ADOPTION OF GREEN SUPPLY CHAIN INITIATIVES BY ISO 14001 CERTIFIED MANUFACTURING FIRMS IN MALAYSIA: KEY DRIVERS, OUTCOMES, AND MODERATING EFFECT OF RELATIONSHIP ORIENTATION

by

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TABLE OF CONTENTS

	Page
Acknowledgements	ii
Table of Contents	iii
List of Tables	xi
List of Figures	xv
Abstrak	xvi
Abstract	xviii
CHAPTER 1: INTRODUCTION	1
1.0 Introduction	1
1.1 Background of the Study	3
1.1.1 Global Environmental Issues	3
1.1.2 Environmental Issues in Malaysia	7
1.1.3 Evolution of Environmental Management Initiatives	10
1.1.4 The Concept and Importance of Green Supply Chain	13
1.2 Statement of the Problem	16
1.3 Research Questions	21
1.4 Research Objectives	22
1.5 Scope of the Study	22
1.6 Significance of the Study	25
1.6.1 Theoretical Contributions	25
1.6.2 Practical Contributions	27
1.7 Definition of Key Terms	28
1.8 Organization of the Thesis	31

CHAPTER 2: LITERATURE REVIEW 33

2.0 Chapter Overview 33

2.1 Green Supply Chain Initiatives 33

2.1.1 Eco-Design 37

2.1.2 Green Purchasing 39

2.1.3 Supplier Environmental Collaboration 41

2.1.4 Customer Environmental Collaboration 43

2.1.5 Reverse Logistics 44

2.2 Drivers for Adoption of Green Supply Chain Initiatives 47

2.3 Outcomes of Green Supply Chain Initiatives 51

2.3.1 Environmental Outcomes 53

2.3.2 Economic Outcomes 54

2.3.3 Operational Outcomes 56

2.3.4 Intangible Outcomes 57

2.4 Relationship Orientation 59

2.4.1 The Concept of Relationship Orientation 59

2.4.2 The Importance of Relationship Orientation 61

2.5 Theoretical Base of the Study 63

2.5.1 Institutional Theory 64

2.5.2 Natural Resource-Based View of the Firm 68

2.5.3 The Relational View of the Firm 71

2.6 Initial Theoretical Framework of the Study 72

2.7 Summary of the Chapter 74

CHAPTER 3: DEVELOPMENT OF THEORETICAL FRAMEWORK AND RESEARCH HYPOTHESES 76

3.0 Chapter Overview 76

3.1 Interviews Design and Administration 76

3.2 Green Supply Chain Initiatives in Malaysia 80

3.2.1 Eco-Design in Malaysia 81

3.2.2 Green Purchasing in Malaysia 82

3.2.3 Environmental Collaboration in Malaysia 85

3.2.4 Reverse Logistics in Malaysia 86

3.3 Concluding Remarks about Green Supply Chain Initiatives in Malaysia 88

3.4 Drivers for Green Supply Chain Initiatives in Malaysia 90

3.5 Concluding Remarks about Drivers for Green Supply Chain Initiatives in Malaysia 95

3.6 Outcomes of Green Supply Chain Initiatives in Malaysia 97

3.7 Concluding Remarks about Outcomes of Green Supply Chain Initiatives in Malaysia 99

3.8 Relationship Orientation in Malaysia 100

3.9 Theoretical Framework 103

3.10 Research Hypotheses 104

3.10.1 Direct Effects of Drivers on Green Supply Chain Initiatives 104

3.10.1.1 Effect of Regulations on Green Supply Chain Initiatives 105

3.10.1.2 Effect of Customer Pressures on Green Supply Chain Initiatives 107

3.10.1.3 Effect of Social Responsibility on Green Supply Chain Initiatives 108
3.10.1.4 Effect of Expected Business Benefits on Green Supply Chain Initiatives 110
3.10.2 Outcomes of Green Supply Chain Initiatives 111
3.10.2.1 Effect of Green Supply Chain Initiatives on Environmental Outcomes. 111
3.10.2.2 Effect of Green Supply Chain Initiatives on Economic Outcomes. 112
3.10.2.3 Effect of Green Supply Chain Initiatives on Intangible Outcomes. 113
3.10.3 Moderating Effect of Relationship Orientation 114
3.11 Control Variables 118
3.12 Summary of the Chapter 119
CHAPTER 4: RESEARCH METHODOLOGY 120
4.0 Chapter Overview 120
4.1 General Research Design 120
4.2 Population and Sample 121
4.3 Respondents 123
4.4 Development of the Survey Instrument 124
4.4.1 Items for Green Supply Chain Initiatives 124
4.4.2 Items for the Drivers 128
4.4.3 Items for the Outcomes 133

4.4.4 Items for Relationship Orientation 135

4.5 Questionnaire Design 138

4.6 Pre-Testing of the Questionnaire 139

4.6.1 Validity Testing 140

4.6.2 Reliability Testing 141

4.7 Survey Administration 142

4.8 Statistical Analysis Techniques 143

4.8.1 Descriptive Statistics 143

4.8.2 Factor Analysis 143

4.8.3 Reliability Analysis 144

4.8.4 Tests of Differences 145

4.8.5 Correlation Analysis 146

4.8.6 Multiple Hierarchical Regression 146

4.8.7 Moderated Hierarchical Regression 147

4.9 Summary of the Chapter 148

CHAPTER 5: SURVEY FINDINGS 149

5.0 Chapter Overview 149

5.1 Response Rate 149

5.2 Profile of Sample Firms and Respondents 152

5.3 Goodness of Measures 155

5.3.1 Factor Analysis of Green Supply Chain Initiatives 156

5.3.2 Factor Analysis of Green Supply Chain Initiatives Drivers 158

5.3.3 Factor Analysis of Green Supply Chain Initiatives Outcomes 161

5.3.4 Factor Analysis of Relationship Orientation 163

5.3.5 Reliability Analysis 165

5.4 Modified Research Framework and Hypotheses 166

5.5 Descriptive Analysis 169

5.5.1 Descriptive Analysis of Green Supply Chain Initiatives 169

5.5.2 Descriptive Analysis of Green Supply Chain Initiatives Drivers 184

5.5.3 Descriptive Analysis of Green Supply Chain Initiatives Outcomes 185

5.5.4 Descriptive Analysis of Relationship Orientation 186

5.6 Correlation Analysis 187

5.7 Hypotheses Testing 189

5.7.1 Effects of Drivers on Green Supply Chain Initiatives 190

5.7.2 Effects of Green Supply Chain Initiatives on Outcomes 197

5.7.3 Moderating Effect of Relationship Orientation 203

5.7.3.1 Moderating Effect of Supplier Relationship Orientation 205

5.7.3.2 Moderating Effect of Customer Relationship Orientation 212

5.8 Summary of the Chapter 218

CHAPTER 6: DISCUSSION AND CONCLUSION 220

6.0 Chapter Overview 220

6.1 Recapitulation of Findings 220

6.2 Discussion 226

6.2.1 Existence of Green Supply Chain Initiatives in Malaysia 226

6.2.2 Drivers for Green Supply Chain Initiatives 230

6.2.3 Outcomes of Green Supply Chain Initiatives 237

6.2.4 Moderating Effect of Relationship Orientation 239

6.2.5 Effect of Control Variables 242

6.3 Major Results of the Study 244

6.4 Implications of the Study 245

6.4.1 Theoretical Implications 245

6.4.2 Managerial Implications 249

6.5 Limitations of the Study 251

6.6 Directions for Future Research 254

6.7 Conclusion 257

REFERENCES 261

APPENDICES

Appendix A: QUESTIONNAIRE 286

Appendix A1: Questionnaire Design 287

Appendix A2: Covering Letter of the Questionnaire 294

Appendix A3: First Reminder Letter 295

Appendix A4: Second Reminder Letter 296

Appendix B SPSS OUTPUT 297

Appendix B1: Chi-Square Test for Differences between Early and Late Responses 298

Appendix B2: Profile of Responding Firms 304

Appendix B3: Profile of Respondents 306

Appendix B4: Factor Analysis 308

Appendix B4.1: Factor Analysis for GSCI 308

Appendix B4.2: Factor Analysis for Drivers 311
Appendix B4.3: Factor Analysis for Outcomes 315
Appendix B4.4: Factor Analysis for RO 318
Appendix B5: Reliability and Descriptive Statistics 321
Appendix B6: Tests for GSCI Differences 325
Appendix B6.1: T-tests for GSCI Differences 325
Appendix B6.2: ANOVA Tests 329
Appendix B7: Pearson Correlations between all the Variables 336
Appendix B8: Regression of Drivers on GSCI 337
Appendix B9: Regression of GSCI on Outcomes 346
Appendix B10: Moderated Hierarchical Regression for SRO 358
Appendix B11: Moderated Hierarchical Regression for CRO 364
Appendix C INTERVIEWS 370
Appendix C1: Interviews Transcripts 371
Appendix C2: Letter for the Interviews 379

LIST OF TABLES

		Page
Table 1.1	Major Environmental Pollutants, Sources, and Effects	5
Table 2.1	Green Supply Chain Initiatives Based on Literature	35
Table 2.2	Summary of Empirical Studies on Drivers for Environmental Initiatives	48
Table 2.3	Outcomes of Green Supply Chain Initiatives Based on Literature	52
Table 2.4	Summary of the Types of Isomorphism	66
Table 3.1	Key Profile Items for Company A and Company B	78
Table 4.1	Items for Eco-Design	126
Table 4.2	Items for Green Purchasing	127
Table 4.3	Items for Reverse Logistics	128
Table 4.4	Items for Regulations	129
Table 4.5	Items for Customer Pressures	130
Table 4.6	Items for Social Responsibility	131
Table 4.7	Items for Expected Business Benefits	133
Table 4.8	Items for Environmental Outcomes	134
Table 4.9	Items for Economic Outcomes	134
Table 4.10	Items for Intangible Outcomes	135
Table 4.11	Items for Customer Relationship Orientation	137
Table 4.12	Items for Supplier Relationship Orientation	138
Table 4.13	Pre-Test of the Questionnaire for Reliability	141
Table 5.1	Response Rate of the Study	150

Table 5.2	Chi-Square Test for Differences between Early and Late Responses	151
Table 5.3	Profile of Sample Firms	153
Table 5.4	Profile of Respondents	155
Table 5.5	Rotated Factor Loadings for Green Supply Chain Initiatives	157
Table 5.6	Rotated Factor Loadings for the Drivers	159
Table 5.7	Rotated Factor Loadings for the Outcomes	161
Table 5.8	Rotated Factor Loadings for the Relationship Orientation	164
Table 5.9	Cronbach's Alpha for Study Variables	165
Table 5.10	Restated Hypotheses	167
Table 5.11	Descriptive Statistics of Green Supply Chain Initiatives	170
Table 5.12	T-tests for Green Supply Chain Initiatives Differences	170
Table 5.13	ANOVA Tests for Differences of Green Supply Chain Initiatives by Some Elements of Firms' Profile	172
Table 5.14	Post Hoc Tests of Differences in Green Purchasing between Types of Industry	174
Table 5.15	Post Hoc Tests of Differences in Green Purchasing between Firm Sizes	175
Table 5.16	Post Hoc Tests of Differences in Eco-Design between Firm Sizes	177
Table 5.17	Post Hoc Tests of Differences in Green Purchasing between Firm Ownership	179
Table 5.18	Post Hoc Tests of Differences in Eco-Design between Firm Ownership	181
Table 5.19	Post Hoc Tests of Differences in Reverse Logistics between Firm Ownership	182
Table 5.20	Descriptive Statistics of Green Supply Chain Initiatives Drivers	185

Table 5.21	Descriptive Statistics of Green Supply Chain Initiatives Outcomes	186
Table 5.22	Descriptive Statistics of Relationship Orientation	186
Table 5.23	Mean, Standard Deviation, and Pearson Correlation Coefficients for All Variables	188
Table 5.24	Multiple Regression Result: The Effect of Control Variables and Drivers on Green Purchasing	192
Table 5.25	Multiple Regression Result: The Effect of Control Variables and Drivers on Eco-Design	194
Table 5.26	Multiple Regression Result: The Effect of Control Variables and Drivers on Reverse Logistics	195
Table 5.27	Summary of Hypotheses Testing Results for the Effect of Drivers on Green Supply Chain Initiatives	196
Table 5.28	Multiple Regression Result: Effects of Control Variables and Green Supply Chain Initiatives on Environmental Outcomes	198
Table 5.29	Multiple Regression Result: Effects of Control Variables and Green Supply Chain Initiatives on Economic Outcomes	199
Table 5.30	Multiple Regression Result: Effects of Control Variables and Green Supply Chain Initiatives on Cost Reductions	201
Table 5.31	Multiple Regression Result: Effects of Control Variables and Green Supply Chain Initiatives on Intangible Outcomes	202
Table 5.32	Summary of Hypotheses Testing Result for the Effect of Green Supply Chain Initiatives on the Outcomes	203
Table 5.33	Moderating Effect of Supplier Relationship Orientation on the Relationships between Drivers and Green Purchasing	205
Table 5.34	Moderating Effect of Supplier Relationship Orientation on the Relationships between Drivers and Eco-Design	208
Table 5.35	Moderating Effect of Supplier Relationship Orientation on the Relationships between Drivers and Reverse Logistics	210
Table 5.36	Moderating Effect of Customer Relationship Orientation on the Relationships between Drivers and Green Purchasing	213

Table 5.37	Moderating Effect of Customer Relationship Orientation on the Relationships between Drivers and Eco-Design	214
Table 5.38	Moderating Effect of Customer Relationship Orientation on the Relationships between Drivers and Reverse Logistics	216
Table 5.39	Summary of Hypotheses Testing Result for Moderating Effect of Relationship Orientation	217

LIST OF FIGURES

		Page
Figure 1.1	Types of Environmental Management Initiatives	12
Figure 1.2	The Concept of Green Supply Chain	14
Figure 2.1	Example of Impact Evaluation Matrix	39
Figure 2.2	Reverse Logistics Activities	45
Figure 2.3	Initial Theoretical Framework of the Study	74
Figure 3.1	Theoretical Framework of the Study	104
Figure 5.1	Modified Theoretical Framework	166
Figure 5.2	Differences in Green Purchasing between Types of Industry	174
Figure 5.3	Differences in Green Purchasing between Firm Sizes	176
Figure 5.4	Differences in Eco-Design between Firm Sizes	178
Figure 5.5	Differences in Green Purchasing between Types of Firm Ownership	180
Figure 5.6	Differences in Eco-Design between Types of Firm Ownership	182
Figure 5.7	Differences in Reverse Logistics between Types of Firm Ownership	183
Figure 5.8	Effect of Drivers on Green Supply Chain Initiatives	191
Figure 5.9	Effect of Green Supply Chain Initiatives on the Outcomes	197
Figure 5.10	Moderating Effect of Relationship Orientation	204
Figure 5.11	Moderating Effect of Supplier Relationship Orientation on Customer Pressures – Green Purchasing Relationship	207
Figure 5.12	Moderating Effect of Supplier Relationship Orientation on Customer Pressures – Eco-Design Relationship	209
Figure 5.13	Moderating Effect of Supplier Relationship Orientation on Customer Pressures – Reverse Logistics Relationship	211

MENGGUNAPAKAI INISIATIF RANTAIAN BEKALAN HIJAU OLEH FIRMA PEMBUATAN YANG DIIKTIRAF ISO 14001 DI MALAYSIA: PENDORONG UTAMA, HASILAN DAN KESAN PENYEDERHANAAN ORIENTASI HUBUNGAN

ABSTRAK

Isu-isu berkaitan alam sekitar sentiasa dititikberatkan oleh kerajaan, masyarakat dan organisasi perniagaan. Rantaian bekalan hijau muncul sebagai suatu pendekatan baru untuk memperluas tanggungjawab organisasi terhadap alam sekitar, yang meliputi keseluruhan rantaian bekalan mereka. Selain dari kepentingan rangkaian bekalan hijau dalam menyelesaikan isu-isu berkaitan alam sekitar dan menyediakan faedah ekonomi kepada organisasi, tidak banyak yang diketahui tentang rantaian bekalan hijau, terutamanya dalam konteks Malaysia. Kajian ini mengkaji sejauh mana kewujudan inisiatif rantaian bekalan hijau di Malaysia, pendorong yang memotivasikan firma-firma untuk menerima inisiatif tersebut, dan hasilan sebenar daripada menggunapakai tersebut. Selain itu, kajian ini mengkaji kesan penyederhanaan orientasi hubungan bekalan dan pelanggan terhadap perhubungan di antara pendorong dan inisiatif rantaian bekalan hijau. Untuk mencapai objektif ini, kajian ini menggunakan kaedah temu duga secara mendalam di samping kajian pos. Tiga temu duga secara mendalam dijalankan untuk menentukan pemboleh ubah dan perhubungan kajian. Analisis temu duga menunjukkan terdapatnya tiga kategori inisiatif rantaian bekalan hijau yang biasa ditemui di Malaysia (eko-rekaan, pembelian hijau, dan logistik berbalik), empat kategori pendorong (peraturan, tekanan pelanggan, tanggungjawab sosial dan faedah perniagaan dijangka), dan tiga kategori hasilan persekitaran (sekitar, ekonomi dan

hasilan tidak ketara). Kajian ini dijalankan di kalangan firma yang telah menerima pengiktirafan ISO 14001 di Malaysia. Sejumlah 132 respons yang boleh diguna telah diterima daripada responden. Analisis faktor tinjauan pada data kajian menambah satu lagi kategori, iaitu kategori keempat (pengurangan kos) dalam senarai hasilan. Keputusan kajian menunjukkan bahawa jangkaan faedah perniagaan merupakan pendorong yang paling mempengaruhi inisiatif rantaian bekalan hijau (mempunyai kesan positif terhadap tiga inisiatif lain) diikuti oleh peraturan dan tekanan pelanggan (mempunyai kesan positif ke atas eko-rekaan dan pembelian hijau) dan akhir sekali adalah tanggungjawab sosial (mempunyai kesan positif ke atas eko-rekaan sahaja). Kajian mendapati bahawa eko-rekaan mempunyai kesan positif ke atas kategori hasilan yang keempat, logistik berbalik mempunyai kesan positif dalam pengurangan kos sahaja, manakala pembelian hijau tidak menunjukkan kesan positif pada mana-mana hasilan. Kajian ini mendapati kesan penyederhanaan positif daripada orientasi hubungan bekalan terhadap hubungan di antara tekanan pelanggan dan tiga inisiatif rantaian bekalan hijau. Walau bagaimanapun, kajian mendapati tiada bukti yang meyakinkan untuk menyokong kesan penyederhanaan daripada orientasi hubungan pelanggan terhadap hubungan di antara pendorong dan inisiatif rantaian bekalan hijau. Di samping itu, kajian mendapati bahawa tiga daripada pemboleh ubah kawalan (jenis industri, pemilikan firma, dan penyertaan dalam persatuan hijau) mempunyai kesan positif terhadap inisiatif rantaian bekalan hijau.

ADOPTION OF GREEN SUPPLY CHAIN INITIATIVES BY ISO 14001 CERTIFIED MANUFACTURING FIRMS IN MALAYSIA: KEY DRIVERS, OUTCOMES, AND MODERATING EFFECT OF RELATIONSHIP ORIENTATION

ABSTRACT

Environmental issues constitute continuous concern for governments, societies, and business organizations. Green supply chains emerged as a new approach that extends environmental responsibility of organizations throughout their entire supply chains. Despite the importance of green supply chains in alleviating environmental issues and providing economic benefits to organizations, little is known about green supply chains, especially in the context of Malaysia. This study investigates the extent of existence of green supply chain initiatives in Malaysia, the drivers that motivate firms to adopt these initiatives, and the actual outcomes of adoption. In addition, the study investigates the moderating effect of supplier and customer relationship orientation on the relationships between the drivers and green supply chain initiatives. To attain its objectives, the study utilized in-depth interviews in addition to mail survey. Three in-depth interviews were conducted to specify variables and relationships of the study. Analysis of the interviews revealed three categories of green supply chain initiatives commonly found in Malaysia (eco-design, green purchasing, and reverse logistics), four categories of drivers (regulations, customer pressures, social responsibility, and expected business benefits), and three categories of outcomes (environmental, economic, and intangible outcomes). The survey was carried out among ISO 14001 certified firms in Malaysia. A

total of 132 usable responses were received from the respondents. Exploratory factor analysis of the survey data added fourth category of outcome (cost reductions) to the list of outcomes. The results of the survey indicate that expected business benefits is the most influential driver on green supply chain initiatives (has positive effect on the three initiatives) followed by regulations and customer pressures (have positive effect on eco-design and green purchasing), and lastly comes social responsibility (has positive effect on eco-design only). The study found that eco-design has positive effect on the four categories of outcomes, reverse logistics has positive effect on cost reductions only, whereas green purchasing does not show positive effect on any of the outcomes. This study found positive moderating effect of supplier relationship orientation on the relationships between customer pressures and the three green supply chain initiatives. However, the study found no convincing evidence to support the moderating effect of customer relationship orientation on the relationships between the drivers and green supply chain initiatives. In addition, the study found that three of the control variables (type of industry, firm ownership, and participation in green associations) have positive effect on green supply chain initiatives.

Chapter One

INTRODUCTION

1.0 Introduction

Natural environment becomes a challenging issue to business organizations in recent years as a result of global and local environmental problems. Business operations, such as sourcing, manufacturing, and logistics, are believed to be responsible for most of these problems (Beamon, 1999). Consequently, business operations have been subject to increasing pressures and scrutiny from various stakeholders inside and outside organization such as government agencies, workers, neighbors, and not-for-profit groups (Azzone & Noci, 1998; Sarkis, 2006). This is over and above growing demand of customers and environmental societies for more environmentally friendly products.

These challenges and pressures push firms to seriously considering environmental impacts while doing their business. Green becomes a common practice to portray the environmentally-friendly image of products, processes, systems and technologies, and the way business is conducted (Vachon & Klassen, 2006a). However, most of the adopted green solutions, especially in developing countries, remain to be the traditional command-and-control or "end-of-the- pipe" solutions where a firm tries to eliminate or reduce negative environmental impacts, after they are created, rather than adopting proactive approaches to reduce the sources of waste or pollution (Anbumozhi & Kanda, 2005; Walton, Handfield, & Melnyk, 1998).

The traditional green initiatives are associated with many weaknesses and problems. The end-of-the-pipe approach does not eliminate pollutants, but merely transforms them from one medium to another (Sarkis, 2006). Moreover, focusing green practices inside organization may expose the organization to negative environmental performance of other organizations in its supply chain. For instance, the poor environmental performance of small suppliers can affect badly the performance and image of buying companies (Christmann & Taylor, 2001; Cousins, Lamming & Bowen, 2004; Faruk et al., 2002; Hall, 2001). In addition, community stakeholders often do not distinguish between an organization's environmental practices and the practices of its suppliers (Rao, 2002; Sarkis, 2006).

In recent years, a more externally-oriented approach has been emerged where a firm extends its environmental responsibility beyond its boundaries and tries to reduce sources of waste and pollution throughout its entire supply chain. This extended responsibility occurs across multiple organizations, upstream and downstream the supply chain, and take different names including product stewardship, closed-loop supply chain, in addition to green supply chain (Canning & Hanmer-Lloyd, 2001; Faruk et al., 2002; Vachon & Klassen, 2006a).

This study address the issue of green supply chains as promising area of study and practice that have the potential to provide significant benefits to the firm and the society. The study tries to identify key drivers or motivators to green supply chain initiatives and the actual outcomes of these initiatives. In addition, the study explores the moderating effect of relationship orientation on the relationships between drivers and green supply chain initiatives. The study starts with this introductory chapter which

gives general idea about the research topic and problem of the study. The chapter starts with providing background of the study that includes explanation of environmental issues or concerns at the global as well as local (Malaysian) level. The background includes also illustration of the evolution of environmental initiatives and explanation of the concept and importance of green supply chain. The chapter then explains the problem of the study and the research questions and objectives. Next, the chapter portrays the significance of the study and its expected contributions. The chapter ends with defining the key terms of the study and organization of the thesis.

1.1 Background of the Study

As a result of mass industrialization and consumption around the world, environmental concerns are increasing in importance and effect on business objectives and performance. This section provides background information about environmental issues facing the world and Malaysia and explains the evolution of environmental initiatives in addition to the concept and importance of green supply chain and its expected role in mitigating these problems and providing advantages and opportunities to business organizations.

1.1.1 Global Environmental Issues

Today, the world witnesses several environmental problems at global level. The most serious of these problems are global warming and ozone depletion. Global warming is considered by many scientists to be the major environmental problem confronting life on Earth (Moffat, 2004). A recently released report by Intergovernmental Panel on

Climate Change (IPCC) stated that: "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC, 2007, p.5).

Other than global warming, there is the problem of ozone depletion. Ozone layer is a layer that protects the earth from harmful ultraviolet radiation. World Meteorological Organization (WMO) reported that ozone layer was found to be eroding, and over the South Pole the average ozone concentration was discovered to be down 50 percent, and in isolated spots it had actually disappeared forming what is known as 'ozone hole' (WMO, 2007).

It should be noted that developing countries are the most impacted by environmental problems. Markandya and Halsnaes (2004) estimated that over 90 percent of developing parts of the world are negatively impacted by climate change, with South and South East Asia being the most impacted, compared with only 0.1 to 0.5 percent in developed countries. Developing countries suffer most from climate change partly because the physical impacts are greatest in their regions and partly because of the large populations that are affected (Markandya & Halsnaes, 2004).

Beside these problems, countries around the world are suffering from local environmental pollution problem. Air pollution, water pollution, environmental degradation, and waste disposal represent continuous concern to many governments and societies. Numerous gas, liquid, and solid pollutants are produced by modern production and consumption activities that posit serious threats to human, animal, and plant health and life. Table 1.1 presents major types of these pollutants, their sources,

and effects on human health and ecological constituents. The table indicates that there are two major types of pollutants: (1) air pollutants; include harmful gases such as ozone and carbon monoxide, and (2) land pollutants; include harmful solid material such as lead and oil. Inspection of the sources of these pollutants reveals that business activities and their products are the major source of gases and other releases that cause global warming, ozone depletion, and other environmental problems.

Table 1.1

Major Environmental Pollutants, Sources, and Effects.

Pollutant	Sources	Effects
Particulate Matter (PM_{10}): Is the general term used to describe respirable particles of less than 10 microns in size.	Particulate Matter mainly come from motor vehicle exhaust, heat and power generation, industrial processes, and open burning activities.	PM_{10} can cause eye and throat irritation, as well as respiratory problems such as decreased lung functions. PM_{10} can cause also undesirable impact on environment such as reduced visibility, also can affect plant, soil, and water sources.
Ozone: A colorless gas that is the major constituent of photochemical smog at the earth's surface. In the upper atmosphere (stratosphere), however, ozone is beneficial, protecting the earth from the sun's harmful rays.	Sources of this pollutant include vehicles, factories, landfills, industrial solvents, and numerous small sources such as gas stations, farm and lawn equipment, etc.	Ozone causes significant health and environmental problems at the earth's surface. It can irritate the respiratory tract, produce impaired lung function. It can also reduce yield of agricultural crops and injure forests and other vegetation.
Carbon Monoxide: Odorless and colorless gas emitted in the exhaust of motor vehicles and other kinds of engines where there is incomplete fossil fuel combustion.	Automobiles, buses, trucks, small engines, and some industrial processes.	Reduces the ability of blood to deliver oxygen to vital tissues, affecting primarily the cardiovascular and nervous systems.
Nitrogen Dioxide: Light brown gas at lower concentrations; in higher concentrations becomes an important part of unpleasant-looking brown, urban haze.	Result of burning fuels in utilities, industrial boilers, cars, and trucks.	One of the major pollutants that causes smog and acid rain. Can harm humans and vegetations when concentrations are sufficiently high.
Sulfur Dioxide: Colorless gas, odorless at low concentrations but pungent at very high concentrations.	Emitted largely from furnaces and boilers, as well as petroleum refineries, smelters, paper mills, and chemical plants.	One of the major pollutants that causes smog. Can also, at high concentrations, affect human health. Can also harm vegetation and metals.

Table 1.1 ***(Continued)***

Pollutant	Sources	Effects
Lead: Lead and lead components can adversely affect human health through either ingestion of lead-contaminated soil, dust, paint, etc., or direct inhalation.	Transportation sources using lead in their fuels, coal combustion, smelters, car battery plants, and combustion of garbage containing lead products.	Elevated lead levels can adversely affect mental development and performance, kidney function, and blood chemistry.
Toxic Air Pollutants: Includes pollutants such as arsenic, asbestos, and benzene.	Chemical plants, industrial processes, motor vehicle emissions and fuels, and building materials.	Known or suspected to cause cancer, impairment of immune and nervous systems, respiratory effects, birth and reproductive defects.
Stratosphere Ozone Depleters: Chemicals such as chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform. These chemicals destroy the protective ozone layer that screens out harmful ultraviolet (UV) radiation before it reaches the earth's surface.	Industrial household refrigeration, cooling and cleaning processes, car and home air conditioners, some fire extinguishers, and plastic foam products.	Increased exposure to UV radiation could potentially cause an increase in skin cancer, increased cataract cases, suppression of the human immune response system, and environmental damage.
Greenhouse Gases: Gases that build up in the atmosphere that may induce global climate change – or the "greenhouse effect." They include carbon dioxide, methane, and nitrous oxide.	The main man-made source of carbon dioxide emissions is fossil fuel combustion for energy-use and transportation. Methane comes from agricultural processes. Nitrous oxide results from industrial processes, such as nylon fabrication.	The extent of the effects of climate change on human health and the environment include increased global temperature, increased severity and frequency of storms and other "weather extremes," melting of the polar ice cap, and sea-level rise.
Persistent Toxicants: PCBS, DDT, heavy metals, and so on.	Industrial discharge; wastewater from cities; pesticides from farms, forests, home use, and so on; seepage from landfills.	Poison or cause disease in coastal marine life. Contaminate seafood. Fat-soluble toxicants that bioaccumulate in predators.
Oil: Crude petroleum oil and its products.	Runoff from cars, heavy machinery, industry, other land-based sources; oil tanker operations and other shipping; accidents at sea; also offshore oil drilling and natural seepage.	Low-level contamination can kill larvae and cause disease in marine life. Oil slicks kill marine life, especially in coastal habitats. Tar balls from coagulated oil litter beaches and coastal habitat.

Source: Buchholz (1998, p.143, 144, 195).

In addition to pollution, there is a problem of rapid consumption of natural resources, especially the nonrenewable ones, such as oil, coal, metals, and forests, to provide raw materials and energy for economic activities. Such rapid consumption of natural resources posits serious questions about the availability of these resources for the coming generations (Buchholz, 1998). Beamon (1999, p.332) reported that "indeed, waste generation and natural resource use, primarily attributed to manufacturing, contribute to environmental degradation." Therefore, there is a need for business organizations to change their way of doing business to incorporate environmental issues in all of their operations. Greening business operations is suggested as a solution to the environmental problems. The continuation of "business as usual" models can have serious environmental, economic, and social consequences (Moffat, 2004).

1.1.2 Environmental Issues in Malaysia

There is a general trend in most Asian countries towards industrialization and manufacturing (Anbumozhi & Kanda 2005). Asia is now the world's largest manufacturing base, and is closing in on becoming the world's largest market (Wu & Cheng, 2006). In Malaysia, the trend towards industrialization is obvious. Malaysia moved from an agriculture-based economy, focusing on rubber and palm oil, to industrialized economy focusing on electronics and heavy industry (Rao, 2004). The Malaysian manufacturing sector contributed 32% of the gross domestic product (GDP) in 2007, exports of manufactured products account for 75 percent of Malaysia's total export in 2007 (MIDA, 2007).

Whereas such industrialization brings considerable economic and social benefits, it brings also negative environmental effects. The increased level of industrialization can result in environmental concerns such as land, water, and air pollution in addition to degradation of natural resources (Huong, 1999). Therefore, it is important for Malaysia to achieve a balance between high standard of living and environmental protection. As stated by Hassan, Awang and Jaafar (2006, p.270) "the challenge for the new millennium is to develop an industrial system that has minimal socio-ecological impacts, without compromising quality of life."

In Malaysia, environmental issues have become very important issue of concern for the Malaysian government and the public. The Environmental Quality Act was established in 1974 and has been amended a number of times to encompass 18 sets of regulations related to clean air, sewage and industrial effluent assessment (Rao, 2004). Moreover, numerous pressure groups were formulated to monitor environmental issues. Pressure groups include non-governmental organizations (NGOs) such as Environmental Protection Society of Malaysia, in addition to intense media coverage of environmental problems and inclusion of environmental issues in school curricula(GPNM (Green Purchasing Network Malaysia), 2003).

However, despite government efforts and growing public awareness of environmental issues, environmental problems continue to persist. The two major environmental problems facing Malaysia are atmospheric pollution and solid and hazardous wastes (Perry & Singh, 2002; Hassan, Awang & Jaafar, 2006). A recent environmental quality report published by the Malaysian Department of Environment (DOE) pointed that "the overall air quality for Malaysia in 2005 deteriorated quite

significantly compared to the previous year" (DOE, 2006, p.6). The report pointed out that the primary air pollutants in Malaysia are haze episodes, particulate matter, and ground level ozone (refer to Table 1.1 for explanations about these pollutants).

One of the major issues of concern in Malaysia is the increasing amount of solid wastes. Solid wastes are composed of end-of-life or 'consumed' products. Growing level of industrialization and consumption has increased the generation and types of solid waste (Hassan et al., 2006). The amount of solid waste generated in Malaysia increased from 16200 tonnes per day in 2001 to 19100 tonnes in 2005 or an average of 0.8 kilogram per capita per day (Ninth Malaysia Plan, 2007, p.455). Solid waste management is one of the most important issues of local authorities, where much money and efforts are spent in the collection and disposal of solid waste (Hassan et al., 2006).

Scheduled or unsafe wastes constitute the most hazardous part of solid wastes that may directly affect human health. The 2006 environmental quality report highlighted that scheduled wastes produced by the manufacturing industry is increasing. Specifically, the report mentioned that "a total 548916.11 metric tones of scheduled wastes were generated in 2005 as compared to 469584.07 metric tones in 2004" (DOE, 2006, p.58). The main part of this amount is being transferred to disposal sites without treatment, but within the nearest future (at least in 2010) the capacity limit of the nation's disposal sites will be hit (Hassan et al., 2006).

Whereas end-of-life products are increasingly being considered as environmental liability and business opportunity in many parts of the world, especially developed countries (Geyer & Jackson, 2004), the traditional approach in Malaysia and many developing countries towards end-of-life products is to landfill or incinerate them

with considerable cost and damage to the environment (Ferguson & Browne, 2001; Hassan et al., 2000; Rock, 2002). Despite concerted efforts to promote reuse, reduction and recycling (3Rs) of materials, the amount of solid waste recycled in Malaysia remained at less than 5.0 per cent of total waste disposed (Ninth Malaysia Plan, 2007).

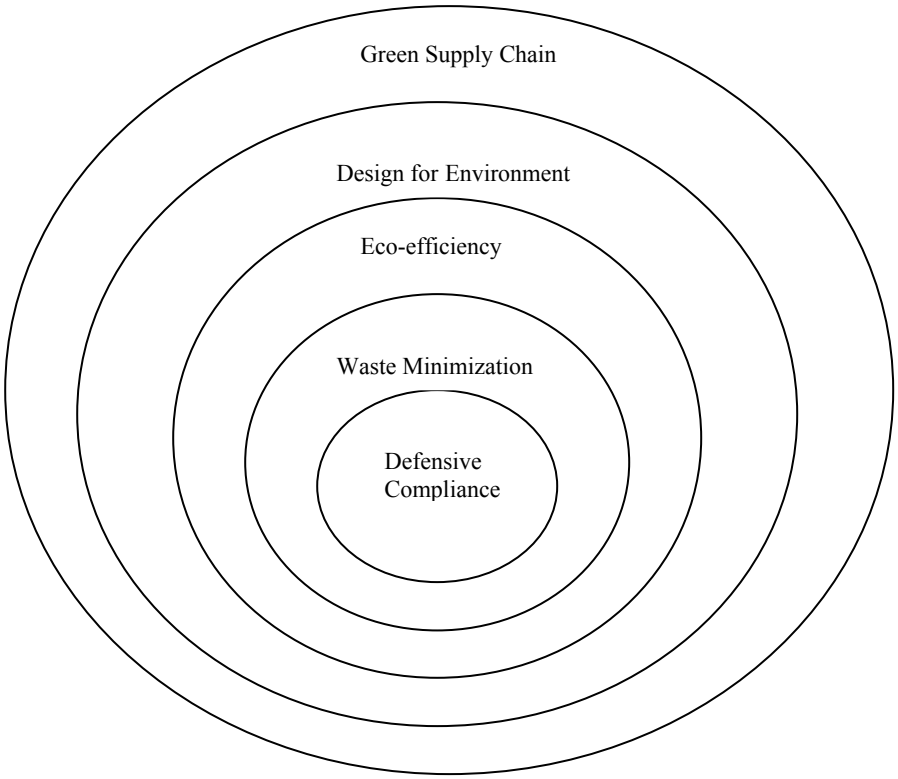
The above discussion signifies that Malaysia, and other countries, are facing serious challenge regarding how to balance economic development with environmental sustainability and, therefore, achieve the three components of "triple bottom line" of sustainability: social, economic, and environmental performance (Carter & Rogers, 2008; Wells & Seitz, 2005; Welford, 2004). In response to this challenge, business organizations start to adopt environmental management initiatives. These initiatives range from simple reactive ones to the more proactive initiatives, such as green supply chains. The following subsection illustrates environmental management initiatives undertaken by business organizations.

1.1.3 Evolution of Environmental Management Initiatives

Environmental management initiatives represent procedures and techniques that enable organizations to respond to environmental problems in an effective manner (Welford, 2000). These initiatives can be categorized into five types as follows:

1. ***Defensive Compliance*:** In this method, companies commit minimal resources to environmental management to comply with environmental legislations. Defensive compliance companies consider environmental issues as a regulatory nuisance to be met only because noncompliance would result in severe financial penalties (Handfield et al., 1997).

2. ***Waste Minimization or Cleaner Production*:** In this method companies go beyond compliance and try to minimize the amount of waste generated in the production process without fundamentally changing the pollution-generating process to prevent the waste from occurring. Such efforts are also referred to as 'end-of-pipe' solutions (Banerjee, 2001).
3. ***Eco-efficiency*:** Eco-efficiency tries to achieve both environmental and economic benefits to a firm. The World Business Council for Sustainable Development (WBCSD, 2006) defined eco-efficiency in terms of delivery of competitively priced goods and services designed to satisfy human need and enhance quality of life, while progressively reducing environmental impacts and resource intensity of these goods and services. The purpose of eco-efficiency is to maximize value creation while having minimized the use of resources and emissions of pollutants (WBCSD, 2006).
4. ***Design for Environment*:** Design for environment integrates environmental aspects or considerations, such as product recyclability and reusability, into the product design. Its goal is to consider the complete product life cycle when designing environmental aspects into a product or process (Sarkis, 1998).
5. ***Green Supply Chain*:** Green supply chain extends the idea of environmental management beyond the boundaries if organizations to include suppliers, customers and other players in the supply chain (Handfield et al., 2005). Extending green activities throughout the supply chain represents an evolution over environmental endeavors that focus on firm-specific impacts and end-of-pipe initiatives (Matos & Hall, 2007).



Source: Adapted from Welford (2000, p. 39)

Figure 1.1: **Types of Environmental Management Initiatives**

Comparing the five environmental management initiatives, it is clear that green supply chain incorporates the principles of other initiatives, i.e., waste minimization, eco-efficiency, and design for the environment (Handfield et al., 2005) as shown in Figure 1.1 above. However, green supply chain differs from the other initiatives by adding external dimension to environmental management. The following subsection illustrates further the concept and importance of green supply chain, as a focus of this study.

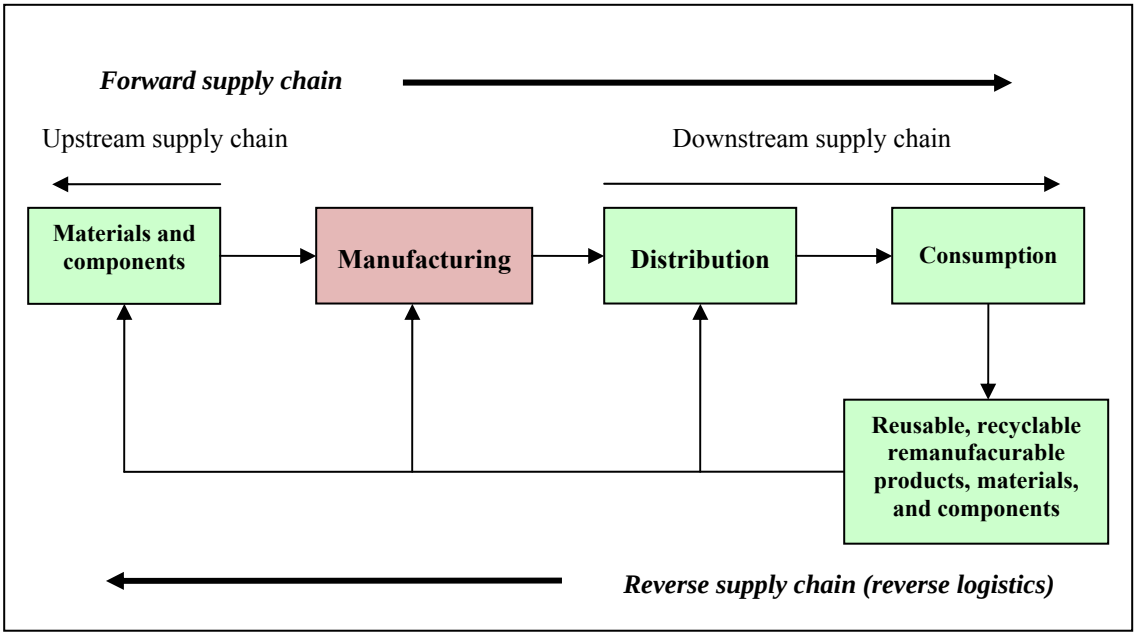
1.1.4 The Concept and Importance of Green Supply Chain

Supply chain is typically defined as "a set of three or more entities directly involved in the upstream or downstream flows of products, services, finances, and/or information from a source to a customer." (Mentzer et al., 2001, p.4). This definition of ordinary supply chain set the boundaries of supply chain to end in the final consumer. Moreover, the ordinary supply chains are based on a linear production paradigm which relies on constant input of virgin natural resources and unlimited environmental capacity for assimilation of wastes (Geyer & Jackson, 2004).

Unlike the ordinary supply chain, green supply chain considers environmental impacts of products and services while they flow throughout the supply chain. Green supply chain is defined as "the extension of the traditional supply chains to include activities that aims at minimizing environmental impacts of a product throughout its entire life cycle, such as green design, resource saving, harmful material reduction, and product recycle or reuse." (Beamon, 1999, p.339).

From the definitions of both ordinary and green supply chains it is clear that green supply chain "close the loop" of a typical common or forward supply chain by including reuse, remanufacturing, and/or recycling of products and materials into the common forward supply chain (Wells & Seitz, 2005). The objective of green supply chain is to eliminate or minimize negative environmental impacts (air, water, and land pollution) and waste of resources (energy, materials, products) from the extraction or acquisition of raw materials up to final use and disposal of products (Eltayeb & Zailani, 2007; Hervani, Helms & Sarkis, 2005). Figure 1.2 illustrates the concept of green supply chain. The figure shows two types of supply chain: forward supply chain that

delivers goods and services to end consumers, and reverse supply chain that takes back used products for the purpose reuse, remanufacture, or recycling.



Source: Adapted from Hervani, Helms and Sarkis (2005, p.335)

Figure 1.2: **The Concept of Green Supply Chain**

From Figure 1.2 above, it is obvious that green supply chain deals with environmental issues at both forward and reverse supply chain. At forward supply chain, green supply chain addresses environmental issues at both the back (upstream) and end (downstream) supply chains (Geyer & Jackson, 2004; Seuring, 2004).

At downstream, green supply chains focus on reducing environmental burdens of products during their use and disposal. Such reduction can have significant environmental benefits because products normally generate significant environmental emissions and wastes during their use that may exceed those generated during manufacturing stage (Hassan, Awang, & Jaafar, 2006).

At upstream supply chains, green supply chains can have significant effects in improving environmental performance of suppliers (Sarkis, 2006). In Malaysia, environmental problems of suppliers constitute major concern because most suppliers are small and usually lack resources and capabilities to improve their environmental performance (GPNM, 2003; Rao, 2006). Therefore, green supply chains can contribute to the problem of greening of suppliers, especially in developing countries.

In addition to the forward supply chain benefits, green supply chain closes the loop by including reverse supply chain. Reverse supply chains fulfill two main objectives. First, it diverts end-of-life products from landfill or incineration by collecting them for economic value recovery. Second, the secondary resources that result from the reprocessing of these end-of-life products replace primary resources in forward supply chains.

In this respect, green supply chains can have environmental and business benefits. Studies show that green supply chains can result in reduced costs of materials and energy (Carter, Kale & Grimm, 2000; Zhu & Sarkis, 2004), improved market performance (Rao & Holt, 2005), and improved image and reputation of the firm (Bakken, 2004). Furthermore, anecdotal evidence shows that many firms realize economic benefits from green supply chains, for instance:

- Commonwealth Edison produced US$50 million in financial benefits from managing materials and equipment with a life-cycle management approach.
- Texas Instruments saves US$8 million each year by reducing its transit packaging budget for its semiconductor business through source reduction, recycling, and use of reusable packaging systems (20% annual savings).

- Xerox implemented a program to take back used copiers as a source of material for new machines. Customers like the program because they no longer worry about machine disposal. Xerox estimates "several hundred million" dollar savings annually (LMI, 2005).

Accordingly, green supply chains are important for alleviating global and local environmental problems in addition to providing economic and competitive benefits to organizations (these issues will be further explained in Chapter 2). The importance and value of green supply chains motivated the researcher to conduct this study to explore more on this topic and shed some light on it as a promising area of study and practice.

1.2 Statement of the Problem

Whereas the concept of green supply chain has valuable environmental and business value and represents an evolution over firm-specific and end-of-pipe environmental initiatives, the available evidence indicates that green supply chain initiatives are not wide-spread among business organizations especially in developing countries (Anbumozhi & Kanda, 2005; IGES, 2005;.OECD, 2004; Ramasamy & Ting, 2004; Srivastava & Srivastava, 2005; Thompson & Zakaria, 2004; Zhu, Sarkis & Lai, 2007a). The Green Purchasing Network of Malaysia (GPNM) reported that:

> *At present, the practice of green purchasing amongst the manufacturing industries including the SMIs in Malaysia is virtually non-existent. This is because the concept is still new to many. The implementation of environmental techniques by Malaysian SMIs is based very much on ad-hoc practices and many of them do not actually subscribe to any particular environmental concept* (GPNM, 2003, p.23).

The main reasons for this low level of spread of green supply chain initiatives include:

1. High cost of green supply chain initiatives coupled with uncertainty of returns (Bowen et al., 2001b; Clift, 2003; Min & Galle, 2001; Linton, Klassen & Jayaraman, 2007; Vachon & Klassen, 2006a; Walley & Whitehead, 1994; Wu & Cheng, 2006; Wycherley, 1999),
2. Lack of resources, expertise and capabilities (Bakker & Nijhof, 2002; Lamming & Hampson, 1996; Simpson, Taylor & Barker, 2004; Rao, 2006; Richey, Genchev & Daugherty, 2005; Sinding, 2000),
3. Complexity of green supply chain relationships (Lamming, 1996; Matos & Hall, 2007).

Handfield, Melnyk, Calantone, and Curkovic (2001) summarized the obstacles facing green supply chain initiatives in three main points:

(1) Managers believe that minimal environmental performance is sufficient, since the environment does not have a direct impact on competitive priorities and considered as costly deterrent to productivity,

(2) Managers are unsure how to improve their environmental performance and what is meant by being "green".

(3) With severe competition and shorter product life cycle, managers are under pressure to improve quality, reduce costs, and improve flexibility to satisfy customer requirements (even if this means less environmentally practices and products are adopted).

With these obstacles in mind, questions arise about to what extent green supply chain initiatives exist in practice? What are the drivers that motivate organizations to

adopt these initiatives? And what are the actual outcomes realized by the adopting organizations?

In-depth search in the available literature shows that there is a lack of studies that try to answer these questions (Srivastava, 2007). Rao (2002) pointed to the dearth of research concerning supply chain environmental management even in developed countries where it originated, although it might prove to be an important solution to greening industry in South East Asia region. Vachon and Klassen (2006a, p. 796) pointed out that "very little research has focused on the management of green supply chain initiatives and their potential impact on an organization's environmental management."

In Malaysia, there is a lack of empirical studies that investigate even the mere existence of green supply chain initiatives in the country. With the exception of Rao (2002) study, no other study found empirically investigating the extent of existence of green supply chain initiatives in the general South East Asian region. However, Rao's study investigates the existence of green purchasing based on a sample of only 52 companies taken from five countries (Philippines, Indonesia, Malaysia, Thailand, and Singapore), therefore it is difficult to draw valid and reliable conclusions about the existence of green supply chain initiatives in Malaysia from his study.

Besides investigating the extent of green supply chain initiatives adoption, the study tries to find out the drivers or motivators that induce business organizations to adopt green supply chain initiatives. These drivers are expected to contribute to the diffusion of green supply chain initiatives among business organizations. The few empirical studies that investigate the drivers for green supply chain initiatives found

mixed results. For instance, whereas some studies found significant positive relationship between regulations and green purchasing (Min & Galle, 2001; Preuss, 2001) and customer pressures and green purchasing (Carter & Carter, 1998), other studies found no significant relationship between regulations and green purchasing (Bowen et al., 2001a; Zhu, Sarkis & Lai, 2007a) and between customer pressures and green purchasing (Zhu, Sarkis & Lai, 2007a). Therefore, the true drivers that induce firms to adopt green supply chain initiatives remain to be unresolved issue.

In addition to investigating the drivers for green supply chain initiatives, this study investigates the outcomes of adopting green supply chain initiatives. The study of the outcomes of green supply chain initiatives is expected to portray effects of green supply chain initiatives on business firms. The relationship between green supply chain initiatives and performance outcomes has been subject to numerous studies but the results are not conclusive. Whereas Carter, Kale and Grimm (2000), Rao and Holt (2005), and Zhu and Sarkis (2004) found that green supply chain initiatives have significant positive relationship with environmental and economic performance of organizations, Vachon and Klassen (2006b) and Zhu, Sarkis and Lai (2007a) found no significant relationships between green supply chain initiatives and such performance outcomes. This inconclusive result raises the question of what are the actual outcomes that can be realized from the adoption of green supply chain initiatives.

Moreover, the available studies investigated only the environmental, economic, and operational outcomes of green supply chain initiatives. However, intangible outcomes, such as organizational image and customer loyalty, received little consideration as an outcome of green supply chain initiatives. Although empirical

studies showed that intangible outcomes result from the adoption of internal green practices such as Environmental Management Systems (EMS), (Hui, Chan & Pun, 2001; Perry & Singh, 2002; Poksinska, Dahlgaard & Eklund, 2003; Rao, 2002; Sulaiman & Ahmad, 2002; Tan, 2005; Vastag & Melnyk, 2002), no empirical study found investigating the intangible outcomes of green supply chain initiatives. Therefore, this study tries to find out actual environmental, economic and intangible outcomes resulting from the adoption of green supply chain initiatives.

In addition to finding out the drivers and outcomes of green supply chain initiatives, the study investigates the moderating effect of relationship orientation on the relationships between the drivers and green supply chain initiatives. Relationship orientation refers to the relationships between an organization and its customers and suppliers. Previous research showed that relationship orientation can help the firm in adopting environmental initiatives through improving capabilities, setting standards, sharing resources, exchanging expertise and knowledge, reducing transaction costs, and changing products and processes (Boyd et al., 2007; Dyer & Chu, 2003; Florida, 1996; Florida & Davison, 2001; Geffen and Rothenberg, 2000; Green, Morton & New, 1996; Sarkis, 1995; Theyel, 2006). However, no previous study found investigating the moderating effect of relationship orientation on the drivers-green supply chain initiatives relationships.

The study of the effect of relationship orientation is of special importance to the adoption of green supply chain initiatives because these initiatives are mainly external-oriented and depend on external parties in their adoption. Therefore, existence of strong relationships with external parties, especially suppliers and customers, is expected to

help in the diffusion of green supply chain initiatives among business organizations. Relationship orientation is also is of special importance in Asian countries such as Malaysia. Unlike the situation in Western countries, Asian business is characterized by the existence of strong, culturally-based, relational bonds (Chen, 1995; Lasserre & Shuttle, 1999). Whereas studies in other fields, such as marketing (Roslin & Melewar, 2004; Sin et al., 2002), demonstrated the positive role of these bonds in improving distribution channel and marketing performance, no study found investigating their effect on green initiatives in general and green supply chain initiatives in particular.

In summary, the main problem of the research can be stated as follows: "To what extent green supply chain initiatives being adopted in the manufacturing sector in Malaysia? What motivate firms to adopt these initiatives? What are the outcomes of adoption? And what is the effect of relationship orientation on the adoption process?"

1.3 Research Questions

Based on the problem of study, the specific research questions that the study tries to answer are:

1. To what extent green supply chain initiatives are adopted among the certified manufacturing firms in Malaysia?
2. What are the key drivers that induce these firms to adopt green supply chain initiatives?
3. What are the outcomes that result from green supply chain initiatives adoption?
4. What is the moderating effect of relationship orientation on the relationships between the drivers and green supply chain initiatives?

1.4 Research Objectives

Based on the above questions, the study tries to attain the following objectives:

1. To investigate the extent of adoption of green supply chain initiatives among the certified manufacturing firms in Malaysia.
2. To identify the drivers that induce these firms to adopt green supply chain initiatives.
3. To identify outcomes that result from the adoption of green supply chain initiatives.
4. To examine the moderating effect of relationship orientation on the relationships between the drivers and green supply chain initiatives.

1.5 Scope of the Study

This study is mainly exploratory and explanatory in nature. According to Aaker and Day (1986, p.51): "exploratory research is used when one is seeking insights into the general nature of a problem, the possible decision alternatives, and relevant variables that need to be considered. There is typically little prior knowledge upon which to build." Given that green supply chain is a new area of study and practice and little is known about it, especially in the context of Malaysia, the exploratory part of the study is necessary to explore and describe green supply chain initiatives in Malaysia.

Based on the exploratory part, the study identifies variables of the study and depicts relationships between these variables in a form of theoretical framework. To specify the nature and strength of relationships in the framework, the study includes explanatory part which is based on using statistical techniques to test the relationships.

Accordingly, the study contains qualitative and quantitative parts. The qualitative part contributes to the development of basic variables and hypotheses of the study. However, the study depends, in its generation of main findings and conclusions, on the quantitative part of the study. This means that the qualitative part serve mainly as the basis of the quantitative part of the study.

The integration of qualitative and quantitative approaches, i.e, literature review, in-depth interviews, and survey, to answer the research questions is called triangulation (Jick, 1979). Triangulation allows researchers to be confident in their results, help to uncover the deviant or off-quadrant dimension of a phenomenon, and better develop the study's hypotheses and ground a set of constructs for empirical testing (Jick, 1979; Snow & Thomas, 1994; Wacker, 1998).

The study focuses on ISO 14001 certified manufacturing firms in Malaysia. The manufacturing sector was selected because it is the largest sector in terms of sales, employment, and contribution to the economy (MIDA, 2007; Department of Statistics Malaysia, 2007). Moreover, the sector has tremendous contribution to the environmental problems in Malaysia (DOE, 2006). Thereby, any effort to improve environmental performance of this sector can produce substantial benefits. Within the manufacturing sector, the study focuses on EMS ISO 14001 certified companies. These companies were selected because they are expected to have the highest level of green supply chain initiatives adoption (refer to Chapter 4 for details).

The study concentrates on product-based green initiatives and not process-based ones. This means that the study do not indulge in the technical aspects of greening production processes such pollution control technologies used inside organizations. The

focus of the study is limited to environmental issues related to materials and product such as product design, material sourcing, and return of products. This is consistent with the suggestion of Handfield, Sroufe and Walton (2005, p.18) who suggested that: "to best integrate environmental issues into supply chain management, companies should begin by evaluating the role of environmental issues in commodity strategies."

The study focuses on the *adoption* of green supply chain initiatives. By focusing on adoption, the study concentrates on the initial acceptance and take up (internalization) of green supply chain initiatives, without indulging into the issues related to subsequent phases of implementation. The focus on the adoption or initial take up of green supply chain initiatives is consistent with the general objective of the research, i.e., to see how the initiatives are generally diffused among manufacturing firms and not how they are successfully implemented within the firms.

The study investigates green supply chain initiatives, as well as relationship orientation, from the perspective of relationships of a firm with its immediate suppliers and customers. This means that the study do not include the members of extended and ultimate supply chains, i.e., supplier's suppliers and customer's customers (Mentzer et al., 2001). The exclusion of these members of the supply chain was done because the data were collected from a focal firm (manufacturer) in the supply chain. Whereas it is easy for a firm to evaluate its relationships with direct suppliers and customers and provide reliable data concerning these relationships, it is very difficult for the firm to provide reliable data concerning its extended supply chain members due to the lack of direct interactions with these members.