the same time meet the expectations of stakeholders.

Importance of managers' perceptions in the process of integrating stakeholder demands:

Another interesting managerial issue that can be highlighted from findings of this study is the importance of considering managers' perception in the process of integrating stakeholder demands within environmental programs. While the results of the descriptive statistics and case study analysis indicated that more pressures were perceived from non-market stakeholders, in reality managers tend to give less attention to requirements of non-market stakeholders when designing their environmental programs. This was mainly related to how managers perceived the source of environmental pressures (i.e. whether it is market opportunity or just as a normal business challenge), suggesting that managers' perception plays a key role in environmental programs (Sharm, 2000; Buysse and Verbeke, 2003; Garcés-Ayerbe *et al.,* 2012). Generally speaking, the results show that what managers perceive may not always be the actual driver for the development of green practices by the firm. Also, it revealed that managers clearly believe that incorporating the environmental requirements of market stakeholders in general and customers and shareholders demands in particular into environmental programs, offer their firms greater opportunities in terms of competitiveness and long-term survival. Some factors may have partially caused this attitude. Among these is the lack of experience of the importance of environmental management in general, importance of satisfying non-market stakeholders in particular and the lack of market incentives offered by the non-market stakeholders. Firms willing to benefit from their environmental efforts should broaden the focus of their environmental strategies by giving suitable attention to the environmental requirements of both market and non-market stakeholders. This is because, although market stakeholders provide the primary resources to the firm, the non-market stakeholders can influence the reputation of the firm and influence its relationships with the market stakeholders (Roome and Wijen, 2006). This implies that managers should understand that underestimating the requirements of certain groups of stakeholders (government agencies, community, NGOs and media) might reduce the business gains of the firm. In fact, building collaborative relationships with this group of stakeholders may enhance the reputation of the firm and provide it with positive business outcomes, as was observed by some of the case companies (PaintCo, PowerCo and OilCo). Also, exceeding the requirements of the non-market stakeholders may provide the firm with greater innovation capabilities and flexibility to adopt more advanced green practices that enable them to meet more stringent legislative requirements. Thus, firms should ensure that environmental managers are equipped with good experience and training that enable them to better identify the market opportunities from the environmental demands of both market and non-market stakeholders. Managers should also regularly participate in environmental seminars and courses offered by different government agencies and NGOs to better understand the requirements of these stakeholders and how to turn their demands into new business opportunities.

The firm's ability to successfully manage and integrate stakeholder environmental demands should be supported by the availability of complementary critical resources and capabilities such as the development of CFC and collective GOM competencies. The development of these capabilities can be considered as a critical intangible asset for the firm. The importance of these complementary capabilities in effectively integrating the requirements of different stakeholders into environmental programs is discussed below.

Implications for government:

The findings of this research may also benefit the decision makers of different government agencies and NGOs in understanding the behaviour of the manufacturing firms in relation to environmental management. For instance, the results showed that managerial perceptions about stakeholder pressures are critical in influencing the environmental commitment of the firm to meet the requirements of different stakeholders. The findings showed that firms tend to focus more on the requirements of market stakeholders. These results suggest that market forces can have stronger influence on the environmental behaviour of firms. Therefore, different segments of stakeholders can increase their influence on the firm's commitment by applying market incentives, rather than using monitoring, control and command approaches.

The results of the case study analysis showed that regulatory and other non-market environmental forces do not generate enough incentive to innovate in terms of environmental management. These forces are perceived as a source of increasing production costs for the firm. The demands of this stakeholder segment focuses on the adoption of short-term, end-of-pipe pollution control solutions and provide less incentive to be innovative. In fact, many of the existing studies highlighted that pollution prevention, rather than pollution control practices, enhance the environmental and business performance of the firm (Garcés-Ayerbe *et al.,* 2012). This implies that the current resources allocated by the government for encouraging or forcing manufacturing firms to become greener may not result in the intended financial and environmental outcomes they desire. They might be providing the wrong incentives for these firms or using ineffective approaches for greening their operations. This may also imply that, besides the monitoring approaches, more voluntary environmental regulations and collaborative approaches are needed to encourage manufacturing firms to adopt more advanced green practices that go beyond the minimum legal requirements. These collaborative forms may include managerial and technical training, support, and providing financial incentives for good performers. The voluntary regulations may encourage firms to develop an integrated environmental system as an important element of quality management. The case study analysis showed that Omani companies are willing to increase their environmental efforts by implementing voluntary environmental programs such as ISO 14001. The Omani government can encourage the implementation of these programs that in turn could enable the Omani firms to improve their competitiveness by providing incentives (e.g. training courses, subsidising part or all of certification fees). Providing these incentives may facilitate the process of obtaining these widely recognised international certificates by Omani firms. Moreover, the analysis showed that Omani firms were also more concerned about the increasing cost and challenges of recycling and disposing of hazardous materials/components. They considered the lack of appropriate infrastructures for waste management and recycling in the country as one of the main barriers that held back the progress of their environmental efforts. This reveals that for the Omani government to encourage the adoption of more GOM practices, it should establish a good recycling and waste management system infrastructure. Finally, the findings also suggested that smaller firms are less concerned about and less motivated to be involved in the process of enhancing their environmental management. This may be due to the resource constraints of these firms. Because the number of small and medium size firms in Oman has increased dramatically over the past few years, the Omani government should consider providing enough financial and non-financial incentives to motivate these firms to be more active in the process of enhancing their environmental capabilities and performance.

8.2.2.2 Performance implications of the collective GOM competency

The theories and empirical supporting evidence provided in the research offer managers a better explanation as to why their environmental efforts to green their operations do not always result in achieving the desirable business outcomes. By distinguishing the internal from the external GOM practices, managers should now be able to see the superior value of considering the implementation of GOM practices as a collective competency. Complementary collaboration and simultaneous adoption of various internal and external GOM activities enables efficient and effective accomplishment of the goals of the parties involved in the GOM implementation. It increases the chances of having more synergetic GOM strategies that combine, share and take advantage of various existing GOM resources and capabilities. This allows the firm to increase the overall benefits of GOM and improve their performance. It is important to note, however, that developing such a collective competency may not be achieved in the short-term. It is a long-term objective that may need more time, effort and experience to be developed.

These findings encourage managers to develop a complementary set of environmental practices. This bundle of practices is valuable, rare, non-substitutable and hardly imitable by competitors, which could enhance the market competitiveness of the firm and enable it to have a sustainable competitive advantage. The complementarity of organisational resources and practices is a firm specific competency (Mitra and Singhal, 2008). Firms within a specific industry or across industries are heterogeneous in relation to how these collective GOM practices are developed. The environmental resources and practices and the way in which they are managed are unlikely to be perfectly transferable from one organisation to another (Hart, 1997). Developing a collective GOM competency is particularly important for the Omani manufacturers aiming to improve their international reputation and enhance their attractiveness as a partner in the supply chain of Western firms. The performance outcomes of the collective GOM practices are sensitive to the contribution of employees, managers, internal departments and collaboration with external supply chain partners in various environmental areas.

The collective GOM competency implies that managers should give equal attention to investment in developing both internal and external GOM practices. Some of these practices focus mainly on improving the environmental performance within the firm's internal operations, while others aim to reduce the environmental impact beyond the firm's internal operations. Focusing on single environmental practices may force the firm to face the economic risks associated with environmental violations of either its internal operations or activities of its external supply chain members. Thus, due to the high level of interdependency among these practices (Zhu *et al*., 2008c & 2012), firms should strive to reduce the environmental risks throughout the entire PLC by considering the collective influence of various GOM practises on performance.

In fact, when considering the direct relationships between the collective GOM competency and performance, the collective approach of GOM practices revealed that it was significantly linked to environmental performance, business benefits and spending. Because the collective competency is more positively associated with environmental performance and business benefits than with spending, this research provided managers with empirical evidence that the adoption of the collective GOM competency is worth the efforts of their companies in terms of environmental and economic performance. Examples of positive business outcomes include reducing the overall operational and production costs, enhancing customer satisfaction, increasing volume of production, enhancing overall quality of the product, improving the level of efficiency and increasing sales.

When considering the indirect influence of the collective GOM competency on economic performance via the environmental performance, findings show that the collective competency is strongly related to environmental performance. At the same time the environmental performance is strongly related to business benefits, suggesting that the improvement in the environmental performance is essential and a prerequisite for achieving greater levels of positive economic outcomes. If the environmental performance of the firm is high, then firms can save more resources for future projects. For environmental managers, this finding provides evidence that developing the required skills and experience to achieve higher levels of environmental performance enable their firms to take greater advantage of combining various GOM practices.

The fact that the level of environmental performance of developing collective GOM competency is not related to spending implies that the collective GOM competency has a direct effect on organisational spending. That is, increasing the level of environmental investments in developing the collective GOM competency will directly increase the level of spending, regardless of the environmental performance a firm can achieve. Despite the fact that the collective GOM competency can have strong positive influence on long-term business outcomes, managers should understand that some operational expenses are expected from the development of this competency. Thus managers should prepare their firms to accept these short-term operational expenses. This objective can be achieved by enhancing the level of environmental performance. It can also be accomplished by developing the right combination of GOM practices that enable the firm to achieve a better fit with the requirements of various stakeholders, which likely could reduce the negative economic implications of the firm's GOM initiatives.

8.2.2.3 Evaluating the role of CFC on effective adoption of the environmental practices

The results of the mediation test provide managers with empirical evidence that the development of environmentally oriented CFC is important to facilitate the development of the collective GOM competency. While the mediation results suggest that collaboration of core functional areas within the firm is needed to develop GOM practices to best respond to non-market stakeholders requirements, this is not necessarily true when developing green practices to respond to requirements of market stakeholders. In other words, firms can successfully adopt GOM practices to respond to demands of non-market stakeholders only when CFC is in place. However, the CFC development is not an important condition to successfully adopt GOM practices that are needed to meet the requirements of market stakeholders, but its presence can enhance the firms' willingness and ability to achieve this objective.

Overall, the results revealed that CFC forms the foundation upon which many other types of environmental practices, programs and projects are effectively developed. The fact that environmental management is a complex and multi-functional task (Hart, 1995; Handfield *et al.*, 1997), reveals that CFC can be particularly effective in handling environmental challenges and implementing different environmental tasks. These tasks may include sharing critical information related to environmental performance and goals, developing more synergetic environmental programs, effective stakeholder management, establishing more efficient and innovative ways to deal with the environmental challenges and developing a successful and comprehensive product life cycle assessment.

The case studies revealed that CFC could play a key role in progressing the environmental capability and performance of the firm by opening multiple channels to receive and clearly identify stakeholder environmental demands. It also helps in establishing a more collaborative environment within the firm, which in turn could enable the firm to respond to environmental challenges more efficiently and as a whole unit. Hence, the existence of CFC can enhance the effectiveness of GOM practices in satisfying the stakeholders' requirements and, ultimately, increase the chances for more business successes. CFC is a firm internal specific and core operational capability that a firm can fully control to effectively achieve its environmental objectives. This suggests that the firm should start with developing the CFC capability that enables various core departments to work as a team. Managers should keep in mind that CFC does not directly lead to success, but can be considered as a key enabler to success (Carter and Dresner, 2001). On the other hand, failure to develop the CFC to fully use the creative capability of different functional areas within the firm may imply higher resources and efforts for the implementation of GOM practices.

The multi-grouping mediation test showed that the influence of CFC on adopting GOM practices is stronger for firms with highly visible environmental impacts (e.g. large size, highly polluting and highly internationalised). This implies that the need for CFC and other internal environmental capabilities to effectively receive and translate the requirements of various stakeholders into action increases when the operations of the firm become more visible to a wider range of stakeholders. Managers should give more attention to the development of CFC capability when the level of visibility of their firm's operations increases. At the same time this finding reveals that, although establishment of formal CFC programs is important for highly visible firms, a formal CFC program may not be required to reap the full benefits of CFC in the situations of less visible firms.

However, using the results of further moderation tests, international orientation was found to be positively and significantly moderate the relationship between CFC and the adoption of GOM practices. This implies that the benefits of CFC for the effective adoption of GOM practices are significantly greater for highly internationalised firms. The finding that the effectiveness of CFC is significantly related to different levels of firm international orientation reveals that firms can easily achieve more benefits from CFC under high internationalisation situations.

The case studies offered guidance into how to develop CFC. For example, managers should not only rely on the traditional ways of establishing CFC through face to face communication, but they can use other efficient ways of communication such as e-mail and phone. Also, managers should not look at the basic costs of CFC, but should consider assessing the overall potential benefits of CFC on stakeholder satisfaction, production performance, employees performance and environmental performance. Further, assigning a cross functional-team appeared to be critical to identify the environmental challenges faced by different departments, develop the environmental practices that fit with these challenges, determine the consequences of operations throughout the entire PLC, and use the results of this assessment as a main guide to prepare the future environmental plans. Managers should consider structuring the cross-functional team in a way that increases the levels of communication and coordination between different departments and allows feedback from employees of these departments. This cross-functional team can act as a liaison between employees of different departments and play an important role by cataloguing the technical and managerial expertise available within different departments (Carter and Dresner, 2001). The case studies also suggested that employees' commitment to collaborative environmental programs could be enhanced by selecting the right team/department leaders who are willing to work with other departments as a team, providing employees with the required level of training on various environmental areas and by developing an effective HRM rewording system that encourages the employees to be more innovative in dealing with various environmental challenges.

Contextual contributions:

The findings of the current research enhanced the GOM literature by discussing the vital role of collective adoption of GOM practices across the manufacturing firms in Oman. Previous GOM studies have given considerable attention on other contexts such as UK manufacturing sector (Bowen *et al.,* 2001a & 2001b), U.S.A (Egri and Herman, 2000; Dixton-Fowler *et al*., 2013) and China (Zhu and Sarkis, 2004 & 2008; Zhu *et al.,* 2012). Omani firms are increasingly becoming global manufacturers and attractive suppliers for many foreign firms. This can be seen by the dramatic increase in the exportby Omani firms to the international market in 2012 (the non-oil export increased by more than 28%) compared to 2010 (PAIPED, 2012). Adopting GOM initiatives can further enhance the attractiveness of the Omani firms to become a partner in the supply chain of Western firms by reducing the environmental risks associated with the operations of the entire supply chain members.

The findings show that globalisation and regulatory environmental requirements play a key role in driving the adoption of green practices in the Omani firms in order to improve their environmental capabilities and performance. With the aim of satisfying their local as well as international stakeholders and helping the Omani government to achieve sustainable development, the Omani firms have given considerable attention to the development of various GOM practices. However, the lack of more advanced environmental practices such as those related to comprehensive PLC assessment, reverse logistics and establishing more environmentally oriented collaborative relationships with their customers might suggest that Omani firms are still in the early stages of adopting advanced GOM practices. This may be due to the lack of enough financial incentives from the government. It could also happen because some of these firms may lack the required tools and experience to effectively identify and translate stakeholder environmental requirements into action.

The findings shows that it pays to be green in the context of Omani manufacturing firms and provide preliminary evidence that the Omani firms can improve their economic performance by implementing effective and integrated GOM programs. This would encourage and facilitate the adoption of more green practices among the Omani firms and can help to improve the overall environmental performance of the entire country.

The relationships between drivers, practices and performance of the environmental practices adoption among the Omani manufacturing firms were investigated in this research and a number of significant relationships were found between these factors. Manufacturing firms of other GCC countries (Oman, U.A.E, Qatar, Kuwait, K.S.A, and Bahrain) can also learn from the managerial implications of this research because they share many similar socio-cultural, market and environmental characteristics.

8.3 Limitations and future research

Despite the theoretical and practical contributions of this study, it suffers from some limitations, which might provide opportunities for future research. These limitations are summarized below:

1- The sample size

The importance of having a sufficiently large sample size has always been a concern in SEM studies, especially the CB-SEM. Improper sample size may influence the robustness and accuracy of the results of multivariate analysis. In fact, the author of this thesis strived to obtain the largest number of observation during the data collection period by using different approaches to encourage more respondents to participate. The low sample size is increasingly becoming one of the main limitations of survey-based studies, including the current research, due to the growing reluctance of enterprises to respond to non-relevant documents such as academic questionnaires. Although the sample size used in this research is smaller than the recommended size for robust CB-SEM analysis (i.e. ≥200 observations), this sample (i.e. 138) is acceptable when compared to other contemporary CB-SEM studies (e.g., Rao and Holt, 2005;Wong *et al.,* 2011; Liu *et al.*, 2010; Zeng *et al.,* 2010a; Wong *et al.,* 2012), which used even fewer observations to draw their conclusions. Also, the sample size satisfies the rule of thumb for good structural modelling estimates suggested by Barclay *et al.,* (1995) and supported by Henseler *et al.,* (2009:292) by having a sample size greater than or equal to ten times the largest number of structural paths directed at a particular construct in the model. In the conceptual model of this research, the three structural paths that were directed to the GOM construct represented the largest number of structural paths that are directed to a latent construct. Despite the theoretical and practical implications of this research, a larger sample size is always recommended in order to obtain more accurate and reliable results.

2- Alternative models:

Findings of this research contribute to the literature by investigating the antecedents and consequences of developing a collective GOM competency. This study also focused on extending research on the mediation effect of organizational environmental capabilities on the relationship between stakeholder pressures and implementation of GOM practices (Rueda-Manzanares *et al.,* 2008; Sarkis *et al.,* 2010) by examining whether this mediation effect varies across firms with different characteristics. These relationships were examined using an integrated model that was developed based on a critical review of the existing literature. However, the author of this thesis acknowledges that the model developed and tested in this research is one of a number of alternative models that could be tested to understand the relationship between drivers, enablers, practices and performance of GOM. For instance, this research hypothesized stakeholder pressures and CFC as main antecedents of collective adoption of GOM practices and environmental and economic performance as consequences of implementing these practices. Alternatively, researchers can evaluate how increasing economic performance can promote the adoption of more GOM practices and how the latter could increase the level of awareness various groups of stakeholders of the importance of GOM. Also, in this study an antecedent approach of CFC has been used in investigating GOM, but an outcome approach of CFC is yet to be fully explored. Further, by empirically examining the possible moderation effects of firm characteristics on the relationship between CFC and GOM practices, findings of this research provide the foundations for future research in the area related to the conditions within which the effectiveness of organizational environmental capabilities is maximized. Further analysis on the possible moderating effects of organizational characteristics on other structural links between the constructs will be useful to help obtain additional insights on drivers, practices and performance of GOM differences. This can enable more control over contextual factors, which in turn could enhance the robustness of the findings of this research. Due to a relative small sample size used to test the conceptual model of this research, testing the moderation effects of firm characteristics on the relationships between stakeholder pressures and adoption of GOM practices or from the latter to performance constructs might not be properly and truly achieved. A smaller sample size may lead to loss some of the statistical power needed to test the multi-grouping moderation effects, especially when a complex model is estimated (Hair et al., 2006). A large sample size may be required to be able to simultaneously detect the possible moderating effects of the firm's characteristics on various direct and indirect links between drivers, practices and performance of GOM, which should be consider by future studies. In short, the proposed complementarity model of GOM provides a foundation for further development of empirical work in this area, but to further enhance the validity of the findings obtained in this research all the above alternative models should be considered by future studies.

1- Context of the research

The researcher recognises that the hypotheses of this research were confirmed using data collected from a single country, Oman. Hence, the findings may be country-specific. In fact, Oman as a context of research has not been studied before and thus this research provides insights about the environmental drivers, practices and performance of the Omani manufacturing companies. However, Oman as a developing country has different environmental expectations compared to other, more developed, countries that are more sensitive about the environmental problems of manufacturing companies. These differences in country's environmental expectations may influence the firms' willingness to develop various types of environmental practices (Wagner, 2005) and my ultimately affect the environmental and economic performance. This could be an interesting area of investigation for future studies.

In fact, the influence of the differences in country environmental expectations was obvious in this research. It resulted in the elimination of some of the measurement items used to measure the constructs related to the environmental drivers, practices and performance during the EFA and CFA process. Although these items were developed based on the literature (see section 5.2.2 for details), some of these items were not suitable for the Omani context. The case study analysis revealed that most of the final items used to test the conceptual model of this research were also observed during the interviews. It also provided a list of other drivers, practices and performance indicators (Table 6.2, 6.3 and 6.4 respectively) that might be more suitable to be used to measure constructs related to the environmental drivers, practices and performance in the context of the Omani manufacturing sector or in any other similar contexts such as the manufacturing sectors of other GCC counties. When examining the relationships between the environmental drivers, practices and performance in this region, future studies might consider using the list of items summarised in Table 6.2, 6.3 and 6.4, in addition to other measurement items reported from the final CFA results (Table 5.5.4).

2- Influence of industry characteristics

This research has considered the potential influence of only three firm specific characteristics (pollution intensity, size and international orientation) on the adoption of collective GOM competency by firms. The results showed that a universal conclusion is likely to exist regardless of firm size or pollution intensity. However, the researcher could not control for the effects of other firm characteristics (e.g. age and/ ownership – Claver *et al.,* 2007) and the effect of the industry sector on the development of CFC and the collective GOM practices competency. This was largely due to the insufficient sample size in each specific category of firm age, ownership and industry sector. However, the industry was partially controlled for concerning pollution intensity. Thus, future studies may consider examining the possible moderating effects of other firm characteristics and/or industry characteristics on the relationships investigated in this study. Also, this research did not consider the potential influences of firm or industry characteristics on the performance of the firm. This is because, much has been done on this area by previous studies (e.g. see Dixton-Fowler*et al*., 2013).

3- Perceptual data and single respondent biases

Another limitation of the research is related to its design. This research relies mainly on using self-reported measures of a key informant per company to obtain data related to drivers, enablers, practices and performance of GOM, which might lead to some degree of bias. In fact, this issue of using a single respondent per company is a general limitation in many survey studies. Some earlier research in GOM suggested that this issue does not result in significant concerns (Vachon, 2007; Dixton-Fowler *et al.,* 2013; Zhu *et al.,* 2013) and researchers should rather use several remedies to eliminate its effects and enhance the validity of the research findings. Due to difficulty of fully eliminating any potential bias resulting from using a single respondent, in this research several procedural and statistical remedies were used to address and reduce the effects of a single respondent bias (see Section 6.3.2). Although results of these remedies did not identify single respondent bias, due to the dynamic, multi-functional and complex nature of adopting GOM practices and their underlying drivers and performance outcomes, using more than one respondent per company is more recommended. This approach may enable a more accurate picture of the complementary adoption of GOM practices and its performance implications to be obtained, which should be considered by future studies. Also, future studies may consider using more objective measures for the constructs under investigation, which could be challenging because most of the time environmental drivers and/or practices of firms are not publicly available.

4- Longitudinal studies:

Another limitation of this research is related to the fact that data collected to measure the adoption of GOM practices and their performance implications were collected at a certain point in time. However, performance outcomes of GOM practices might not be realised immediately after the adoption of these practices, or they might change over time. Thus, more longitudinal studies may be needed to complement findings of this research and test how the performance implications of the GOM adoption vary over time.

5- Other interesting areas

Based on the scope and model constraints of the current research and because of time constraints of the participants from case companies, several issues have not been considered in this research, but may need future attention.

For instance, the current research did not consider how the integration and complementarity between various environmental practices can be achieved and how environmentally oriented CFC can be achieved. In addition, it did not determine the most appropriate level of CFC that is needed to ensure effective and efficient achievement of the firm’s environmental goals. In fact, the case study analysis provided some good insights and guidance on how CFC can be achieved but the effectiveness of different forms of CFC and the optimum level of CFC could not be tested in this research. Examining these issues using the quantitative methods might require the development of specific constructs that can measure the level of CFC within the firm, the effectiveness of different forms of CFC implementation, and/or measure the approaches used by firms to strategically and operationally integrate, on complementary base, their environmental activities. According to the author's knowledge, such constructs and/or items to measure these constructs are still not available in the literature. Future research might also consider investigating these issues using more in-depth interviews with managers of the manufacturing firms.

Furthermore, the conceptual model developed in this research was tested in the context of the manufacturing sector. This is largely because the level of pollution produced by the manufacturing firms is expected to be higher than in the service sector. However, testing this integrated model in the context of the service sector, which might have different environmental expectations and performance, may provide new insights on the relationships between the antecedents and consequences of GOM practices and on the mediating role of the CFC on these relationships. Thus, future studies might consider testing the current conceptual model in the service sector to determine if findings of this study can be generalised to companies operating in other non-manufacturing industries.

In this research, the complementarity model of the environmental management was used. Accordingly, by integrating four distinct yet interrelated sets of environmental practices into a second order construct called 'collective GOM competency', this research found empirical evidence for the superiority of the second order construct in providing a general explanation on the relationships between drivers, practices and performance of adopting environmental practices. However, using the first order model might be recommended in order to have an in-depth understanding of how the two distinct groups of stakeholders (i.e. market and non-market stakeholders) can influence the adoption of each of the four sets of environmental practices proposed in this research (i.e. EMSs, source-reduction, eco-design and external environmental management). For example, the individual competency model showed that market stakeholders encouraged firms to adopt all sets of environmental practices. This result might suggest that the collective adoption of these four sets of environmental practices is needed more in order to respond to the requirements of this group of stakeholders. However, pressures of non-market stakeholders encouraged firms to adopt only source-reduction practices but not EMSs, eco-design or external environmental practices. Consequently, future research should focus on conducting more in-depth interviews with top people from the government and industry in order to have a better understanding of why the role of non-market stakeholders is limited on the adoption of the source-reduction practices.

8.4 Conclusion

This chapter has highlighted the contributions of this research. The findings showed that in general stakeholder pressure is related to the adoption of GOM practices. However, stakeholder characteristics and the dependences associated with these to create new value for the firm's operations are influencing the level of resources and commitment allocated to the development of GOM practices. The findings showed that market stakeholder pressures are more related to the development of GOM practices than non-market stakeholders. The findings also provided evidence that CFC mediates the relationship between stakeholder pressures and the adoption of GOM practices and that the effectiveness of CFC does not always depend on organisational characteristics. Finally, the findings confirmed that GOM is directly related to the organisational environmental performance and spending, but indirectly related to the organisational business benefits via environmental performance.

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Appendices

A: A copy of the distributed survey:

Questionnaire: Environmental Management in Manufacturing Firms in the Sultanate of Oman

Nottingham University Business School

This questionnaire has been developed to research and evaluate the environmental management practices adopted by Omani manufacturing firms. The researcher is a PhD student at the University of Nottingham, United Kingdom. All the information provided **will remain strictly confidential**. *"Thank you for your participation"*.

Part 1: Company and respondent information:

1.Company nationality (please specify): ....

2. Company operations (please tick): a. Oman only b. Oman based but export outside c. Subsidiary of an overseas company

3. Main Company ownership (i.e. major shareholder): a. Publicly traded b. Privately owned c. Government owned

4. Number of workers in your company-in Oman (Please specify or tick): ....
a. Less than 10 b. 10-19 c. 20-49 d. 50-99 e. 100-200 f. more than 200

5. Main activity (please tick or specify): □ Food & beverage □ *Wood & wood products* □ Paper & paper products□ *Publishing activities, printing, photocopying* □ Refined oil & liquid natural gas □ *Chemical* □ *Plastic products* □ Non-metallic mineral products □ *Basic metals* □ Fabricated metals products □ *Manufacturing of machines & equipment* □ Electronic appliances & electronic machines
□ *Textiles* □ Leather &saddles □ *Medical & optical equipment and machinery* □ Vehicles and trailers □ *others* (please specify) ....

7. Age of your company in Oman (years of operation):
a. Less than 2 years b. 2-5 years c. 6-10 years d. More than 10 years

8. % of Export in total annual sales turnover:
a. Not at all b. Less than 10% c. 10 - 20 % d. 21 - 50 % e. More than 50 %

9. % of imported materials/ components used to produce your main products:
a. Not at all b. Less than 10% c. 10 - 20 % d. 21 - 50 % e. More than 50 %

10. Your (the respondent) position in the company (Please specify):...
11. **Years of experience** in the company **(in total)**:..

Part 2: Environmental management practices

Q. Please assess the degree to which your company has developed the following environmental practices/activities	not considering it	planning to consider it	considering it currently	carrying out to some degree	carrying it out fully
Increase the use of recycled materials to manufacture products	1	2	3	4	5
Reducing the level of materials/components that are considered as harmful (but not illegal) and replacing them by materials/components which are not problematic.	1	2	3	4	5
Use of standardized components to facilitate their reuse	1	2	3	4	5
Using advanced inventory management techniques to avoid obsolete inventory	1	2	3	4	5
Providing on-going support from the company's top management for the environmental activities	1	2	3	4	5
Conducting regular maintenance & care of the production equipment and technologies	1	2	3	4	5
Redesigning the product or the production process to eliminate any potential environmental problems and/or to reduce the demand for energy	1	2	3	4	5
Using packaging and pallets which can be reused or recycled	1	2	3	4	5
Providing training to employees/managers on various environmental management areas	1	2	3	4	5
Adopting environmental management systems and procedures for internal use (e.g., planning, evaluating, controlling environmental activities and reporting environmental performance).	1	2	3	4	5
Recycling and consuming production waste internally	1	2	3	4	5
Reducing the variety of raw materials used in producing the company products	1	2	3	4	5
Cross functional communication and\\ collaboration for environmental improvements	1	2	3	4	5
Reducing environmental problems by increasing the overall life of the product (e.g., use of more durable components or engines which last longer)	1	2	3	4	5
Environmental compliance and internal auditing programs	1	2	3	4	5
Recycling of waste for internal use	1	2	3	4	5
Use of various techniques to make it easier to disassemble and dispose products at the end of their useful life (e.g. clear identification of materials-colours & codes, easy to break joints between components)	1	2	3	4	5

Remanufacturing a product where some of the parts or components are reused while others are replaced	1	2	3	4	5
Ensure that all waste is disposed of in a more environmentally friendly way	1	2	3	4	5
Sales of excess inventory to avoid obsolescence	1	2	3	4	5
Replacing a more environmentally problematic material with another non problematic material	1	2	3	4	5
Working with customers and/or suppliers to develop a mutual understanding of responsibilities regarding environmental performance	1	2	3	4	5
Working with customers and/or suppliers to reduce the environmental impact of supply chain activities (e.g. managing waste products)	1	2	3	4	5
Conducting joint planning sessions, workshops and knowledge sharing activities with customers and/or suppliers to anticipate and resolve environmental-related problems	1	2	3	4	5
Including environmental considerations in selection criteria for suppliers	1	2	3	4	5
Providing suppliers with written environmental requirements for purchased items	1	2	3	4	5
Providing customers with detailed and written environmental information related to products	1	2	3	4	5
Requiring suppliers to have formal or informal environmental management system (e.g. ISO 14000)	1	2	3	4	5
Requiring suppliers to be in compliance with particular environmental regulations (e.g. hazardous material labelling or emission caps)	1	2	3	4	5
Requesting suppliers to provide environmental information to assure their environmental compliance	1	2	3	4	5

Part 3. Pressures from stakeholders

Q. Please assess to what extent your firm felt pressures from the following stakeholders to implement some or all of <u>the above</u> *environmental practices*	not at all	a little bit	to some degree	relatively strong	Very Strongly
Clients/Customers	1	2	3	4	5
Central Government	1	2	3	4	5
Internal Shareholders (employees/managers who own one or more shares in the company)	1	2	3	4	5
External Shareholders (e.g., financers and creditors)	1	2	3	4	5
Employees (including workers and managers)	1	2	3	4	5
Media	1	2	3	4	5
Environmental protection groups	1	2	3	4	5
Society (e.g., community requirements)	1	2	3	4	5
Competitors	1	2	3	4	5
Suppliers	1	2	3	4	5

Part 4. Environmental and economic performance

Q. Please assess to what extent you think that implementing some or all of the above environmental practices has affected your firm's performance in the following ways	not at all	a little bit	to some degree	relatively strong	Very Strongly
Reduction of solid waste disposal	1	2	3	4	5
Reduction of air emissions	1	2	3	4	5
Reduction of water emissions (i.e. reduction of polluted water discharged from your company)	1	2	3	4	5
Decrease of consumption of hazardous / harmful / toxic materials	1	2	3	4	5
Reduction of environmental accidents	1	2	3	4	5
Improve firm's environmental situation	1	2	3	4	5
Decrease of cost for energy consumption	1	2	3	4	5
Increase number of customers	1	2	3	4	5
Decrease of fee for waste treatment	1	2	3	4	5
Enhance firm's reputation	1	2	3	4	5
Decrease of fee for waste discharge	1	2	3	4	5
Increased overall environmental investment	1	2	3	4	5
Increased operational costs	1	2	3	4	5
Increased training costs	1	2	3	4	5
Increased cost of purchasing environmentally friendly materials	1	2	3	4	5

Part 5. Influence of international markets on firm's environmental activities

Q. Please indicate how strongly you agree or disagree with each of the following statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Our firm actively considers the effect of our environmental activities on our sales to foreign customers	1	2	3	4	5
Regional government's environmental regulations influence our firm's environmental management activities	1	2	3	4	5
Our firm actively considers the effect of our environmental activities on our international competitiveness	1	2	3	4	5
Our firm actively considers the effect our environmental activities have on our export sales	1	2	3	4	5
Potential conflicts between our products and environmental regulations will affect our firm's environmental management activities	1	2	3	4	5

Part 6. Influence of cross functional collaboration on firm's environmental activities

Q. Please indicate the degree of collaboration between different departments in your firm in the following areas	not at all	a little bit	to some degree	relatively strong	Very Strongly
Working together to reduce environmental impacts of our firm's activities	1	2	3	4	5
Achieving environmental goals collectively	1	2	3	4	5
Sharing critical information about our firms' environmental activities and performance	1	2	3	4	5
Making joint decisions about ways to reduce overall environmental impact of our firm's products.	1	2	3	4	5

Please write down your e-mail or fax number if you wish to receive a copy of the research results................................

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