

RESIDENTS' PERCEPTIONS OF ENVIRONMENTAL IMPACTS OF THE 2008 BEIJING  
GREEN OLYMPIC GAMES

By

LIYAN JIN

A THESIS PRESENTED TO THE GRADUATE SCHOOL  
OF THE UNIVERSITY OF FLORIDA IN A PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF SCIENCE

UNIVERSITY OF FLORIDA

2010

© 2010 Liyan Jin

To my family and friends

## ACKNOWLEDGMENTS

I would like to acknowledge the support I have gotten from my committee, especially Dr. James J. Zhang for his guidance and direction through the process. As my advisor, Dr Zhang provided invaluable assistance in keeping me on track and working toward the goal. In addition, other committee members Drs. Daniel Connaughton, Kyriaki Kaplanidou, Matthew Walker, Michael Sagas and Xingdong Ma provided thoughtful guidance and advice to keep me moving through the process. I am grateful for their help and patience. I also thank my parents and my friends for their loving encouragement and support.

## TABLE OF CONTENTS

	<u>page</u>
ACKNOWLEDGMENTS .....	4
LIST OF TABLES .....	7
LIST OF FIGURES .....	8
LIST OF ABBREVIATIONS.....	9
ABSTRACT.....	10
CHAPTER	
1 INTRODUCTION .....	11
Statement of Problem .....	13
Purpose of the Study .....	14
Research Questions.....	14
Theoretical Framework.....	14
The Yale Attitude Change Approach .....	15
Theory of Reasoned Action.....	16
Social Exchange Theory.....	16
2 REVIEW OF LITERATURE .....	19
History of the Olympic Games .....	19
Origin of the Games .....	19
Bidding Development.....	20
Development of the Green Olympics .....	23
Organizations Involved .....	23
The Third Dimension .....	26
Olympic Games and Environmental Responsibility .....	28
Contributions of Previous Host Cities.....	29
Tokyo and Seoul Olympic Games .....	29
Lillehammer, Sydney, and Torino Olympic Games .....	30
2008 Beijing Green Olympics .....	32
“Green Olympics” in Beijing .....	33
Beijing’s Preparations for “Green Olympics” .....	34
Air Quality.....	34
Energy.....	35
Public Transportation .....	37
Water Environment .....	39
Ecological Conservation and Construction .....	41
Industrial Pollution .....	42

Solid Waste Management.....	43
Awareness, Perception, and Attitude.....	44
Awareness of Green Olympics.....	44
Awareness and Attitude.....	46
Residents Perceptions of Mega Events.....	47
Residents' Attitude toward Mega Event.....	51
Summary.....	52
3  METHOD .....	56
Participants .....	56
Instrument.....	58
Procedures.....	60
Data Analyses .....	61
4  RESULTS .....	65
Descriptive Statistics .....	65
Intercorrelations.....	67
Hierarchical Regression Analyses .....	68
5  DISCUSSION.....	77
Implication .....	81
Future Study.....	82
APPENDIX	
A  SAMPLE OF QUESTIONNAIRE .....	84
B  SAMPLE OF CONSENT FORM FOR PARTICIPANTS.....	90
LIST OF REFERENCES .....	91
BIOGRAPHICAL SKETCH .....	100

LIST OF TABLES

<u>Table</u>	<u>page</u>
3-1 Discriptive statistics for Sociodemographic Variables (N=298). .....	63
4-1 Item Analysis for the Awareness Variable. ....	71
4-2 Descriptive Statistics for the Perception Factors. ....	72
4-3 Descriptive Statistics for the Attitude, Behavioral Intention, and Actual Behavior Factors. ....	73
4-4 Zero-order Correlation among Awareness, Perception, Attitude, Behavioral Intention, and Actual Behavior Factors. ....	74
4-5 Hierarchical Regression Analyses Examining the Relationships of Awareness, Perception, Attitude, and Behavioral Intentions to Actual Behavior Associated with Green Olympics Movement. ....	75
4-6 Hierarchical Regression Analyses Examining the Relationships of Awareness, Perception, Attitude, and Behavioral Intentions to Actual Behavior Supporting Mega Sport Events. ....	76

## LIST OF FIGURES

<u>Figure</u>	<u>page</u>
2-1 Theoretical Model--Relationships among Awareness, Perception, Attitude, Behavior Intention, and Actual Behavior. ....	55

## LIST OF ABBREVIATIONS

BOCOG	Beijing Organizing Committee for the Olympic Games
CFCs	Chlorofluorocarbons
CNG	Compressed Natural Gas
CO	Carbon Monoxide
EB	Executive Board
EPB	Beijing Environmental Protection Bureau
HCC	Host City Contract
HCFC-22	Hydrochlorofluorocarbons-22
NO <sub>2</sub>	Nitrogen Dioxide
NOC	National Olympic Committee
IOC	International Olympic Committee
IPC	International Paralympic Committee
PM <sub>10</sub>	Particulate Matter
PV	Polyvinyl
PVC	Polyvinyl Chloride
UNEP	the United Nations Environmental Program

Abstract of Thesis Presented to the Graduate School  
of the University of Florida in Partial Fulfillment of the  
Requirements for the Degree of Master of Science

RESIDENTS' PERCEPTIONS OF ENVIRONMENTAL IMPACTS OF THE 2008 BEIJING  
GREEN OLYMPIC GAMES

By

Liyan Jin

May 2010

Chair: James J. Zhang  
Major: Sport Management

The significance of environmental sustainability has been widely recognized throughout the world. The Olympic Games, which aim to serve the harmonious development of human dignity, have integrated the environment as a third dimension along with sport and culture since 1996. The purpose of the study was to explore the level of awareness of Beijing Green Olympic Initiatives, perceived environmental impact, attitude toward the Olympic Games, behavioral intentions to support future hosting of mega sport events, and actual behavior among residents in Beijing as the host city of Olympic Games during the post-game management period. The Yale attitude change approach, the theory of reasoned action, and the social exchange theory served as the theoretical foundation for this study to examine the relationship among awareness, perception, attitude, behavior intention and actual behavior. As a result of the Zero-order correlation analysis, significant relationships were found among perception factors, attitudinal factors, behavioral intention factors, and actual behavior factors. The Hierarchical regression analyses for actual behaviors of supporting mega sport events showed that the behavioral intention and attitude factors presented mediating effects, while awareness was not found to be predictive of actual behaviors of mega sport events.

## CHAPTER 1 INTRODUCTION

Today, the significance of the environment has been widely recognized throughout the world. The blemished environment should become an important concern for every country, organization, and citizen. This holds true for all sport events, especially the Olympic Games, one of the greatest sport events in the world, which involve a large number of people from almost every country. According to Jagemann (2003), sport can be a considerable cause of damage to the environment due to the use of non-renewable resources, the emission of detrimental substances during the construction process and operation of sport facilities, and the production and disposal of sport equipment. To reduce the negative impact from sport activities, it is important to integrate environmental concerns into the development of sport events.

Hosting the Olympic Games may cause severe environmental problems with numerous resources, activities, and constructions involved, such as waste accumulation, air pollution, and noise pollution. Early in 1989, Mathisen suggested that “the Games would disturb the area’s ambience and nature setting” (1989: p.142). The 1992 Winter Olympic Games in the French Savoy Region led to widespread environmental damage and urged the International Olympic Committee (IOC) to respond and present a strategy for repelling the adverse impacts of the mega event (Cantelon & Letters, 2000). In an attempt to avoid and eliminate the potential and existing conflicts, the environment was added to the Olympic movement as the third pillar along with sport and culture in 1996 (Beyer, 2006). Since then, environmental issues have become one of the key factors to choose a host city, and have been considered as the essential concerns during the host city’s preparatory period. Sydney was the first city to win an Olympic bid with a comprehensive environmental protection plan. However, both Sydney, Australia (2000) and

Athens, Greece (2004) were widely regarded as failures in executing principles of environmental sustainability during the Olympic Games (Chan, Koenig, & Rajarethnam, 2006).

Greenpeace originally considered the “Green Games” as a global showcase of integrating environmental concerns into areas such as transportation, energy, waste disposal, refrigeration, and construction (Chan et al., 2006). The concept of the Green Games eventually evolved into a mandate from the International Olympic Committee (IOC), and has been a component of every Olympic Games since 2000 (Chan et al., 2006). For the 2008 Beijing Olympic Games, Beijing worked closely with the IOC, the United Nations Environmental Program (UNEP), and Greenpeace to stage Green Games. New technologies and policies were widely used to improve air quality and energy efficiency in China. Green Programs were applied to beautify the appearance of the city, and educational projects were carried out to increase Chinese citizen awareness of environmental problems and stimulate proper behaviors toward a clean environment.

Residents’ perceptions of the impacts from mega events have been studied by a number of researchers. Event planners and organizers must consider the views of residents of the host city to obtain successful and sustainable investments (Williams & Lawson, 2001). Deccio and Baloglu (2002) stated that the cooperation of local residents acts as a vital element in the success of mega events such as the Olympic Games. They also suggested that residents’ supportive attitude toward the events is likely to determine the longevity of their positive behaviors. A wide range of studies on residents’ perceptions of mega events have been conducted in western countries such as the United States, Canada, Australia, and several European countries. However, there are few such studies in developing countries, particularly rare in China, where studies about residents’ perceptions of the environment are scarce. As the third Summer Green Games and the

first Olympic Games in China, the 2008 Beijing Olympic Games were of great significance and special meaning to the world and the host country. Beijing spent billions of dollars on hosting the 29th Summer Olympic Games, especially on improving the environment.

To successfully host the Green Olympics, Beijing made impressive progress in environmental protection. Aiming to improve the air quality, Beijing greatly increased the use of clear and renewable energy, applied a variety of energy saving technologies, expanded public transportation system, and set very stringent emission standards. Wastewater treatment plants, along with sewage and water reuse systems, were improved to satisfy the water needs and increase the efficiency in the use of water. Regulations and laws were enforced to protect water sources and improve water quality in Beijing. A set of greening projects was carried out in Beijing to increase the green coverage and beautify the city. As for controlling the industry pollutions, Beijing closed and relocated a large number of polluting companies and set new industrial regulations. Solid waste management systems were improved in Beijing, and recycle projects were initiated to encourage residents to separate waste collection. Furthermore, a series of environmental education programs were implemented not only in Beijing but also across the whole country to raise awareness of environmental problems and increase environmental knowledge within the public.

### **Statement of Problem**

Previous researchers have investigated mega events from a variety of aspects and presented that they have social, economical, and environmental impacts on the host community. However, most of previous studies on large-scale sport events have primarily focused on economic impacts of sport events (Barker, Page & Meyer, 2002; Fredline & Faulkner, 2000; Twynam & Johnston, 2004). After the 2008 Olympic Games were held, it is necessary to investigate the effectiveness

of Beijing in greening the Games, promoting the awareness of environment among its residents, and influencing residents' attitudes toward the Olympic Games.

### **Purpose of the Study**

The purpose of the study was to explore the awareness of Green Olympics, perceived environmental impact, attitude toward the Olympic Games, behavioral intentions to support future hosting of mega sport events, and actual behavior toward the Olympics among residents in the host city of Beijing Olympic Games. This study would further examine the relationship among awareness, perception, attitude, and behavioral intentions.

### **Research Questions**

The following were the research questions in this study:

1. What were the levels of awareness of Green Olympics, perceived environmental impact, attitude toward the Olympic Games, behavioral intentions to support future hosting of mega sport events, and actual behavior toward the Games among residents in Beijing as the host city after the 2008 Olympic Games?
2. What were the relationships among awareness of Green Olympics, perceived environmental impact, attitude toward the Olympic Games, behavioral intentions to support future hosting of mega sport events, and actual behavior toward the Games among residents in Beijing as the host city after the 2008 Olympic Games?

### **Theoretical Framework**

In numerous academic disciplines ranging from psychology, sociology, marketing, to advertising, researchers have developed or adopted various theories to explain the concepts of awareness, perception, attitude, and behaviors, and how these components are interrelated. To guide the conduct of this study, three related theoretical approaches were reviewed and adopted. The theoretical framework for this study was primarily based on the Yale attitude change approach, Ajzen and Fishbein's (1980) theory of reasoned action, and Ap's (1992) social exchange theory.

## **The Yale Attitude Change Approach**

The Yale attitude change approach developed by Carl Hovland indicates that human attitudes (the affective component) are usually influenced or changed by altering the opinions or beliefs (the cognitive or knowledge component) that people have (Zimbardo, Ebbesen & Maslach, 1977). This approach presents a sequential process with four elements: attention, comprehension, acceptance, and retention. Together, these elements determine how effective the persuasive communication can be. Specifically speaking, to change a person's attitude, the first step is to get the individual's attention to the communicated content. Second, the message used to change the individual's attitude must be understood by the person. Third, the arguments and conclusions delivered via the message must be accepted by the receiver. Fourth, the major point of the message must be retained long enough to change the person's attitude. The effectiveness of the communication is influenced by the source of the message (i.e., the credibility, status, race, religion), the characteristics of the message (i.e., the structure, order, type of appeal), the characteristics of the audience (i.e., persuasive-ability, intelligence, self-esteem, initial position), and audience's reactions to a persuasive message. Based on this approach, a person's opinion, perception, affect, and action can be changed following the processes (Zimbardo et al., 1977). The Yale attitude change approach explains that attitude can be changed by altering beliefs (knowledge) and other related factors may influence the process of attitude change. In this study, awareness and perception are a state of knowledge; therefore, awareness is likely to impact one's attitude. Change of knowledge will lead to the change of attitude. After Beijing was selected as the host city of the 2008 Olympic Games, a large number of messages about the Green Olympics were delivered to the Chinese citizens, especially residents in Beijing, through government announcements, media publicity, educational programs, and community campaigns.

## **Theory of Reasoned Action**

Ajzen and Fishbein's (1980) Theory of Reasoned Action is an approach to predict and understand an individual's behavior. To explain this theory in reverse order of concepts, a person's behavior is determined by his/her behavioral intention which is a function of his/her attitude toward the behavior and subjective norms. Attitude toward the behavior is influenced by the individual's beliefs about the consequences of performing a behavior and his/her evaluation of the outcomes, either positive or negative. Subjective norms are impacted by one's beliefs that specific individuals or groups think he/she should or should not perform the behavior. Exposure to different information lead to the formation of different beliefs, which also reflect a person's past experience. Azjen and Fishbein stated that "attitudes are a function of beliefs" (p. 7) and that "attitudes toward any object are determined by beliefs about that object" (p. 62). In these contexts, beliefs refer to knowledge about the attitude object. According to Azjen and Fishbein, beliefs may be formed via direct observations, or accepting information from outside sources, or self-generated through inference process. They also argued that there is a causal relationship between beliefs and behavior. To influence people's behavior, it is suggested that they should be exposed to sufficient information and also able to alter their beliefs in a social environment. Because these beliefs will in turn determine attitudes and subjective norms, which then determine intention and the corresponding behavior. All in all, there is a strong relationship among beliefs (knowledge), attitude, and behavior.

## **Social Exchange Theory**

Social exchange theory is regarded as the conceptual and theoretical basis in this study for understanding the perceived environmental impacts of the Beijing Green Olympics and residents attitude toward the Games. This theory has been utilized as an appropriate and effective foundation to study residents' perceptions (Ap1992; Bryant & Napier, 1981; Gursoy, Jurowski &

Uysal, 2002; Jurowski, 1994; Jurowski, Uysal, & Williams, 1997; Perdue, Long, & Allen, 1990; Perdue, Long, & Kang, 1999). It is supported that this theory may explain residents' motivations for entering into an exchange or their lack of support for such an exchange (Deccio & Baloglu, 2002).

Social exchange theory involves the trading and sharing of resources between individuals, role occupants, or groups acting as single units. Resources can be any item, concrete or symbolic, which may be of material, social, or psychological in nature. It is suggested that when exchange of resources is high or balanced, or high for the host party in an unbalanced relationship, the impacts are viewed positively by residents. When resource exchange is low in either balanced or unbalanced exchange relations, impacts are viewed negatively by those involved. This theory suggests that the primary motivation for initiating exchange from the residents' perspective is to improve the community's well-being; residents evaluate events as either positive or negative in terms of the expected benefits or costs deriving from the services they supply; and residents' perceptions and attitudes are predictors of their behavior. Host residents are more likely to develop a positive evaluation of the exchange if the perceived returns are reasonably equitable according to their support for or participation in the exchange. Positive evaluations of the results arising from the social exchange may reinforce the desire for future participation in the relationship; therefore, if the perceived benefits from events outweigh the costs, residents in the local community are likely to support and participate in future exchange relations (Ap, 1992). Based on the social exchange theory, it is suggested that residents who are likely to obtain the greatest benefits from the event often favor and support hosting the event more than those who receive fewer benefits (Perdue et al., 1990; Ritchie, 1988). After hosting the event, the positive evaluation of its social impacts is likely to lead to supportive attitude

toward future events (Besculides, Lee, & McCormick, 2002; Brunt & Courtney, 1999; Madrigal, 1993). The perceived detrimental impacts to the environment is possible to cause negative attitudes toward hosting future mega events while the events regarded as catalysts in preserving the natural environment lead to positive attitude toward the future events (Liu & Var, 1986). The social exchange theory implies that residents' perception of impacts from the Beijing Olympic Games would influence their perception and attitude toward the event, which in turn affect their intentions of supporting the hosting future mega sport events.

Based on the existing research, Olympic Games may generate both positive and negative influence on the environment. As environmental issues associated with the Olympic Games are becoming important concerns among residents in host cities who may influence the success of hosting the Games, it is critical to understand residents' view of the environmental impact, awareness of the environmental programs, attitude, intention to support, and actual behavior relating to the Games. Research findings from investigating residents' perception of the 2008 Beijing Green Olympics were expected to have a great value on marketing mega sport events from the environmental aspects. It was anticipated that the research findings would fill the void in the literature by primarily focusing on environmental aspect of mega sport events and build linkages from awareness and perception to attitude, intention, and then to actual behavior. Gaining an in-depth understanding of the relationships among these variables would also enable mega event organizers to identify specific variables that have the most impact on residents' actual behaviors and thus to formulate and implement plans to adjust and improve event operations, and promotional strategies.

## CHAPTER 2 REVIEW OF LITERATURE

This chapter is divided into four sections: the first section reviews the history of the Olympic Games; the second section reviews the literature regarding the development of Green Olympics; the third section reviews the literature on 2008 Beijing Green Olympics, and the fourth section reviews the literature on awareness, perception, and attitude relating to the environment and mega events.

### **History of the Olympic Games**

#### **Origin of the Games**

The Olympic Games were originated from a five-day long event between 776 B.C. and 261 A.D. in ancient Greece which included running, wrestling, horse-racing, chariot races, the pentathlon, and competitions for the best trumpeters and heralds (Chalkley & Essex, 1999). It was a French nobleman, Baron Pierre de Coubertin (1863–1937), who contributed to the revival of the modern Olympic Games in Athens in 1896. In 1914, the Olympic flag including the five interlaced rings was adopted. The flag symbolizes the union of the five continents and the meeting of athletes across the world at the Olympic Games. In 1924, the first Winter Olympic Games were staged in Chamonix, France (IOC, 2007).

Pierre de Coubertin also established the principle that the Games should be held in different locations every four years as a means of promoting and diffusing the Olympic spirit of freedom, progress, and equality throughout the world (Essex & Chalkley, 2004). De Coubertin's original objectives and principles remain to be a guiding force for the Games. These principles include supporting the objectives of competitive sport, providing a legacy of facilities to foster athletic development and reinforcing the function of the sports via giving more opportunities for training and competition (Essex & Chalkley, 1999).

## **Bidding Development**

The Olympic Games were not always as popular as they are now. For the first three Olympic Games, the host cities were assigned without any competition. Later, the situation got better but the total amount of bidding cities remained less than 12 candidates until 1992. Between 1964 and 1984, there were even fewer bids received as a result of the complexity and costs involved in the preparation for the Rome Games in 1960. From 1968 to 1976, new threats were presented in hosting the Olympic events, including civic opposition (Mexico, 1968), terrorism (Munich, 1972), long-term indebtedness (Montreal, 1976), and international boycotts (Moscow, 1980 and Los Angeles, 1984). Therefore, the Games of 1984 were staged in Los Angeles as they were the only candidate. Due to the public fear over the financial burden, the Los Angeles Games were totally funded by private organizations and individuals, which turned out to be a commercial success and later on played a key role in increasing and motivating the interest of potential hosts in staging the Games. Consequently, 22 cities expressed their willingness to host the Games of 1992. Most recently, the Games of 2004 received 48 bids, and the Games of 2008 had more than 61 candidates. The increase in bidders since 1992 shows the popularity and support the Olympic Games has given in many countries and across the world. (Chalkley & Essex, 1999).

A selection process is regularly applied to select the best host city for the Olympic Games, usually seven years before the Olympic Games are to be held. During this process, the IOC will investigate each potential city's capability to host the Games and assess the advantages and disadvantages of the city's proposed project. According to the by-law of Rule 34 in the Olympic Charter, before submitting an official proposal to the IOC, the city that wishes to stage the Olympics must get an official approbation from the National Olympic Committee (NOC) of its country to be considered as an applicant city. Each country can only have one applicant city

(IOC, 2007). In 1999, a new two-phase host city selection was adopted by the IOC Executive Board (IOC, 2002a).

The first phase of the new selection process refers to the “Candidature Acceptance Procedure”, during which all applicant cities are required to submit an applicant file based on the questionnaire prepared by the IOC administration. The questionnaire includes questions on motivation, general concept, public opinion, political support, finance, venues, accommodation, transportation, security, and general conditions and experience. Under the authority of the IOC Executive Board, IOC administration is instructed to develop a report assessing the ability of each applicant city, including its country, to host, organize, and stage high level international multi-sports events, especially the Olympic Games. To prepare the report, IOC administration appoints a number of experts and representatives, and establishes an IOC Candidature Acceptance Working Group. Also, outside experts not commissioned to any applicant city are invited to conduct specific research and submit reports to the Working Group. Considering all the opinions from internal and external experts, representatives, and IOC Directors, the Working Group decides on a number of technical criteria to assess the applicant cities including government support, public opinion, general infrastructure, sports infrastructure, Olympic Village, environmental conditions and impact, accommodation, transportation, security, experience from past events, finance, and general concept. Following the submission of the report by the IOC administration, IOC EB will determine which cities will be accepted as candidate cities (IOC, 2002b).

During the following phase, candidate cities are required to submit a Candidature File to the IOC which should be developed within a strict framework provided by the IOC. In this File, each candidate city needs to answer 149 questions on 18 themes, including national, regional,

and candidate city characteristic, legal aspects, customs and immigration formalities, environmental protection and meteorology, finance, marketing, general sport concept, sport facilities, Paralympic Games, Olympic Village, medical and health services, security, accommodation, transportation, technology, communications and media services, Olympism and culture, and guarantees (IOC, 2002c). In the meantime, an Evaluation Commission, composed of inter alia, IOC members, members representing the International Federations (IFs), members representing the National Olympic Committees (NOCs), representatives of the Athletes' commission and the International Paralympic Committee (IPC), as well as other experts, will then examine the cities' candidatures and inspect the sites. The Commission also needs to verify the information in each City's Candidature File, analyze the challenges that each city may face, and submit a report on the 18 themes of all candidatures to the IOC members. The final list of candidate cities entering into the IOC Session for election is determined by the IOC EB based on the report by the Evaluation Commission. After considering the report, the Session holds a ballot to select the host city in a country that does not have a candidate city running for hosting the Games (IOC, 2007). If three or more cities remain as candidates in the final ballot, the last-placed city in each round of voting is eliminated until one of the cities obtains a majority of the votes (Japanese Olympic Committee, 2009).

Following the IOC's announcement of the selected host city for the Olympic and Paralympic Games, a written agreement that is regarded as the Host City Contract (HCC) will be signed by the IOC, the host city, and the NOC of the host country. The HCC explains the legal, commercial, and financial rights and obligations of the three parts relating to the Olympic Games. The specific content of the HCC may vary from Games to Games due to the changes and modifications. The HCC shall have the priority if there is any conflict between the provision of

the HCC and the Olympic Charter (IOC, 2009a). The HCC requires that the host city and the NOC acknowledge and support the environmental sustainable development as a significant concern in conducting their obligations and activities, as well as the post-Olympic use of venues and other facilities and infrastructures. The city and NOC also need to take into account of environmental legislation, promote the concept of environmental protection, and leave a positive legacy in environmental practices and policies relating to the Olympic Games (IOC, 2009b).

### **Development of the Green Olympics**

#### **Organizations Involved**

There are three main organizations involved in guiding and supervising the Green Olympics movement: the IOC, the United Nations Environmental Program (UNEP), and the Greenpeace. The IOC was founded on June 23<sup>rd</sup>, 1894 by the French educator Baron Pierre de Coubertin who was inspired to revive the Olympic Games of Greek antiquity (IOC, 2008). The IOC is an international non-governmental non-profit organization. It exists as a central organization of the Olympic Movement; owns all rights to the Olympic symbols, flag, motto, anthem, and Olympic Games; and aims to fulfill the mission, role, and responsibilities established in the Olympic Charter. Its primary responsibility is to select the host city for the Winter or Summer Olympic Games, and supervise the preparation and organization of the Games. It is also responsible for negotiating the television rights and sponsorship agreements, and distributing the revenues to its partners and member countries. In 1996, environment protection was added to the Olympic Charter as a new mission for the IOC, where the IOC is responsible for ensuring that the Olympic Games take place in harmonious with the environment, encouraging and supporting environmental concerned issues, and promoting sustainable development in sport .(IOC, 2007).

The UNEP, established in 1972, is the voice for the environment within the United Nations system. It is considered to be an important entity to educate, advocate, and promote the proper use and sustainable development of the global environment. The UNEP is in cooperation with diverse partners, for instance, the United Nations entities, international organizations, national governments, non-governmental organizations, the private sector, and civil society. It has been working on sports and environmental issues since 1994. The program aims to promote the integration of environmental considerations in sports, raise environmental awareness of and respect for the environment among the public especially young people, and to encourage environmentally friendly sport facilities and sporting goods (UNEP, 2007).

The UNEP has been working closely with the IOC as well as the organizing committees of potential host cities since 1994 when they signed an Agreement to incorporate environmental issues in Olympic Games. The UNEP is represented on the IOC Sport and Environment Commission to review environmental issues related to the Olympic Games, and gives suggestions to the IOC Executive Board on environmental issues. Since 2003, UNEP has actively participated in the IOC's biennial World conference on Sport and Environment. Except for the Olympics, the UNEP also played an important role in the 2006 FIFA World Cup in Germany, the 2010 FIFA World Cup in South Africa and the 2010 Commonwealth Games in New Delhi, India (UNEP, 2007).

Greenpeace, founded in 1971, is an independent global campaigning organization that acts to change attitudes and behavior, protect and conserve the environment, and promote peace in the world. It has been campaigning against environmental degradation as its primary mission. Today, Greenpeace is present in 40 countries across Europe, the Americas, Asia, and the Pacific (Greenpeace, 2008). Greenpeace's active participation in the Olympics dates back to 1992, when

the organization assigned an architect to develop an eco-design Athletes Village, and submitted to an anonymous design contest by the Sydney Bid Company for the 2000 Games. Greenpeace's design was one of the five winners of that competition. After that, the concept of Green Olympics reached every aspect of the Sydney's Olympic development. Greenpeace cooperated Sydney officials in establishing an environmental guidelines and making environment one of the vital advantages for the city's 2000 Olympic bid. After Sydney's successful bid, Greenpeace continued to be heavily involved in both monitoring and working with Sydney in varieties of environmental issues to ensure the best environmental outcomes. In the meantime, Greenpeace developed a relationship with the IOC and its Sport and Environment Committee to help ensure the environment continue to be one of the three dimensions in the Olympic development. To provide an independent, third party assessment on the host cities' environmental achievements, Greenpeace carried out its first complete report on Sydney's efforts in 2000 (Zhang, 2008).

After the Sydney Games, Greenpeace released the Greenpeace Olympic Environmental Guidelines: A guide to Sustainable Events, to independently assess the sustainability of all Olympic Games. The guidelines also serves as a set of benchmarks and challenges for sporting and non-sporting event organizers interested in a low impact environmental approach to hosting large events. Since the Sydney Games, Greenpeace has continuously been involved in monitoring and commenting on the host cities' environmental initiatives. To assess the effectiveness of the host cities in staging Green Olympics, Greenpeace released its measurement of Athens Games in 2004 and of Beijing Games in 2008 (Zhang, 2008) . The ultimate objective of Greenpeace is to raise environmental awareness and leave a long-term environmental legacy through the Olympics (UNEP, 2007)

### **The Third Dimension**

The 1998 Winter Olympic Games at Nagano in Japan was recorded as the first Games at which a clean environmental policy was released by IOC. The historical benchmarks for the environmental policy development of the Olympic Games were due to the extensive environmental damages caused by the 1992 Winter Olympic Games in Albertville and Savoy Region, France and the following environmentally conscious Winter Olympic Games in 1994 in Lillehammer, Norway. The Games in Albertville caused significant environmental damages due to insensitivity to vulnerable alpine ecosystems in venue construction and the lack of any environmental policy and guidelines. The 1992 Albertville Olympics were the most regionalized Olympic Games with competition sites located in 13 Alpine communities spread over 1,657 square kilometers, and the only games that dramatically and irreparably marred the landscape. Because of the coincidence of the IOC decision to change the Winter and Summer Games sequence, Lillehammer was awarded as the host city of the 1994 Winter Games. The Norwegian people showed their long-standing and well-developed respect for nature and proved that the environmental damage of staging the games might be avoided. These two games evoked global awareness of the environment and activity within the IOC, and urged the IOC to respond and make effort to repel the adverse environmental impacts of the Olympic Games (Cantelon & Letters, 2000).

In 1994, during the Centennial Olympic Congress in Paris, it was suggested that environment should be accommodated as the third dimension of the Games (Beyer, 2006). In 1995, at the World Conference on Sport and the Environment, the IOC President Samaranch expressed: "The International Olympic Committee is resolved to ensure that the environment becomes the third dimension of the organization of the Olympic Games, the first and second being sport and culture" (Jagemann, 2003). Subsequently, in 1996 the following paragraph was

included into Chapter 1 of the Olympic Charter: "... the mission and role of the International Olympic Commission is ... to encourage and support a reasonable concern for environmental issues, to promote sustainable development in sport and to require that the Olympic Games are held accordingly" (IOC, 2007, p15).

Since 1996, organizing committees of the Olympic Games have progressively increased their focus on environmental and sustainable development issues in preparing for and staging Olympic Games. All cities bidding to host the Games are required to have a comprehensive environmental program that is executed during the preparatory phase of the Games. Also, the World Conference on Sport and Environment is held every two years since 1995, where hundreds of representatives, from NOCs and IOC-affiliated sports federations and associations, gather together to review the impacts of various mega sport events on the environment and organizational contributions to sustainability.

In 1999, the IOC collaborated with the UNEP to develop the Agenda 21 for Sport and the Environment, which is a comprehensive plan of action to be taken by each organization, government, and country in the area where human causes negative impacts on the environment. It includes several measures to improve the environment affected by mega events. One of them is the improvement of socio-economic conditions of the host city. The second is the conservation and management of resources in the host city environment. The agenda also includes strengthening the role of groups in order to explore the host city's maximum environmental potential. Finally, the agenda ensures that the policy of sustainable development is integrated into the Olympic movement's actions. It is currently implemented by the Olympic membership countries and other sport organizations.

## **Olympic Games and Environmental Responsibility**

According to Olympic Charter (IOC, 2007), Olympism is “a philosophy of life exalting and combining in a balanced whole the qualities of body, will and mind.” This philosophy “seeks to create a way of life based on the joy of effort, the educational value of good example and respect for universal fundamental ethical principles,” and aims to “place sport at the service of the harmonious development of man, with a view to promoting a peaceful society concerned with the preservation of human dignity” (p.11). It also presents that one of the IOC’s missions is to encourage environmental concern, promote sustainable development in sport, and stimulate the development of Green Olympics (IOC, 2007). According to the United Nations’ definition, sustainable development refers to a balanced development between people’s economic and social needs with the ability of the earth’s resources and ecosystems to satisfy present and future needs (Beyer, 2006).

During the Centennial Olympic Congress in 1994, the relationship between Olympic Games and the environment was the main discussion topic. It was suggested that the IOC could and should be an agent for focusing attention on environmental issues, and sensitizing the world to environmental responsibilities in general. The environmental policies and action programs needed the support of every informed and concerned citizen. It was also discussed that the Olympic Games should play a powerful role in modifying the attitudes and behavior of the population though they might cause tremendous environmental challenges. Another important aspect of the Congress was that sport was viewed as a valuable asset for promoting awareness of environment protection because it could be practiced effectively by all sectors of society and was fully accepted by the public. Other topics such as sporting goods industry, waste management, energy saving and recycling, sports infrastructure, and construction materials were also

important topics during the conference that helped to develop more practical solutions on environmental aspect (Mascagni, 2008).

Green Olympics has been developed with an aim to carry out the environmental responsibilities of the Games in developing sustainable Olympics, encouraging respect for the nature and environment, and raising environmental concern among all the athletes, spectators, and even every citizen to create a harmonious world. The Sport and Environment Commission created in 1995 has been working on the promotion of sustainable development and environmental responsibility. Its objectives are set to reduce the negative impact on the environment, utilize the Games as a vehicle to develop and improve the environment in and around the host city, leave a green legacy in the host city, and promote awareness on the importance of a healthy environment (IOC, 2007).

## **Contributions of Previous Host Cities**

### **Tokyo and Seoul Olympic Games**

The Olympic Games has been considered as a major opportunity for urban planners and policy-makers to improve the infrastructure and environment of the city even before the environment was added as the third element to the Olympic Movement. Both Tokyo and Seoul made outstanding environmental improvements compared to other games before 1994. They used the Olympic Games as a stimulus to diminish pollution, advance sanitation standards, modernize waste disposal systems, and raise environmental standards. In the Tokyo Games of 1964, the city made a number of environmental improvements. For instance, the water supply system of the city that pipe water from Kanagawa and other adjacent districts was improved. Its waste management system was ameliorated as a result of three newly constructed sewage disposal plants. Standards of public health within the city were also improved through regulating refuse and garbage collections, renovating public toilet facilities, controlling food hygiene, and

cleaning streets and rivers. In the Seoul Games of 1988, various programs were applied to encourage public transportation so as to reduce air pollutions from personal car emissions. An environmental beautification program was carried out to ensure health and hygiene standards throughout the city. The local residents were encouraged to involve in these projects via conservation awareness campaigns and the formation of local committees for environmental beautification. Also, new programs were introduced to deal with air pollutions, garbage control, and water quality preservation (Chalkley & Essex, 1999).

### **Lillehammer, Sydney, and Torino Olympic Games**

According to the UNEP's environmental review, the Lillehammer Games of 1994, the Sydney Games of 2000, and the Torino Games of 2006 all set new benchmarks for environmental awareness and sensitivity (UNEP, 2007). Lillehammer was the host city for 1994 Winter Olympic Games. It was the first city to add the sustainable environmental policy to the existing elements of the Olympic movement. The Games were referred to as the Olympic environmental showcase due to the collective effort of government, environmental agencies, and groups in the planning process and the introduction of the environment as the third dimension of the Olympic movement. About 20 environmentally concerned projects were initiated and a four-point plan for the environment was drawn up. These projects focused on the harmonious integration of facilities into the landscape, the use of natural and local materials, and measures addressing energy conservation and recycling. Lillehammer provided an example to diminish the conflict between the Games and the environment, and led to the creation of mature environmental policies and specific regulations for the organization of future Olympic Games (Cantelon & Letters, 2000).

The 2000 Sydney Olympics was the first attempt to green the Games and also the first city to win an Olympic bid with a series of environmental protection measures attached to its

application. The Sydney Olympic Committee made great efforts in executing environmental principles. It introduced sustainable technological solutions into the design, construction, and implementation of the Games, and achieved a number of notable successes. For example, Sydney cleaned up a toxic site, increased renewable energy use, reduced PVC use, established sustainable water management system, improved public transportation, and used solar and electric vehicles (Chan et al., 2006). Sydney chose the Homebush Bay area as the site for the Games Village. This was a toxic site that had nine million cubic meters of waste filling more than 160 hectares of natural wetlands. This toxic area had a detrimental impact on the wider environment and water resources. It was replaced with sustainable and environmentally sound infrastructure for preparing and hosting the Olympic Games. Another important success of Sydney was the switch from conventional fossil fuels to clean and renewable energy. For instance, the grid-connected solar photovoltaic and rooftop solar power were widely used at the Olympic Park and the Olympic Village to satisfy the huge energy demands of the Games. The Sydney Olympics diminished Polyvinyl Chloride (PVC) use especially in water and waste pipes at most of the Olympic venues. PVC produces harmful chemicals and dioxins which are likely to cause birth defects, cancer, and hormone disruption. An Australian-made PVC-free cable was developed especially for use at the Village and other venues, and is now available to the Australian general market. Sydney also introduced sustainable water management systems at the Olympic Park whose design was to maximize collection of storm water and minimize on-site demand for water. One of the most critical successes of the Games was the high degree of public transportation use by building public transit into each event ticket. The use of electric and solar-powered vehicles in the Olympic Park was another step toward complete environmental awareness (Greenpeace, 2001).

Torino Winter Olympic Games in 2006 were characterized by a structured sustainability strategy, taking into account not only the environmental aspect of sustainability, but also its social and economic dimensions. The sustainability reporting was one of the most important contributions of the Torino Games. The reporting could be used to measure, evaluate, communicate, and improve the social and environmental performance of the Olympic Committee. Generally, it may be explained as the process for the public to assess an organization's economic, environmental, and social performance. Torino 2006 Olympics were the first Games to draw the attention of IOC on the sustainability reporting. It was suggested by IOC that sustainability reporting should become a systematic activity of Olympic Organizing Committees starting from Vancouver 2010 XXI Winter Olympics. The Torino Games also represented the first case in Italy to apply the Strategic Environmental Assessment. A considerable number of environmental activities were implemented in Torino regarding different issues like water cycle, soil use, energy consumption, waste production, ecosystem, landscape, and urban environment. For example, through the Green Procurement Project, sponsors were selected based on the ecological quality of products. The Torino's Education Program covered all the primary and secondary schools in the national territory, involving more than 6,000 schools and 600,000 students on the whole (Frey, Iraldo, & Melis, 2007)

### **2008 Beijing Green Olympics**

Competition to host the Olympic Games has been intense since the 1984 Los Angeles Olympic Games. After an unsuccessful bid for the 2000 Summer Olympics, Beijing doubled its efforts and was eventually elected as the host city for the Games of the XXIX Olympiad on July 13, 2001 (UNEP, 2007). The Beijing Organizing Committee for the Olympic Games (BOCOG) stated that lasting goal for the XXIX Olympic Games would be to promote the environment as

the third pillar of Olympism and that sport could be a powerful force in raising awareness about sustainable development at local and global levels.

### **“Green Olympics” in Beijing**

The “Green Olympics” concept was initiated in 2000 by BOCOG and Beijing Municipal Government to promote the environmental sustainability of the Games (UNEP, 2007). It emphasizes the BOCOG’s commitment to Olympic values and sustainable development. BOCOG set three guiding principles for the Games: Green Olympics, High-tech Olympics, and People’s Olympics. In the UNEP’s environmental review of Beijing Olympic Games, it explains “Green Olympics” as follow:

The city of Beijing identifies environmental protection and strict environmental standards as a key requisite for the design and construction of the Olympic Games facilities. BOCOG is charged with ensuring that environmentally friendly technologies and measures are applied in the construction of infrastructure and venues, and that urban and rural forestation and environmental protection area carried out. The committee is also responsible for promoting environmental awareness among the general public, and encouraging the citizens of Beijing to make green consumption choices (p. 32).

The “Green Olympics” concept was also reflected in the five Olympic mascots that were designed to promote environmental awareness. Beibei was a flying fish, meaning “clear water”; Jingjing was a panda, representing environmental protection and “Green Hills”; Yingying was a Tibetan endemic protected antelope delivering “Grass-covered Ground” message; Nini was a flying swallow, referring to the message of “Blue Sky”; and Huanhuan represented the Olympic Flame (UNEP, 2007). In addition, the Green Olympics concept was also delivered through the Green Olympic logo that was composed of people and green trees and used for Green Olympics communication and education (UNEP, 2007).

## **Beijing's Preparations for "Green Olympics"**

The environment was prominent in Beijing's original bid, planning, and preparation for the 2008 Olympic Games. In the Green Olympics Program that was formed during Beijing's bid for the Games, Beijing set aside a total investment of U.S. \$12.2 billion for green initiatives: \$ 5.6 billion for the period of 1998-2002 and \$ 6.6 billion for the period of 2003-2007 (UNEP, 2007). From 1998-2007, Beijing spent a total of ¥120 billion (i.e., \$15.7 billion) on environmental initiatives (BOCOG, 2007a). According to a report released by UNEP after the Beijing Olympics, Beijing invested over \$ 17 billion on environmental projects. China took a bold step in cooperating with the Greenpeace, the IOC, and the UNEP to participate in the "Green Olympics." Beijing made notable efforts during the preparatory period for the Games in the following environmental areas: Air quality, energy, transportation, water environment, ecological conservation and construction, industrial pollution, and solid waste management (UNEP, 2007, 2008; Zhang, 2008).

### **Air Quality**

Preparation for staging the Games provided the Beijing Municipal Government with a great impetus for addressing air quality problems. From 1998 to 2008, the government applied more than 200 environmental measures to reduce air pollution, such as controlling vehicle emission standards, investing in public transportation, increasing energy efficiency, constantly monitoring air quality, and reforming energy structure by increasing the use of other green energy resources. These projects all represented viable long-term solutions for reforming air quality and also represented great policy achievements for Beijing.

Beijing applied the Standard II National Ambient Air Quality Standards (GB 3095-1996) to monitor its daily air quality, which mainly reflected levels of four major air pollutants: Sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), and particulate matter

(PM<sub>10</sub>) (UNEP, 2007). According to data released by the Beijing Environmental Protection Bureau (EPB) from measurements conducted by 27 monitoring stations in the municipal area, the number of days with air quality equal to or above the National Standard increased from 100 days in 1998 to 241 days in 2006 (UNEP, 2007), to 274 days in 2008 (UNEP, 2008) . From 2000 to 2006, annual means of SO<sub>2</sub>, NO<sub>2</sub>, and CO concentrations in Beijing were respectively reduced from 71 u g/m<sup>3</sup> to 53 u g/m<sup>3</sup>, 71ug/m<sup>3</sup> to 66 ug/m<sup>3</sup>, and 2.7mg/m<sup>3</sup> to 2.1mg/m<sup>3</sup>. However, the concentration of PM<sub>10</sub> in 2006 was almost the same as that in the year of 2000 (UNEP, 2007). The UNEP analyzed daily (24-hour) pollution level in Beijing from July to October 2008 to examine the effects of the temporary measures on air quality. The data revealed that the SO<sub>2</sub> and NO<sub>2</sub> levels were significant below the air quality standard for the entire period, and that the average PM<sub>10</sub> and CO levels fell below the air quality standard most of the time (UNEP, 2008). UNEP (2008) reported that, compared to the same time in previous years, diverse air pollutants in Beijing decrease dramatically during the Games period. After removing the influence of weather condition, it was found that from 1-19 July 2008, various reactive gas concentrations highly relative to vehicle emission, such as NO<sub>2</sub>, decreased by about 40%, PM<sub>10</sub> concentrations decrease by 10% - 25 %, and that traffic related particulate black carbon concentrations decreased by 25% -30%. In addition, SO<sub>2</sub> concentrations also dropped to a lesser extent compared to those pollutants relating to the traffic. Additional control measures were applied to improve the air quality from 20 July until the end of the Games. During this period, NO<sub>2</sub> was reduced by an additional 15%, black carbon dropped by 10% – 20%, PM<sub>10</sub> concentrations remained the same level.

## **Energy**

According to the National Bureau of Statistics, in 2007 China consumed 2.65 billion tons of coal equivalents (TCE). Beijing, one of the highest energy consumption cities in China, relies

heavily on coal that contributes to large quantities of dioxides and particular matter air pollution. A variety of methods were applied by Beijing to reform its energy structure, such as increasing the use of natural gas, wind energy, solar energy, and other forms of renewable energy. Also, several projects were developed by Beijing Municipal Government to increase energy efficiency and reduce energy consumption.

China's 11<sup>th</sup> Five-Year Plan (2006-2010) on energy development states that the country aims to increase the share of natural gas in the primary energy mix from 2.0% to 5.3% by 2010 and up to 10% by 2020 (Jiang, 2007). The purchase of natural gas in Beijing increased from 320 million m<sup>3</sup> in 1998 to 3,520 million m<sup>3</sup> in 2006 (UNEP, 2007). Beijing's ratio of natural gas consumption to total energy consumption increased from 0.5 % in 1997 to 7.0% in 2007 (Beijing Daily, 2008). Between 2003 and 2006, more than 6,000 restaurant and

11,000 household heating systems were converted from coal to electricity, and about 90,000 households in Old Hutong were switched to electric heating by 2008 (UNEP, 2008).

Currently, China is already ranked as the world's third largest wind turbine producer.

Domestically, the installed capacity of wind power has heavily increased in the past few years.

China is now also one of the world's top three solar photovoltaic (PV) producers. The use of solar heaters in Beijing equaled to 3.4 million m<sup>2</sup> in 2006, 17.6% more than that in 2005. Over

120,000 solar powered street lamps, one of the highest numbers in the world, were installed in

Beijing. To increase energy efficiency, China has set a goal of a 20% reduction in energy

consumption per unit of GDP by 2010 (Zhang, 2008). According to the Beijing Reform and

Development Commission, during the 10<sup>th</sup> Five Year Plan (2001-2005), Beijing's economy grew

by 12.0% annually, while its yearly energy consumption only increased by 5.9%. Energy

consumption per 10,000 RMB of GDP decreased by 45.5%, from 1.14 TCE in 2001 (UNEP,

2007) to 0.714 TCE in 2007, about 38.0% lower than the national average (The Central People's Government of the People's Republic of China, 2008).

Energy saving design and new technologies were widely incorporated in Olympic venues. Six thousand square meters of direct current tube rooftop solar collectors were installed in the residential units of the Olympic Village, which was capable of providing hot water for all of the residential and supporting buildings. In Peking University, 300m<sup>2</sup> solar heating water system was installed to heat all the swimming pool facilities. Solar collectors for bathing facilities were installed in Beijing's shooting range hall and Beijing Olympic Tower. Solar photovoltaic (PV) power generation systems were applied in the National Stadium, Wukesong Stadium, Fengtai Softball Stadium, Chaoyang Park Beach Volleyball venue, and Olympic Forest Park. Geothermal (ground source) heat pump air-conditioning and heating systems were used in Shunyi Olympic Rowing and Canoeing Park, Olympic Forest Park, and Peking University Gymnasium. In addition, renewable energy and energy efficient lighting were widely adopted in the Olympic Green, National Aquatics Centre, and all contract hotels. New techniques and products are currently being encouraged to be adopted in new buildings other than Olympic venues, such as heating preservation/ insulation techniques for outer walls and new types of energy saving windows and doors (Zhang, 2008).

### **Public Transportation**

Beijing had taken some significant steps toward improving and expanding public transportation, increasing low-emission buses and taxis, and adopting high fuel emission standards for new vehicles. To improve its public transportation system, Beijing started the construction of 77 roads and bridges in the years prior to the opening of the Games (UNEP, 2007). A 16 km-long south-middle Bus Rapid Transit line, with a capacity of 100,000 passengers per day, was finished in 2006 (UNEP, 2007). Beijing also built four additional subway lines and

an Olympic Branch Line which runs from Line 10 to Olympic venues. According to the official data, the total subway capacity in Beijing was increased from 1.3 million to 3.9 million between 2000 and 2008 (Zhang, 2008). The number of buses reached 20,000 in 2007, twice the number in 1991(UNEP, 2008).With the new transportation system, Beijing's public ground transportation reached a total of 19 million passengers per day (UNEP, 2007).

Beijing also implemented several effective measures to encourage the use of public transportations. On September 16, 2007, China launched a one week nationwide campaign "Green Transport and Health" to encourage the use of public transportations. It covered Beijing, Shanghai, and 106 other cities in China (UNEP, 2007). In Beijing, subway and public bus fares were cut in an effort to encourage the use of public transportations. During the Olympic Games period, cars with even or odd numbered plates were forbidden to drive on alternative days in Beijing. Also, BOCOG offered people with tickets to the Olympic Games free public transportations for 51 days throughout the city (UNEP, 2007).

Beijing made great efforts to reduce traffic related emission. By the end of 2006, Beijing had replaced more than 47,000 old taxis out of 60,000 and refitted about 7,000 old diesel buses out of 19,000 old diesel buses. During this time, Beijing introduced 3,759 Compressed Natural Gas (CNG) public buses, one of the world's largest CNG bus fleets (UNEP, 2007). For visitors during the Games, 200-300 bicycles were available in the Olympic Park and Olympic Village (UNEP, 2007). In 2001, Beijing implemented an environmental labeling system for vehicles. Vehicles satisfying the requirements were marked with yellow or green labels, which were allowed to circulate in Beijing. Older vehicles with sub-standard emission systems were slowly phased out as well as limited from entering the city center (UNEP, 2007). From March 1, 2008, Beijing initiated a new EURO IV standard, two years ahead of schedule specifically set for the

Olympic Games. Beijing's move from EURO III in 2005 to EURO IV in 2008 was estimated to deliver an overall 50% reduction in emissions (Li, 2008). Temporary transport measures were applied from 1 July to 20 September 2008 to get more vehicles off the roads. For instance, amount of 400, 000 yellow-labeled vehicles were forbidden to use in Beijing; about half of the 3.4million registered vehicles were not allowed to run on alternative days; Up to 70% of the government office vehicle fleet was restricted to use in the city. In total, about 2 million vehicles daily were reduced to operate during this period (UNEP, 2008). Beijing also extended some of the temporary measures until April 2009, which include a ban on vehicles with yellow labels beyond 5<sup>th</sup> Ring Road, time limitation of heavy duty vehicles exceeding the Euro III emission standard, and one day off road per week for vehicles in Beijing (UNEP, 2008).

### **Water Environment**

Beijing, located on a dry plateau in the northern China, struggles with severe water shortages. The water availability per capita of Beijing is just 1/32 of the international average level (Li, 2004). In 2007, Beijing's annual water consumption reached 3.4 billion m<sup>3</sup> (Beijing Water Authority, 2007). Motivated by Green Olympics, a number of new Olympic venues and refurbished venues, such as the National Stadium (Bird's Nest), Olympic Green, and Olympic Forest Park, applied water saving designs including rainwater collection, water efficiency, water re-use, and water recycling features to reduce water demand during and after the Games.

The main water sources of Beijing are the Miyun Reservoir, from which most of Beijing's drinking water comes, and the Huairou Reservoir which provides water for the agriculture. The Olympic Games provided a great opportunity to develop the city's water saving techniques and sewage treatment structures. According to the UNEP's (2007) Environmental Review, the central government closed down heavily polluting enterprises in the area close to the reservoir to guarantee the quality of water supply to the city. To ensure that the quality of water from Miyun

and Huairou Reservoirs continue to meet potable water standards, government authorities banned illegal construction and fish farming, closed down small mines on the upper stream, and developed rural sanitation facilities in the protection zones for ground water resources (Zhang, 2008).

It was reported in the Beijing Daily that Beijing would benefit from 480 million m<sup>3</sup> of recycled water in 2007, which accounted for about 14% of total water consumed in Beijing that year; meanwhile, a number of 600 million m<sup>3</sup> was expected in 2008 throughout the city (BOCOG, 2007b). According to government statistics, 15 projects including the National Stadium (Bird's Nest), Olympic Green, and Wukesong Baseball Field were installed rainwater collection systems, which were capable of utilizing about one million tons of rainwater. The advanced enclosed water circulation system was installed in the Olympic Forest Park, which meant about 95% of rainwater inside the park could be reused for irrigations (Beijing Evening News, 2007). The Olympic Green has a systematic rain gathering water re-use technology that has a collection coverage area of 97 hectares. It can provide 320,000 m<sup>3</sup> of ground water, and also add about 90,000 m<sup>3</sup> to the water system. As a result, 80% of the water in the Olympic Green can be re-used which can provide up to 50,000 m<sup>3</sup> of water for irrigation. All wastewater from the Olympic Green can be recycled for landscape irrigations and toilets in the Olympic Green. In addition, the rainwater recycling system installed in the National Stadium is able to process up to 100 tons of rainwater per hour, of which 80 tons can be reused for landscaping, fire-fighting, and stadium cleaning (Zhang, 2008).

The Games also provided Beijing with an opportunity to develop its wastewater treatment system. From 2000 to 2006, Beijing built 600 km of new sewage pipes, with a total network length of 2,500 km, of which 700 km are also used to collect rain water. Also, 17 new

wastewater treatments plants were built in Beijing before 2007, increasing the total treatment capacity by 2 million tons. The rate of wastewater treatment in Beijing city (not including the Beijing suburb areas) increased dramatically from 22% in 1998 to 90% in 2006 (UNEP, 2007). Wastewater treatment systems were also equipped in some of the Olympic venues including the National Aquatics Center (Water Cube), Shunyi Water Park, Olympic Tennis Center, Olympic Forest Park, and Olympic Center, contributing to a treatment capacity of one million tons in total.

### **Ecological Conservation and Construction**

BOCOG and Beijing Municipal Government carried out a series of greening projects for both Olympic venues and the city of Beijing. For instance, they increased the forest coverage in mountain areas, established an Olympic Forest Park, and greened five major waterways as well as highways. The necessity of forest protection has been recognized by all governments in the world. As the world's largest log importer, China has a great responsibility to work with international organizations and other governments to protect the world's endangered forests. In the last 50 years Beijing has worked on reforestation projects aimed at protecting water resources and conservation soil and water in the mountains, preventing desertification in the plains, and improving green landscapes through a green belt system in the urban area (UNEP, 2007). The forest coverage has increased in Beijing, especially during the 10<sup>th</sup> five Year Plan (2001-2005) period. Forest coverage in the mountain region reached a rate of 57.23% in 2000, 67.84% in 2004, 68.25% in 2005, 69.52% in 2006, and 70.5% by 2008 (UNEP, 2008). Aiming to support the principles of the Green Olympics, on May 30, 2006, BOCOG made an official announcement that timber source from the tropical forests of Indonesia would not be used for Olympic venues, and construction materials with minimal environmental impact would be used instead. Besides,

in the Environmental Protection Guidelines for Beijing 2008 Catering Services, BOCOG presented that disposable chopsticks should not be used in the catering industry (Zhang, 2008).

To improve the ecosystem and the landscape in Beijing, a system of green belt areas were established in its central area. By the end of 2006, more than 100 green belt sectors had been established in the city, which increased its landscape area by nearly 700 ha. Green coverage was added to the borders of the main roads in Beijing, including the Second, Third, and Fourth Ring Roads. An additional 13,300 ha were developed to green the Fourth Ring Road, which is directly linked with the main stadium of the 2008 Olympic Games (UNEP, 2007). Besides, the Olympic Forest Park was built on the Olympic Green, with an area of 680 hectares that is about 1.5 times the size of Central Park in New York City, with 475 hectares of green space (Zhang, 2008). Green coverage in the urban districts in Beijing increased from 36% in 2000 to 43% by the end of 2008, which exceeded the Olympic bid goal of 40% (UNEP, 2008).

### **Industrial Pollution**

Industrial production is economically important for Beijing. Industrial gross product accounts for more than one-third of the city's total GDP. However, it also causes serious environmental problems, such as sulphur dioxide (SO<sub>2</sub>) and soot pollution. To reduce and control industrial pollution, Beijing was committed to closing highly polluting companies, relocating factories outside the urban perimeter, adjusting industrial regulations, and developing new industrial zones. From 1998 to 2006, a dramatic increase in company relocations occurred, and 197 out of 209 companies moved between 2000 and 2006. In the last few years before the Games, 17 major industrial companies were closed or relocated, including the Beijing Second Pharmaceutical Factory, Beijing Dye Factory, and Beijing Coke Plant. The closure of the Beijing Coke Plant resulted in a reduction of 3 million tons of coal consumption a year. SO<sub>2</sub> and soot emissions were also reduced by 7,500 and 7,300 tons respectively (UNEP, 2007). UNEP (2007)

also reported that the Municipal Bureau for Industrial Development required companies in the industrial development zones to follow “3R” approach (Reduce, Reuse, Recycle). New, sustainable, and advanced industrial projects and factories that were equipped with low consumption of natural resources and eco-friendly technologies were strongly supported. To control for pollution emissions, the Beijing Municipal Government launched the “Beijing Municipal Plan for Control of Main Pollutant Emissions During the 11<sup>th</sup> 5-Year Plan” which set stringent environmental regulations for Beijing.

In relation to refrigerants, China has become the leading manufacturer of air-conditioners that use the refrigerant hydrochlorofluorocarbons-22 (HCFC-22), which is both ozone depleting and a potent greenhouse gas (Bradsher, 2007). As a developing country, China has already phased-out chlorofluorocarbons (CFCs) as of July 2007, which was 2.5 years ahead of the 2010 deadline for developing countries. China has planned to phase out HCFCs, with fewer ozone layer damaging effects, by the end of 2030 (UNEP, 2007).

### **Solid Waste Management**

Beijing conducted several projects to improve its solid waste management system. In December 2003, Beijing released a White Paper on Domestic Garbage Disposal that revised its domestic waste management system. New facilities for domestic waste processing were then developed. At the end of 2006, Beijing had 23 domestic waste disposal facilities with a capacity for processing 16,210 tons of waste a day. In 2008, the number of waste treatment facilities increased to 32. In accordance with the principles of waste reduction, reuse, and recycling, the government introduced new standards for waste policy and new regulations to separate compostable and recyclable waste from garbage that could not be recycled or composted. To increase residents’ awareness of separate garbage collection, the municipal government trained employees in more than 140 district offices and over 1,000 real estate management companies

throughout the entire city. Trainers distributed approximately 300,000 copies of brochures, 100,000 posters, and more than one million copies of various publicity materials. About 18,000 residential communities with three million people assisted with implementing separate waste collection. According to UNEP (2008), waste classification and recycling services covered 27% of the population in Beijing by 2007, which exceeded its Olympic bid goals for waste classification and recycling. On-site composting facilities were encouraged by the Beijing Municipality to improve composting rates. In 2006, 270 thousand tons of waste was composted, 1.43 million tons were recycled, and the rate of resource re-utilization was increased to 30.6 %. In 2004 and 2005, two medical waste processing plants were built in Beijing with a total daily processing capacity of 60 tons, meeting the actual needs of the city (UNEP, 2007). On June 1, 2008, the Chinese central government released a policy to forbid the free use of plastic bags and make bags more environmentally friendly (Jinghua News, 2008).

### **Awareness, Perception, and Attitude**

#### **Awareness of Green Olympics**

The term awareness is often used synonymously with consciousness, in the sense of being awake or aware of incoming perceptual stimuli, or possessing certain knowledge, thoughts, or intentions (Zeman, 1997). In this study, awareness is defined as a state of knowledge about the “Green Olympics” concept, ranging from simply recalling of the name to a highly developed cognitive structure based on detailed information. Green Olympics is a relatively new concept to Chinese before Beijing was selected as the host city for 2008. To publicize this concept and raise environmental awareness, a number of education and communication projects were employed before and during the Games.

BOCOG mainly utilized education programs to raise awareness of the environment in primary and secondary schools in Beijing and around the country. The Beijing 2008 Primary and

Secondary School Olympic Education Program was implemented in 2006 throughout the country, involving 400 million students, to promote the Olympic values and encourage environmentally friendly lifestyle. The Green School Project in October 2006, including 728 schools in Beijing, aimed to encourage schools to consider environmental measures in their day-to-day activities and teach environmental values. In addition, the “Reserve a Barrel of Water this Summer” Initiative project, implemented in the primary schools in Beijing 18 districts and counties, was used to develop water saving initiatives and communicating the importance of water saving. In 2005 and 2006, a painting contest, with the theme “Green Dream, Colorful Olympics”, was organized for the primary and secondary students in over 20 provinces, and more than 8,000 pictures were received (UNEP, 2007).

BOCOG also developed several projects to spread the message of Green Olympics among the general public. The Green Olympics Green Action Team was established in 2004 by BOCOG and the Beijing Environmental Protection Bureau. It was used to promote Olympic environmental values, principles, and practices about sustainable development. BOCOG produced several publications on the “Green Olympic” theme, including the IOC Agenda 21, the BOCOG environmental reports for the years 2003-2006, and the environmental guidelines for construction of Olympic venues. In 886 communities in Beijing, the Green Community and Green Home Campaign was launched to raise environmental awareness among Beijing family and communities, encourage water and energy saving, and promote waste sorting and green consumption. Another major project was the “One Day, No Engine Sounds” Campaign in October 2006, including 504 institutions and 407 car clubs, which was used to encourage the adoption of alternative transportation ways other than cars and to raise the awareness of air and noise pollutions. In addition, the Beijing Green Map Initiative was employed to encourage

Beijing citizens to label the environmental and cultural facilities around the city. A travel exhibition, the Close to the Nature Hand in Hand with Fuwa Exhibition, was developed to raise awareness about the living environment and habitat of the four animal-like Fuwa (UNEP, 2007).

Greenpeace believes that it is vital that the theme of “Green Olympics” is promoted among the Chinese public, with the objective of increasing the Chinese public’s level of environmental awareness. Through a set of projects on delivering the message about Green Olympics, it was expected that the Chinese public would have a higher level of awareness about the Green Olympics and have more knowledge about environment.

### **Awareness and Attitude**

The Yale attitude change approach, developed by Carl Hovland, suggests that varying opinions or beliefs (the knowledge component) that people have contribute to the change of their attitudes. Many researchers have conducted studies about the relationship between attitudes and knowledge, which is considered as a complicated one without being fully understood (Zimmerman, 1996). In Petrzela and Korsching’s (1996) study of sustainable agriculture, they found that farmers’ knowledge change about sustainable agriculture lead to the change of their attitudes toward it. Mangas and Martinez’s (1997) suggested that after finishing an environmental education course, there was an increase in both students’ environmental knowledge and their environmental attitudes. Floria, Wolfing, and Fuhrer (1999) indicated that “factual knowledge about the environment is a precondition of one’s environmental attitude.” A relationship was found between knowledge and attitude in the Kuhlemeier Bergh, and Lagerweij’s (1999) study of environmental literacy. Similarly, Bradley, Waliczek and ZaJicek (1999) studied the relationship between knowledge and environmental attitude among high school students, and found that in both the pre- and post-test, students with higher knowledge scores also had higher attitude scores.

## **Residents Perceptions of Mega Events**

Based on Gibson's study about perception, Schwartz (2004) concluded and stated that "perceiving is the picking up of information about the world made available to the perceiver by various sorts of physical stimulation" (p. 93), which results in one's perception. In this context, information, as a feature of a mode of stimulation, exists in the world rather than in the perceiver. It may be picked up, overlooked, or ignored. Mega events are likely to stimulate both positive and negative impacts in several spheres: economic, tourism, commercial, physical, sociocultural, psychological, and political (Delamere 2001; Fredline, Jago & Deery, 2003; Ritchie 1984).

There are many researches who have investigated perceived positive impacts of mega events. These studies have highlighted the economic benefits in the form of tax revenues, employments, and additional sources of income (Deccio & Baloglu, 2002; Getz, 1997; Hall, 1989; Kang & Perdue, 1994; Murphy & Carmichael, 1991; Travis & Croize, 1987; Uysal & Gitelson, 1994). It is suggested that mega events are likely to improve community pride and international recognition of the host community (Hall, 1992; Jeong & Faulkner, 1996; Kim & Petrick, 2005; Mihalik & Cummings, 1995; Mihalik & Simonette, 1998; Ritchie & Aitken, 1984, 1985; Ritchie & Yangzhou, 1987). Many residents consider the lasting facilities created for the event as one of the great benefits (Allen, Hafer, Long, & Perdue, 1993; Chalkley & Essex, 1999; Kendall & Var, 1984; Lankford & Howard, 1994b; Mihalik & Cummings, 1995; Mihalik & Simonette, 1998; Ritchie & Aitken, 1984; Ritchie & Lyons, 1990). Another critical impact of mega-events involves the improvement of residents' life quality (Deccio & Baloglu, 2002; Goeldner & Long, 1987; Hall 2004). It is believed that mega events are able to improve cultural and shopping opportunities for the local residents (Fredline 2005; Jeong & Faulkner, 1996), strengthen regional values and traditions, and even lead to a better understanding about other

cultures (Hall, 1989). In addition, hosting mega events can also improve city beautification and enhance its safety system (Kim & Petrick, 2005).

Mega events are likely to bring benefits to the host communities, but they are also possible to cause problems to the local residents. In terms of the perceived negative impacts, mega events are regarded to cause price inflation and an increase in local tax to construct the facilities required to host the event, which burdens the locals financially (Deccio & Baloglu, 2002). If mega-events require tremendous government assistance and compete for local manpower, the events may receive negative reactions from existing enterprises (Ritchie, 1984). Mega-events are also likely to create some societal problems such as traffic congestion, law enforcement strain, and increased crime (Mihalik & Cummings, 1995). Other societal and cultural problems include the negative influence on traditional family values (Kousis 1989), cultural commercialization (Cohen, 1988), and conflicts between the host community and visitors because of different standards of living, economic welfare, and purchasing power gaps (Tosun, 2002). Mega-events may also damage the image of the host community or make it acquire a poor reputation as a result of inadequate facilities or improper practices (Ritchie, 1984). Higham (1999) and Fredline (2005) identified the displacement of residents as negative effect of hosting mega events. Hall (2001) indicated that after Sydney being selected as the host city for the 2000 Olympic Games, house and rental prices increased substantially in Sydney, which caused relocations of low-income earners.

Studies of residents' perceptions of the impact on the environment in the tourism literature imply that residents may view hosting a mega event as either a positive (Allen, Long, Perdue & Kieselbach, 1988; Murphy 1983; Ritchie 1988) or a negative (Liu, Sheldon & Var 1987; Pizam 1978) impact. Ritchie (1984), one of the earliest researchers who investigated

environmental impact of mega events, suggested a conflict between benefits from the development of facilities and infrastructure for mega events and the potential for environmental degradation caused by facility constructions and their future use. Mega events may be perceived to have negative impacts on the physical and natural environment, including pollution and the destruction or deterioration of natural, cultural, or historical resources. But they also can act as a positive factor for environmental protection. Deccio and Baloglu (2002) indicated that mega events were likely to serve as catalysts for bringing attention to the natural environment and thus help in preserving elements of the physical landscape and local heritage that would have otherwise been ignored.

Based on previous studies, residents' ecocentric attitude, community attachment, and community concern are key factors that influence their perceptions of impacts from mega events (Deccio & Baloglu, 2002; Gursoy et al., 2002; Gursoy & Kendall, 2006). Thompson and Barton (1994) defined "ecocentric" or "environmentalist" as people who value the preservation of the natural environment for its own sake, and explained "anthropocentric" as people who support environmental protection because of materials or physical benefits it can provide for humans. Jurowski (1994) found that rural residents who held higher ecocentric values were more likely to perceive attraction-based or nature-based tourism negatively. Jurowski et al. (1997) reported that there was a significant relationship between the level of ecocentric attitude and host perceptions of impacts. Gursoy et al. (2002) also found that residents' environmental attitude was related to how they perceived the costs and benefits from tourism development. However, Deccio and Baloglu (2002) found that ecocentric attitudes did not have any significant influence on perceived impacts. Residents' attitude about the relationship between human and the environment may influence their values and preferences for preservation and use of resources. It

is shared by researchers that residents with ecocentric values tend to support utilization of resources to protect and preserve environment, and residents with anthropocentric lean to agree sacrifice of environment to satisfy human needs and desires (Jurowski, Uysal, Williams, & Noe, 1993). These research findings indicate that attitudes toward the environment may affect the way residents perceive the impacts of tourism (Jones, Jurowski, & Uysal, 2000).

The level of concern residents have about their community may influence their perception of mega events. Concerns about local issues such as the air quality, water quality, transportation, recreational opportunities, and so forth, may affect how they view the costs and benefits of mega events. Previous research has found mixed conclusions about residents' community concern in relation to their perceptions of events impacts, especially the perceived impact on environment (Allen et al., 1988; Ritchie 1988) and recreation opportunities (Keogh 1990; O'Leary 1976; Perdue et al 1990). Despite some divergent findings, it is usually agreed that residents' concerns about the community influence their perceptions of the potential costs and benefits (Perdue et al., 1990) and their support for venue development (Gursoy et al., 2002).

Attachment to the community, defined as the level of social bonds such as friendships, sentiment, and social participation (Goudy, 1982; Jurowski 1994), considered being another factor that impacts residents' perceptions of mega events. McCool and Martin (1994) reported a greater sense of belonging to a community as closely correlated to higher ratings of both positive and negative impacts. Gursoy and Kendall (2006) studied the relationship between community attachment and attitudes toward mega events, and found that residents highly attached to their community trended to view mega events beneficial for the local community which was consistent with the study by Deccio and Balogu (2002). Jurowski et al. (1997) argued that attached residents were prone to evaluate the economic and social impacts from tourism

positively, while tend to perceive its environmental impacts negatively which was shared in Jurowski et al. (1993)'s study about environmental attitudes. Um and Crompton (1987) found that community attachment was negatively related to the perceived impacts related to the tourism. Lankford and Howard (1994) and Gursoy et al. (2002) did not find a clear connection between attachment and impact perceptions, while Deccio and Baloglu (2002) found that host community attachment had no significant impact on perceived opportunities and support. However, they did find community attachment had a significant influence on perceived concerns.

### **Residents' Attitude toward Mega Event**

Eagly and Chaiken (1993) defined attitude as "a psychological tendency that is expressed by evaluating a particular entity with some degrees of favor or disfavor" (1993:1). Responses that express evaluation and reveal people's attitudes should be composed of three aspects: cognition, affect, and behavior (Rosenberg & Hovland, 1960). The cognitive aspect refers to people's thoughts about the attitude object; the affective aspect means people's feelings or emotions with respect to the attitude object; the behavioral aspect explains people's action relating to the attitude object. In this study, the entity, the attitude object, is the 2008 Beijing Green Olympics.

Based on social exchange theory, if residents perceive that the benefits from hosting the Green Olympics exceed the costs, they will have positive attitude toward them. There is a direct relationship between resident support and the perceived economic benefits and long-term awareness derived from the events (Ritchie & Lyons, 1990; Mihalik & Simonetta, 1998). It is suggested that residents who are likely to obtain the greatest benefits from the event often favor and support hosting the event more than those who receive fewer benefits (Perdue et al., 1990; Ritchie, 1988). Ritchie and Smith (1991) conducted a longitudinal study of the 1988 Winter Olympic Games in Calgary and found that residents consistently supported the event because of

perceived short- and long-term rewards. Turco (1998), on the other hand, found that a majority of residents received social benefits from a hallmark event and were thus more willing to support public funding of facility development and event promotion. After successfully hosting an event, the positive evaluation of its social impacts is likely to lead to residents' supportive attitude toward future events (Besculides, Lee, & McCormick, 2002; Brunt & Courtney, 1999; Lankford & Howard, 1994; Madrigal, 1993). The perceived detrimental impacts to the environment is possible to cause negative attitude toward hosting future mega events while the events which are regarded as catalysts in preserving the natural environment lean to positive attitude toward the future events (Liu & Var, 1986).

### **Summary**

The relationship between sport and environment is significant for the sustainable development. Sport activities can cause environmental degrading (Ritchie, 1984) or lead to the increase of environmental concern (Deccio & Baloglu, 2002). Olympic Games, considering the large number of people, activities, and materials involved, are more likely to have great influence on the environment. According to Olympic Movement's Agenda 21, the concept of sustainable development was adopted as the central theme that must govern the implementation of development plans for the 21<sup>st</sup> century (IOC,2009c), which is also in conformity with the goal of Olympism - to place sport at the service of the harmonious development of humankind. In the Candidature File, it is stated that from the beginning of the candidature to the post-Olympic period, all measures should be taken to minimize or eliminate environmental impact and to benefit the harmonious interrelation of the Olympic Games into the natural surrounding (IOC, 2002). However, environment was not always considered as an importance factor for the Olympic Games until it was added as the third dimension to the Olympic Movement in 1996. The Games had gone from virtually no consideration of environmental issues to some

comprehensive efforts to minimizing adverse effects (Balderstone, 2001). Sustainable development has been a popular concept in all the areas including economic, social, and environment. Today, the world faces a number of major environmental problems that directly influence the health of human beings as well as plants and animals, such as global warming, deforestation, loss of biodiversity, ozone depletion, pollution, and over-consumption of natural resources. During the United Nations Conference of the Environment in 1972, it was declared that environmental protection and improvement should be an urgent desire of the whole world and the duty of all governments. Overtime, the economic development is directly tied to the health of the environment (UNEP, 2009). Therefore, environmental sustainability should become one of the most important considerations for every country and organization aiming to achieve long term benefits, so are the Olympic Games. The IOC in cooperation with the UNEP has conducted various activities to raise awareness and educate people on environmental matters in sport since 1994. In 1995, the Sport and Environment Commission was created to promote the environmental responsibility and sustainable development. The biennial World Conference on Sport and Environment was started in 1995 to bring together experts to contribute to the awareness of the relationship between sport and the environment. After adding the environment to the Olympic Movement in 1996, the Olympic Games that serve to develop a harmonious world have been trying to establish a sustainable relationship with the environment. In 1999, an Agenda 21 was developed by the IOC and the UNEP to give guidance on sport and environment development. The IOC also requires that the host cities pay special attention to the environmental aspect during the preparation, operation, and particularly post-Olympic periods. The Sydney Games in 2000, Salt Lake City Games in 2002, Athens Games in 2004, Turin

Games in 2006, and Beijing Games in 2008 all made efforts to green the Olympics and left some environmental contributions to the host communities.

Obviously, the Olympic Games place great concern on the sustainable development. To realize the essential role of the environment in sport development and ensure that the Olympic Games entail their environmental responsibility, it is necessary to study the Green Olympics' development, and investigate the environmental changes over the course of the Olympics' preparation, operation, and post-Olympic periods. However, few studies have examined the effectiveness of environment protection plans as the third aspect in the Olympic Movement, and even fewer focused on the environmental changes during the whole process of the Games. Overall, it is necessary to examine the awareness, perception, attitude, behavioral intentions, and actual behavior of residents of the host community of Olympic Games, and how they function together and lead to continued reinforcement of environmental protections and improvements. Studying the relationships among awareness, perception, attitude, behavioral intentions, and actual behavior for this study can be illustrated as Figure 2-1.

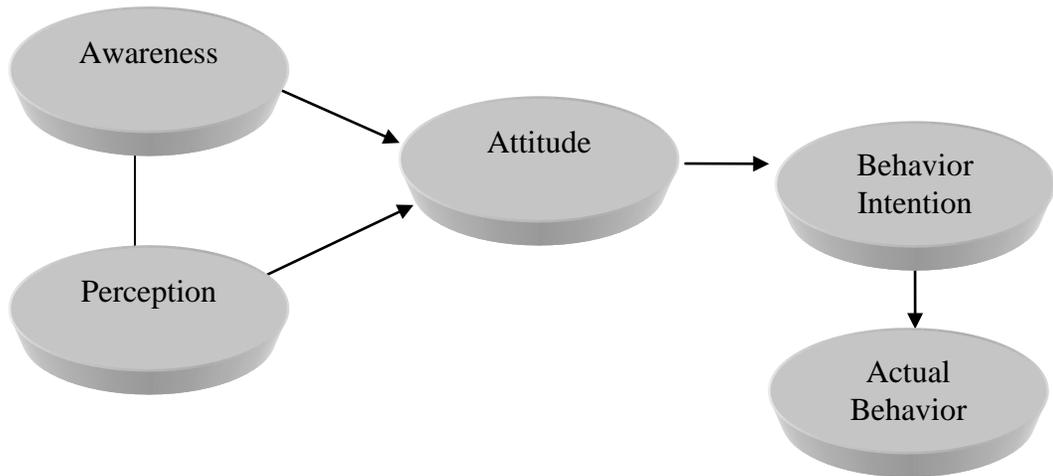


Figure 2-1. Theoretical Model--Relationships among Awareness, Perception, Attitude, Behavior Intention, and Actual Behavior.

## CHAPTER 3 METHOD

The method of this study is presented in the following four sections: (a) participants, (b) measurement, (c) procedures, and (d) data analyses. A survey design was conducted in this study to evaluate the resident's awareness, perception, attitude, behavior intention, and actual behavior associated with the 2008 Beijing Green Olympics.

### **Participants**

This study was conducted from June to August in 2009 in Beijing, China, the host city of the 2008 Olympic Games. A convenient sampling procedure was adopted and participation in this study was completely voluntary. In an attempt to obtain a diversified sample of the residential population, respondents ( $N = 298$ ) were recruited in 16 districts of Beijing, which were of various distances from the National Stadium (i.e., the Bird's Nest). In order to effectively examine the residents' awareness, perceptions, attitude, behavior intention, and actual behavior toward the Beijing Green Olympics, participants in this study needed to have primarily lived in Beijing as their main residential location from 2001 to June, 2009. The year of 2001 was critical as it was when Beijing was granted to host the 2008 Olympic Games by the IOC. In an effort to ensure adult-level memory and assessment accuracy, an individual was required to have been at least 18-years-old in 2001, the legal adult age in China. Therefore, each participant was at least 26-years-old at the time of test administration. To enhance sampling representation of Beijing residents, people with diverse demographic background, such as gender, age, education, and profession, were invited to participate in the study. Data collection was conducted via e-mail, online survey, and face-to-face surveys. Assistance for data collection was obtained from trained research assistants who resided in Beijing.

According to the Beijing Statistical Yearbook-2007 (n.d., 2007), of the sampled residents in Beijing with at least 25-years-old, about 42.4% were male and 57.6% were female. Close to 13.5% with 25 to 30-years-old, 24.0% with age from 30 to 39, 23.6% aged from 40-49, 18.5% with 50 to 59-years-old, and about 20.5% aged 60 or older. In terms of family size, about 35.0% of the sample came from families with three people; 30.5% with two people, 18.0% with four or more people, and 16.5% with only one person.

Of the sample in this study, 56.4% were male and 43.6% were female. The sample contained participants of various age groups, including younger than 30 (40.1%), between 30 and 39 (31.6%), between 40-49 (17.5%), between 50 and 59 (8.8%), and 60 or older (2.05%). A majority of them were married (65.4%). Residence length was widely distributed, including 34.8% respondents with 21 to 40 years of residence, 25.0% with 6 to 10 years, 19.6% with 41 to 60 years, 15.2% with 11 to 20 years, and close to 4.7% with 5 or less years. A majority of the respondents (58.1%) possessed an undergraduate or an advanced degree; however, about 16.8% of the sample had lower than a high school educational background. With respect to family size, 48.3% respondents came from families with three people; 27.2% with four or more people, and 24.3% with one or two persons. Of them, 51.3% respondents were from households with less than ¥6,000 monthly income and on the other hand, 10.7% were of ¥15,000 or more monthly household income. In terms of residential locations, 47.7% of the respondents resided in districts within 15km of the Bird's Nest, 22.3% resided in districts between 31km and 45km away from the Bird's Nest, and close to 15.5% resided in the same district with the Bird's Nest. In terms of community fee, about 50.7% of the residents had no such fee, close to 20.7% paid less than ¥100 or less per month, and 26.5% paid more than ¥100 monthly. Occupational categories were

widely distributed, mainly including education, clerical, student, skilled worker, management, farmer, professional, and sales (Table 3-1).

### **Instrument**

A questionnaire was formulated based on a comprehensive review of literature and a test of content validity. This preliminary questionnaire included the following six sections: awareness, perception, attitude, behavior intention, actual behavior, and demographic background (Table 3-1).

The first section assessed a resident's awareness, basic knowledge, and understanding of the Beijing Green Olympics initiative, which included nine questions in a multiple-choice format and eight questions in a true-or-false format. These questions were of the focus on BOCOG plans for environment improvement and the implementation process of the plans. Identification and formulations of preliminary items were based on key literature containing plans and process of improving the environment of a host city for Olympic Games (e.g., IOC, 2007; UNEP, 2007, 2008; Zhang, 2008).

The second section assessed perceived impact of the Green Olympic initiative. This section contained 21 questions in a 7-point Likert scale (1 = "strongly disagree" to 7 = "strongly agree"), which were derived from a number of previous studies, including Ap and Crompton (1998), Ko and Stewart (2002), Liu and Var (1986), Liu, Sheldon, and Var (1987), and Ritchie and Inkari (2006). The questions generally focused on rating the effectiveness of improving air quality (2 items), use of renewable energy source (2 items), public transportation (3 items), water environment (4 items), ecological construction (4 items), industrial pollution (2 items), solid waste (2 items), and environmental education (2 items).

The third section contained 12 questions measuring individual attitude toward both the 2008 Beijing Olympic Games and the Green Olympics, adopting a 7-point Likert scale (1 =

“strongly disagree” to 7 = “strongly agree”). A number of the questions were adopted from Lindberg and Johnson’s (1997) study on resident attitudes toward event visitors. Respondents were asked whether they perceived that their personal and community benefits of the 2008 Beijing Olympics outweighed the costs of preparing for the Olympics Games. Respondents were also asked whether they agreed, felt pleasant, and favored hosting Olympic Games and seeing changes planned and/or made in the city of Beijing. The 12 items were divided into two conceptual areas: attitude toward the Olympics (6 items) and attitude toward the Green Olympics (6 items).

Section four included 11 items related to intentions to support hosting the 2008 Beijing Green Olympics and bidding for other mega events. The items were phrased in a 7-point Likert scale (1=“strongly disagree” to 7= “strongly agree”), assessing the residents’ intention to support the host of the Green Olympic Games in Beijing, development of Olympic facilities and services, promotion of Beijing as a host city of Olympic Games, and bidding and preparing for other large scale events. These were adopted and modified from Gursoy and Kendall’s (2006) questionnaire assessing residents’ support toward city development for attracting and hosting events and visitors, along with Söderlund (2006) and Zeithaml et al.’s (1996) scales on behavioral intention. The 11 items were conceptualized into two factors: behavior intention toward the mega events (6 items) and behavior intention toward the Green Olympics (5 items).

Section five contained 18 items related to the actual consumption behavior toward the Green Olympics and mega sport events, which were measured on a 7-point ordinal scale. Respondents were asked about the extent to which they followed the Green Olympics’ initiatives in areas such as reducing the water waste, energy saving, increasing environmental knowledge, and promoting positive community engagement in the Green Olympics. Adopting a similar

ordinal scale, respondents were also asked to rate on how often they followed mega sport events via media outlets, how often they attended mega sport events, and volunteered for mega sport events.

Section six consisted of 10 questions measuring demographic background information, including age, gender, marital status, occupation, education level, family size, household income, length of residency in Beijing, region of residence in Beijing, and community fee. Inclusion of these demographic variables was merely for the purpose of sample description. Multiple choice or open-ended format of response was adopted for these demographic variables.

### **Procedures**

Following the development of the preliminary questionnaire, it was submitted to a panel of experts including five university professors in sport management for content validity testing. The panel members were asked to examine the relevance, representativeness, and clarity of items within each conceptual area. According to the feedback of the panel members, the preliminary questionnaire was modified, revised, and improved, mainly in the areas of item adequacy, factor relevance, and wording clarity. With the assistance of two linguist experts in Chinese and English, the modified questionnaire was double-translated from English to Chinese and then from Chinese to English to ensure translation accuracy.

Data collection was conducted via e-mail, online survey, and face-to-face survey administration. Assistance for data collection was obtained from two trained research assistants who resided in Beijing. Their primary responsibilities were to help identify residents located in different districts of Beijing, make the initial contact, obtain e-mail address, and administer the questionnaire. Upon verbally agreeing to participate in the study, an individual was first screened by the following two questions: (a) he/she was 18 years or older in 2001; and (b) Beijing had been his/her primary residential location between 2001 and 2009. After confirming an

individual's suitability for involving in the study, he/she was e-mailed or presented a survey packet that included an Informed Consent Form explaining the purpose and procedures of the study, followed by the questionnaire. Only respondents finishing questions in all six sections of the questionnaire were included in the data analyses. Completing a questionnaire, on average, took approximately 25 minutes. A total of 298 copies of the questionnaire were collected and included in subsequent data analyses and hypothesis testing. Missing values were rarely spotted within the sample of 298 respondents. Among those occasional missing data point, no Not-Missing-At-Random (NMAR) data (Rubin, 1987; Schafer & Graham, 2002) were found. Only few Missing-At-Random (MAR) were detected. For those MAR data, mean substitutions were applied.

### **Data Analyses**

Procedures in the SPSS computer program (SPSS, 2008) were utilized to conduct statistical analyses. Descriptive statistics were calculated for the socialdemographic, awareness, perception, attitude, behavior intention, and actual behavior variables. Skewness and kurtosis of the items were examined. For both skewness and kurtosis cut-off criteria, an absolute value of 3.0 would be considered extreme (Chou & Bentler, 1995). Item analyses that included calculations of item difficulty and item discrimination were conducted for each of the awareness variables. Following the procedure outlining by Bangartner, Jackson, Mahar, and Rowe (2007), top and bottom 27% of the participants were selected based on their total awareness scores derived from the original 17 items. Kuder Richardson formula was used to calculate the internal consistency of awareness items. Cronbach's alpha reliability coefficients were calculated for the perception items under eight factors, attitude items under two factors, behavior intention items under two factors, and actual behavior items under two factors. Zero-order correlation coefficients among the awareness, perception attitude, behavior intention, and actual behavior

factors were calculated and tested. Following the ordinary least square (OLS) procedures (Baron & Kenny, 1986), hierarchical regression analyses were conducted to examine the sequential relationship of awareness and perception to attitude, behavior intention, and actual behavior factors.

Table 3-1. Discriptive statistics for Sociodemographic Variables (N=298).

Variables	Category	<i>N</i>	%
Gender	Male	168	56.4
	Female	130	43.6
Age ( <i>m</i> =35.05; <i>SD</i> =9.65)	Younger than 30	119	40.1
	30-39	94	31.6
	40-49	52	17.5
	50-59	26	8.8
	60 or older	6	2.0
Marriage	Single	99	33.2
	Married	195	65.4
	Divorced	3	1.0
	Widowed	1	0.3
Residence Length ( <i>m</i> =24.93; <i>SD</i> =15.53)	5 or Less	14	4.7
	6-10	74	25.0
	11-20	45	15.2
	21-40	103	34.8
	41-60	58	19.6
	61 or Longer	2	0.3
Education	Advanced Degree	97	32.6
	Bachelor Degree	76	25.5
	High School Graduate	75	25.2
	Middle School Graduate	34	11.4
	Elementary Graduate	14	4.7
Household Income (¥)	¥2,000-3,999	79	26.5
	¥4,000-5,999	74	24.8
	¥6,000-7,999	36	12.1
	¥8,000-9,999	31	10.4
	¥10,000-14,999	34	11.4
	¥15,000-19,999	11	3.7
	¥20,000-29,999	12	4.0
	¥30,000 or more	12	4.0

Table 3-1. Continued.

Variables	Category	<i>N</i>	%
Occupation	Management	26	8.7
	Technical	18	6.0
	Student	34	11.4
	Professional	24	8.1
	Sales	24	8.1
	Farmer	25	8.4
	Clerical	37	12.4
	Education	38	12.8
	Skilled Worker	31	10.4
	Non-Skilled Worker	14	4.7
	Other	6	2.0
Family Size ( <i>M</i> =3.06; <i>SD</i> =1.11)	1	28	9.4
	2	44	14.9
	3	143	48.3
	4	50	16.8
	5	24	8.1
	6	7	2.3
Distance between your district and Bird Nest (km)	In the same district	46	15.5
	1-15km	142	47.7
	16-30km	34	11.5
	31-45km	63	22.3
	More than 45km	12	3.0
Community Fee (¥) ( <i>M</i> =89.50; <i>SD</i> =157.33)	¥0	151	50.7
	¥1-50	22	7.7
	¥51-100	38	13.2
	¥101-200	36	12.6
	¥201-500	35	12.2
	¥501 or higher	5	1.7

## CHAPTER 4 RESULTS

### **Descriptive Statistics**

Findings of item analyses, including item difficulty (D coefficient) and item discrimination (R coefficient), for awareness variables are presented in Table 4-1. According Baumgartner et al. (2007), a D coefficient ranging from .30 to .70 would be acceptable and an R coefficient above .20 would meet minimum criterion. Accordingly, eight questions in either multiple choice or true-false format (i.e., Which of the following is one of the fundamental IOC's requirements for selecting a host city for the Olympic Games? Which of the following is a long-term goal for environmental improvement for the 2008 Beijing Olympic Games? Which of the following was a temporary measure in Beijing's environmental plan that was only implemented during the Olympic Games? Which of the following items about reforming Beijing's energy structure was included in the Beijing Olympic environmental plan? "Green Olympics" was one of the key principals that guided the planning and implementation of the 2008. New cars in Beijing are required to meet the Euro III emission standard. Green coverage in the urban districts of Beijing met the Olympic bid goal by the starting time for hosting the Olympic Games. The city of Beijing has exceeded its Olympic bid goal for waste classification and recycling.) in this section were removed. The remaining eight questions met the D and R criteria and were hence included for subsequent internal consistency analysis adopting the Kuder-Richardson formulae (Baumgartner et al., 2007), which resulted in .736 and was above the .70 criterion. Descriptive statistics for the awareness factor were calculated. Individual total scores ranged from 1 to 8 ( $M = 4.94$ ;  $SD=1.554$ ). Both skewness (-.230) and kurtosis (-.197) values for the awareness variable were well within the acceptable threshold of +3.0 (Chou & Bentler, 1995).

Descriptive statistics for the perception variables are presented in Table 4-2. According to the measurement conceptualization and design of these variables, the 21 perception items were categorized into the following eight factors: air quality (2 items), energy (2 items), public transportation (3 items), water environment (4 items), ecological construction (4 items), industrial pollution (2 items), solid waste (2 items), and environmental education (2 items). Besides mean and standard deviation were calculated for each factor, a weighted mean score was calculated for each factor, with an intention to cross-compare the perceived impact among factors.

Accordingly, the Green Olympics had strongest impact on environmental education and least impact on water quality. Cronbach's alpha coefficients for the factors were .923, .813, .796, .854, .818, .775, .741 and .796, respectively, indicating that the eight factors were all internally consistent and reliable (Cronbach, 1951). Both skewness and kurtosis values for the perception factors were well within the acceptable threshold of  $\pm 3.0$  (Chou & Bentler, 1995).

Descriptive statistics for the attitude, behavioral intention, and actual behavior variables are presented in Table 4-3. Following the measurement conceptualization, the 12 attitude items were categorized into two factors: Attitude toward the Olympics (6 items) and Attitude toward the Green Olympics (6 items). Both of the 'Attitude toward the Green Olympics' factor ( $M = 38.09.16$ ;  $SD = 4.187$ ) and the 'Attitude toward the Olympics' factor ( $M = 36.02$ ;  $SD = 5.301$ ) showed that residents had highly positive attitude toward both the Olympics and the Green Olympics, with weighted mean scores above 6.0 on a Likert 7-point scale. Cronbach's alpha coefficients for the factors were .844 and .871, respectively, indicating that both factors were internally consistent and reliable.

According to the measurement conceptualizations, the 11 items for behavioral intentions were categorized into two factors: behavior intention toward the mega events (6 items) and

behavior intention toward the Green Olympics (5 items). Mean scores for the ‘behavior intention toward the mega events’ factor ( $M=34.44$ ;  $SD=5.664$ ) and the ‘behavior intention toward the Green Olympics’ factor ( $M=29.46$ ;  $SD=4.581$ ) indicated that residents in Beijing had high behavior intentions toward both mega events and the Green Olympics. Cronbach’s alpha coefficients for the factors were .848 and .866, respectively, indicating that the factors were internally consistent and reliable. Similarly, the 18 items on actual behaviors were grouped into two factors according to the measurement conceptualization: actual behavior toward the Green Olympics (10 items) and actual behavior toward the mega events (8 items). Mean scores for the ‘actual behavior toward the Green Olympics’ factor ( $M=58.94$ ;  $SD=5.285$ ) and the ‘actual behavior toward the mega events’ factor ( $M=34.37$ ;  $SD=8.818$ ) revealed that residents were strong in behavioral participation in the Green Olympics activities; however, they were only slightly higher than the neutral point in the Likert 7-point scale in behavioral support toward hosting mega events in Beijing. Cronbach’s alpha coefficients for the factors were .888 and .751, respectively, indicating that they were internally consistent and reliable. Additionally, all skewness and kurtosis values for the attitude, behavior intention, and actual behavior variables were well within the acceptable threshold (Chou & Bentler, 1995).

### **Intercorrelations**

Correlations among awareness, eight perception factors ( air quality energy, public transportation, water quality, ecological construction, industrial pollution, solid waste, and environment education), attitude toward the Olympics, attitude toward the Green Olympics, intention toward the mega events, intention toward the Green Olympics, actual behavior toward the Green Olympics, and actual behavior toward mega events are presented in Table 4-4. Awareness of Beijing Green Olympic Initiatives was significantly ( $p < .05$ ) related to the perception of air quality, perception of water quality, and perceptions of industrial pollution; yet,

it was not found to be significantly ( $p > .05$ ) related to other perception factors, the two attitudinal factors, the two behavioral intention factors, nor the two actual behavior factors. Conversely, all of the perception factors were significantly ( $p < .05$ ) related to the two attitudinal factors, two behavioral intention factors, and two actual behavior factors, respectively. The two attitudinal factors were significantly ( $p < .05$ ) related to the two behavioral intention factors and two actual behavior factors, respectively; in turn, the two behavioral intention factors were significantly ( $p < .05$ ) related to the two actual behavior factors.

### **Hierarchical Regression Analyses**

Hierarchical regression analyses were conducted by adopting the OLS procedures to examine the sequential relationships among awareness, perception, attitude, intention, and actual behavior factors associated with Green Olympic movement and mega sport events (Tables 4-5 & 4-6). According to Baron and Kenny (1986), in order to establish a sequential/mediating effect that a variable has on the relationship between a predicting variable and a criterion variable, four elements are required: (a) the predicting variable is correlated with the criterion variable; (b) the predicting variable is correlated with the mediating variable; (c) the mediating variable is correlated with the criterion variables after controlling for the effect of the predicting variable; and (d) correlation between the predicting and the criterion variables is equal to zero after controlling for the effect of the mediating. In the analyses of this study, the following three three models of a hierarchical order were tested for each of the two actual behavior factors (i.e., support of Green Olympics initiatives and support of mega sport events) respectively as the criterion: (a) intention factors, (b) attitude factors, and (c) perception and awareness factors. For Green Olympics Initiatives, intention toward supporting Green Olympics and intention toward supporting mega sport events were significantly ( $p < .05$ ) predictive of actual behaviors, explaining a total of 45.8% variance. These were consistent with the zero order correlation

coefficients. However, after partialling out the effects of behavioral intention factors, the two attitude factors (attitude toward Green Olympics initiatives and attitude toward Olympic Games) were no longer significantly ( $p > .05$ ) predictive of actual behaviors of supporting Green Olympics initiatives when compared to zero-order correlation coefficients, indicating the presence of mediating effects of the behavioral intention factors. Less than 3.0% additional variance was explained of the actual behaviors in this second step model. Likewise, after partialling out the effects of both behavioral intention and attitude factors, the eight perception factors were no longer significantly ( $p > .05$ ) predictive of actual behaviors of supporting Green Olympics initiatives when compared to zero-order correlation coefficients, indicating the presence of mediating effects of the behavioral intention and attitude factors. Only 9.1% variance was added to the total variance explained in Model 3. It appears that for solid waste, air quality, energy, and water quality, mediating effects were partial; whereas, for environmental education, industrial pollution, ecological construction, and public transportation factors, there were full mediating effects. Same as the zero-order correlation coefficient, awareness was not found to be directly ( $p > .05$ ) predictive of actual behaviors of supporting Green Olympics initiatives, nor indirectly.

For support of mega sport events, intention toward supporting mega sport events was significantly ( $p < .05$ ) predictive of actual behaviors, but not intention toward supporting Green Olympics, explaining a total of 14.8% variance. These were not consistent with the zero order correlation coefficients, where both intention toward supporting mega sport events and intention toward supporting Green Olympics initiatives were related to actual behaviors, suggesting the existence of covariance between intention toward supporting mega sport events and intention toward supporting Green Olympics initiatives. With the presence of intention toward supporting mega sport events, intention toward supporting Green Olympics initiatives became less relevant.

After partialling out the effects of behavioral intention factors, the two attitude factors (attitude toward Green Olympics initiatives and attitude toward Olympic Games) were no longer significantly ( $p > .05$ ) predictive of actual behaviors of supporting Green Olympics initiatives when compared to zero-order correlation coefficients, indicating the presence of mediating effects of the behavioral intention factors. Less than 1.0% additional variance was explained of the actual behaviors in this second step model. Likewise, after partialling out the effects of both behavioral intention and attitude factors, the eight perception factors were no longer significantly ( $p > .05$ ) predictive of actual behaviors of supporting mega sport events when compared to zero-order correlation coefficients, indicating the presence of mediating effects of the behavioral intention and attitude factors. Only 2.0% variance were added to the total variance explained in Model 3. Same as the zero-order correlation coefficient, awareness was not found to be directly ( $p > .05$ ) predictive of actual behaviors of supporting mega sport events, nor indirectly.

Table 4-1. Item Analysis for the Awareness Variable.

Item Statement	Decision	D	R
1. Which of the following is one of the fundamental IOC's requirements for selecting a host city for the Olympic Games?	NO	.907	.341
2. Which of the following aspects is NOT a part of the Green Olympics Program?	YES	.696	.516
3. Which of the following implementation was required by the Beijing Green Olympics program?	YES	.438	.538
4. Which of the following is a long-term goal for environmental improvement for the 2008 Beijing Olympic Games?	NO	.809	.451
5. Which of the following was NOT a part of Beijing's Green Olympic bid commitment?	YES	.525	.648
6. Which of the following was used in Beijing's Olympic venues to host the Green Olympics Program?	YES	.623	.692
7. Which of the following was a temporary measure in Beijing's environmental plan that was only implemented during the Olympic Games?	NO	.784	.516
8. Which of the following program was included in the education plan for the Green Olympics?	YES	.710	.604
9. Which of the following items about reforming Beijing's energy structure was included in the Beijing Olympic environmental plan?	NO	.852	.484
10. "Green Olympics" was one of the key principals that guided the planning and implementation of the 2008.	NO	.981	.209
11. The five Olympic mascots were designed to promote environmental awareness.	YES	.698	.538
12. Beijing reduced the price for subway and public buses during the 2008 Olympic Games.	YES	.716	.462
13. New cars in Beijing are required to meet the Euro III emission standard.	NO	.136	.044
14. The city of Beijing used trees from the tropical forests of Indonesia for its Olympic venues.	YES	.691	.220
15. Green coverage in the urban districts of Beijing met the Olympic bid goal by the starting time for hosting the Olympic Games.	NO	.099	.044
16. The city of Beijing has exceeded its Olympic bid goal for waste classification and recycling.	NO	.796	.198

Table 4-2. Descriptive Statistics for the Perception Factors.

Factor	No. of items	M	Weighted M	SD	Skewness	Kurtosis	$\alpha$
Air Quality	2	10.65	5.33	2.921	-.814	.026	.923
Energy	2	10.69	5.35	2.366	-.890	.944	.813
Public Transportation	3	15.25	5.08	3.624	-.706	.361	.796
Water Quality	4	18.78	4.69	4.974	-.072	-.390	.854
Ecological Construction	4	22.44	5.61	3.559	-.458	.029	.818
Industrial Pollution	2	9.94	4.97	2.551	-.447	.011	.775
Solid Waste	2	9.83	4.92	2.525	-.527	.177	.741
Environmental Education	2	11.14	5.52	2.067	-.998	1.977	.796

Table 4-3. Descriptive Statistics for the Attitude, Behavioral Intention, and Actual Behavior Factors.

Factor	No.of items	M	Weighted M	SD	Skewness	Kurtosis	$\alpha$
Attitude toward the Olympics	6	36.02	6.00	5.301	-.910	.470	.844
Attitude toward the Green Olympics	6	38.09	6.35	4.187	-1.303	1.173	.871
Intention toward Mega Events	6	34.44	5.74	5.664	-.771	1.000	.848
Intention toward Green Olympics	5	29.46	5.89	4.581	-1.689	.215	.866
Actual behavior toward Green Olympics	10	58.94	5.89	8.285	-.889	.907	.888
Actual behavior toward Mega Events	8	34.37	4.30	8.818	-.158	-.221	.751

Table 4-4. Zero-order Correlation among Awareness, Perception, Attitude, Behavioral Intention, and Actual Behavior Factors.

Factor	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Know_8_items(A)		- .142 *	- .061	- .100	- .243**	- .006	- .174**	- .113	.084	- .028	.093	.001	.102	.051	.055
P-AQ (B)			.677**	.576**	.588**	.462**	.499**	.431**	.195**	.494**	.308**	.529**	.418**	.293**	.128**
P-EN (C)				.722**	.564**	.502**	.580**	.592**	.283**	.455**	.310**	.498**	.328**	.433**	.170**
P-PT (D)					.577**	.557**	.631**	.601**	.340**	.450**	.302**	.412**	.329**	.402**	.145**
P-WQ (E)						.566**	.588**	.593**	.395**	.513**	.267**	.520**	.411**	.312**	.232**
P-EC (F)							.585**	.585**	.619**	.560**	.456**	.381**	.443**	.412**	.171**
P-IP (G)								.808**	.510**	.451**	.282**	.460**	.407**	.455**	.173**
P-SW(H)									.550**	.373**	.284**	.407**	.416**	.481**	.201**
P-ED (I)										.408**	.344**	.322**	.409**	.432**	.199**
ATT-OG (J)											.719**	.658**	.639**	.592**	.225**
ATT-GO (K)												.517**	.640**	.527**	.193**
INT_ME (L)													.724**	.584**	.371**
INT_GO (M)														.660**	.339**
BEH_GO (N)															.353**
BEH_ME (O)															

\* Correlation is significant at the .05 level (2-tailed).

\*\* Correlation is significant at the .01 level (2-tailed).

Table 4-5. Hierarchical Regression Analyses Examining the Relationships of Awareness, Perception, Attitude, and Behavioral Intentions to Actual Behavior Associated with Green Olympics Movement.

Variable	Partial R	B	SE. B	$\beta$	t	p
Model 1						
Intention toward Green Olympics	.421	.903	.114	.500	7.924	.000
Intention toward mega sport events	.200	.320	.092	.219	3.480	.001
Model 2						
Intention toward Green Olympics	.316	.709	.125	.392	5.668	.000
Intention toward mega sport events	.115	.191	.097	.131	1.978	.049
Attitude toward Green Olympic Games	.049	.107	.128	.054	0.839	.402
Attitude toward Olympic Games	.175	.328	.108	.210	3.028	.003
Model 3						
Intention toward Green Olympics	.302	.637	.120	.352	5.302	.000
Intention toward mega sport events	.139	.226	.096	.155	2.344	.020
Attitude toward Green Olympic Games	.007	.014	.123	.007	.115	.908
Attitude toward Olympic Games	.210	.401	.111	.257	3.605	.000
Perception – Environmental Education	.106	.393	.221	.098	1.781	.076
Perception – Solid Waste	.156	.653	.247	.199	2.647	.009
Perception – Industrial Pollution	.013	.050	.238	.016	0.212	.832
Perception – Ecological Construction	-.052	-.128	.146	-.055	-0.876	.382
Perception – Water Quality	-.205	-.358	.102	-.216	-3.519	.001
Perception – Public Transportation	.071	.177	.148	.077	1.199	.231
Perception – Energy Use	.146	.576	.234	.165	2.467	.014
Perception – Air Quality	-.186	-.536	.169	-.189	-3.167	.002
Awareness	-.035	-.135	.228	-.025	-0.590	.555

Note:  $R^2 = 0.458$  for Model 1,  $p < 0.001$ ;  $\Delta R^2 = 0.030$  for Model 2,  $p < 0.001$ ;  $\Delta R^2 = 0.091$  for Model 3,  $p < 0.001$ .

Table 4-6. Hierarchical Regression Analyses Examining the Relationships of Awareness, Perception, Attitude, and Behavioral Intentions to Actual Behavior Supporting Mega Sport Events.

Variable	Partial R	B	SE. B	$\beta$	t	p
Model 1						
Intention toward Green Olympics	.107	.281	.152	.146	1.847	.066
Intention toward mega sport events	.192	.410	.123	.264	3.341	.001
Model 2						
Intention toward Green Olympics	.124	.364	.171	.189	2.125	.034
Intention toward mega sport events	.199	.457	.132	.295	3.465	.001
Attitude toward Green Olympic Games	-.022	-.065	.175	-.031	-0.374	.709
Attitude toward Olympic Games	-.046	-.116	.149	-.070	-.0783	.434
Model 3						
Intention toward Green Olympics	.100	.303	.179	.158	1.691	.092
Intention toward mega sport events	.199	.489	.144	.315	3.401	.001
Attitude toward Green Olympic Games	-.022	-.067	.183	-.032	-.365	.716
Attitude toward Olympic Games	-.042	-.117	.166	-.070	-.704	.482
Perception – Environmental Education	.039	.214	.329	.050	0.650	.516
Perception – Solid Waste	.032	.195	.368	.056	0.530	.597
Perception – Industrial Pollution	-.041	-.242	.355	-.070	-0.682	.496
Perception – Ecological Construction	.000	.000	.219	.000	0.000	.999
Perception – Water Quality	.081	.208	.153	.118	1.365	.173
Perception – Public Transportation	-.006	-.021	.221	-.008	-0.094	.925
Perception – Energy Use	.011	.062	.349	.017	0.178	.859
Perception – Air Quality	-.092	-.391	.251	-.130	-1.555	.121
Awareness	.039	.222	.341	.039	0.651	.515

Note:  $R^2 = 0.148$  for Model 1,  $p < 0.001$ ;  $\Delta R^2 = 0.004$  for Model 2,  $p < 0.001$ ;  $\Delta R^2 = 0.020$  for Model 3,  $p < 0.001$ .

## CHAPTER 5 DISCUSSION

The environment has grown to be an important concern for many sport organizations. Evidence demonstrates that sport activities can cause serious damages to the environment degrading (Ritchie, 1984; Jagemann, 2003) and lead to an increase of environmental concern (Deccio & Baloglu, 2002). The IOC, has considered environmental issues as one of the critical factors to choose the host city of Olympic Games since the environment was added to the Olympic Charter as the third dimension in 1996. As the negative environmental impacts of the Olympic Games are becoming more recognized among residents in the host city, it is imperative for both researchers and practitioners to examine how effective the environmental plans of the Olympic Games have been implemented and how they affect residents' perception, attitude, intention, and behavior associated with the Games.

Overall cooperation level of local residents plays a key role in the success of hosting mega events such as the Olympic Games, and residents' supportive attitude toward the events may influence the longevity of their supporting behaviors (Deccio & Baloglu, 2002). A great number of studies on residents' perceptions of mega events have been conducted; however, a majority of these studies focused on the economic impact of mega sport events (e.g., Barker et al., 2002; Fredline & Faulkner, 2000; Twynam & Johnston, 2004). Few studies have examined resident's perception of the environmental impact. Since the inception of the Green Olympic Games, no study has been conducted to primarily examine local residents' environmental perception, or their attitude, intention, and behavior toward the environmental initiatives. Additionally, most of the existing studies on mega sport events have focused on the events hosted in western countries; few studies were conducted in developing countries such as China. Therefore, studying residents' environmental perceptions of the 2008 Beijing Olympic Games is critical to gain a

more comprehensive understanding of what influence residents' support toward mega sport events. The current study was designed to fill this void by exploring the awareness of Green Olympics, perceived environmental impact, attitude toward the Olympic Games, behavioral intentions to support future hosting of mega sport events, and actual behavior toward the Olympics among residents of the host city after the Beijing Olympics; in the meantime, this study also examined the relationship among awareness, perception, attitude, and behavioral intentions following the Yale attitude change approach, the theory of reasoned action, and the social exchange theory as a general theoretical framework.

The current study examined residents' perceived environmental impact of the Beijing Olympic Games, and revealed that respondents generally perceived positive outcome arising from the hosting of the Olympic Games. By comparing the environmental situation in 2001 when Beijing was selected as the host city of the 2008 Olympic Games, respondents were most likely to agree that hosting the Olympic Games contributed to improved air quality and water quality, better use of energy, more convenient public transportation, higher rate of green coverage, enhanced management of industrial pollution and solid waste, and better environmental education. These findings confirmed and supported that mega events could act as a positive factor for environmental protection (Deccio & Baloglu, 2002) to explore the host city's environmental potential (IOC, 2009c), promote the conservation and management of resources in the host city environment (IOC, 2009c), and benefit the harmonious development of human society (IOC, 2007). This finding was expected as both the IOC and the UNEP encourages and supports integrating environment into sport activities. The IOC also requires that the host cities pay special attention to the environmental aspect during the preparation, operation, and particularly post-game periods. To a great extent, these positive findings directly resulted

from Beijing's commitment to eliminate and reduce the negative environmental impact of the Olympic Games as the city government invested over \$27 billion in environmental projects in major urban infrastructural areas, such as air quality, energy, transportation, green coverage, industrial pollution, water quality, solid waste management, and environmental education (UNEP, 2007).

With respect to residents' attitude toward the Olympic Games and Green Olympics, the findings of this study revealed that respondents had strong positive attitude toward both of them. It was also revealed that the perceived environmental impact of the 2008 Olympic Games exerted an important impact on attitude toward the Olympic Games and the Green initiatives. These findings were consistent with the Yale attitude change approach, which claimed that human attitudes are usually influenced by altering people's opinion or beliefs, i.e., the cognitive or knowledge component (Zimbardo et al., 1977). As stated by Schwartz (2004), perception is the outcome of people picking up of information that the world makes available to the perceiver by physical stimulation and Perception as the cognitive component is expected to influence an individual's attitude. In this study, the findings that respondents who perceived positive environmental impact trend had positive attitude toward the Olympic Games and Green Olympics can also be interpreted within the framework of the social exchange theory. According to the theory, if the involved individuals or groups perceive that the benefits outweigh the costs from the social exchange, they are more likely to have positive attitude toward the exchange relationship (Ap, 1992). These findings also supported prior study by Liu and Var (1993), which suggested that events may lead to positive impact on preserving the natural environment, which may in turn contribute to positive attitude toward the events. Similarly, existing research on residents' perceived economic and social impact of mega events also supported the notion that

residents with positive attitude toward the events were usually resulted from short- and long-term perceived benefits of hosting the events (Besculides et al., 2002; Brunt & Courtney, 1999; Lankford & Howard, 1994; Madrigal, 1993; Perdue et. al., 1990; Ritchie, 1988; Ritchie & Lyons, 1990; Ritchie & Smith, 1991; Mihalik & Simonetta, 1998).

The current study also revealed that respondents generally showed positive intention to support future mega events and the Green Olympics, and this intention was found to be significantly influenced by the perceived environmental impact and attitude toward the Olympic Games and the Green Olympics. These findings are consistent with the social exchange theory, which indicated that positive evaluations of the results from the social exchange may reinforce individuals' desire for future participation in the relationship (Ap, 1992). It can also be explained by the theory of Reasoned Action, which suggested that intention is influenced by one's attitude (Ajzen & Fishbein, 1980).

The results in this study showed that a majority of the respondents behaved positively toward the Green Olympics; however, their actual behaviors toward mega event were about somewhat neutral, namely, neither positively nor negatively. Actual behavior in this study was found to be related to perceived environmental impact, attitude toward the Olympic Games and Green Olympics, and intention to support mega events and the Green Olympics. These findings can be interpreted by the theoretical realm of Reason Action (Ajzen & Fishbein, 1980). Based on this theory, a person's behavior is determined by his/her behavior intentions, which is a function of his/her attitude toward the behavior and in turn this attitude is influenced by the individual's beliefs about outcome of performing the behavior. This finding, to some extent, was confirmed by the notion that residents' supportive attitude toward the events might influence their positive behaviors (Deccio & Baloglu, 2002).

In this study, awareness (knowledge) of the Green Olympics did not seem to influence attitude toward the Olympic Games. This finding is contrary to the Yale attitude change approach (Zimbardo et al., 1977), which stated that altering the knowledge component that people would have influence on their attitudes. This might be explained by a lack of effectiveness during the communication process. Citizens in Beijing might not have a good understanding of the Green Olympic initiatives. According to the Yale attitude change approach, the message used to change a person's attitude must be noticed, understood, accepted, and retained long enough to become effective, and the source of the message (i.e., the credibility, status, race, and religion), the characteristics of the message (i.e., the structure, order, and type of appeal), and audience (i.e., persuasive-ability, intelligence, self-esteem, initial position) would influence the effectiveness of the communication. Therefore, it was possible that messages relating to the Beijing Olympics' environmental plans, implementations, regulations, and rules might not have been effectively delivered to local residents due to weaknesses and problems occurring in one or more of the four communication elements of event promotions initiated by the city of Beijing and BOCOG. Apparently, the intended effectiveness level in promoting the awareness of Green Olympic movement was not fully achieved by the host city, indicating a need of improvement by future Olympic Games host cities.

### **Implication**

1. Findings of this study have provided a good overview of residents' reaction to the integration of environmental plans as a potential marketing strategy into the preparations and operations of mega sport events.
2. This study may assist mega sport event planners and organizers to better promote the environmental initiatives to the residents in the host city and even live-event spectators and television audience throughout the world.
3. This study may also assist Beijing government in making more successful allocation of public resources and to gain more support from local residents by identifying the effectiveness of the Green Olympic projects from the residents' perspective.

4. Findings from this study support that effective environmental management and performance before, during, and after mega sport events may stimulate positive attitude, behavior intention, and behavior, implying the importance for event planners and organizers to take on their environmental responsibility for the success and sustainability of their investments.
5. This study may also assist marketers of mega events to recognize the value of the environmental initiatives and formulate effective strategies in future marketing campaigns to increase market share.
6. This study also revealed that, in order to improve the perception of the Green Olympic initiatives among residents of the host city, it is necessary for the IOC and the host city to develop various environmental educational programs relating to the Olympic Games. It is important to make those programs understandable and attractive to people with diverse ages and backgrounds, and make messages accessible to the residents on a daily base via media, TV, radio, Internet, newspaper, and magazine.
7. This study suggested that residents should be fully informed with both positive and negative impacts related to the Green Olympic Games, which allows residents to evaluate and compare the benefits and costs by themselves.

### **Future Study**

Over a period of seven years of preparation for hosting the Olympic Games, various construction projects and operational activities took place in the city of Beijing, along with an increased volume of visitors. During that lengthy time, it was hard for residents to identify whether the Olympics would be beneficial or detrimental to the community's environment. This study was conducted between June to August, 2009 when local residents had finally experienced the city without massive constructions for at least 10 months. Ten months after the 2008 Beijing Olympic Games was a good time frame to conduct this study because residents had fully experienced the city with all the advantages and disadvantages resulting from hosting the Games and had a good amount of time to assess the environmental benefits and costs of the Games. However, to comprehensively understand the effectiveness of the Beijing Green Olympics, residents' environmental perception toward the Games and how it affects their attitude, intention and behavior, continued evaluations through longitudinal future studies are recommended. Better

understanding of environmental plans and their implementation effectiveness for the Olympic Games would help accumulate knowledge and experience for hosting future sport events. For instance, after the Beijing Olympic Games, several major cities in China have strived to host various mega sport events, such as Shanghai (F1), Guangdong (2010 Asian Games), and Shenzhen (2011 Universiade). The Olympic Games have their own special characteristics in terms of the length of the event, amount of resources (i.e., human, time, finance, materials) involved, status, power, and impact. It is suggested that future studies be conducted on other mega events carrying environmental responsibilities, which may benefit the sustainable development of the whole sport industry, and even attract other industries to embrace and follow the trend. Where possible, various mega events can be jointly studied and compared in order to elevate the generalizability of research findings. Additionally, this study was conducted in the city of Beijing, which may have different characteristics (i.e., air quality, pollution, transportation, green coverage) when compared to other host cities of the Olympic Games. It would help benefit the sustainable development of the Olympic Games to research residents in other host cities of the Green Olympics, who are likely of a more diverse cultural background in order to further understand the effectiveness of the Green initiatives and the relationships among residents' environmental perception, attitude, intention, and behavior associated with the Olympic Games.

APPENDIX A  
SAMPLE OF QUESTIONNAIRE

2008 Beijing Green Olympics Survey

May 9, 2009

Dear Participants:

I am conducting a study about the impacts of 2008 Beijing Green Olympics. I am interested in how residents in Beijing perceive and respond to the Green Olympics movement and its programs. Your participation in this study is entirely voluntary. It would be greatly appreciated if you would be willing to take part in this study by completing the enclosed questionnaire.

Please do not include your name or identification number on the survey instrument. It will take approximately 10 to 15 minutes to complete. There are no physical and psychological risks associated with participating in completing this questionnaire. Upon completion, please return the questionnaire to the survey administrator.

Please feel free to contact me if you have any questions about this study. Thank you!

Sincerely yours,

Liyan Jin  
Sport Management Master's Student  
College of Health and Human Performance  
University of Florida  
1001 SW 16 Ave Apt 57  
Gainesville, Florida 32601  
Phone: 352.871.4256  
Email: jinliyan2007@ufl.edu

## BEIJING GREEN OLYMPICS QUESTIONNAIRE

**Purpose:** This purpose of the survey is to gain an understanding of the issues related to environmental impacts of 2008 Beijing Green Olympic Games. The collected information will be solely used for research, and your name will not be identified. Your sincere and honest response is greatly appreciated.

**DIRECTION:** Please answer the following multiple-choice questions according to your awareness level. Only one best answer should be circled for each question.

1. Which of the following is one of the fundamental IOC's requirements for selecting a host city for the Olympic Games?

- A. The city has a well-developed plan for environmental protection and sustainability.
- B. The city has a professional baseball leagues.
- C. The city has many golf courses.
- D. The officials of the city are sports fans.
- E. I don't know.

2. Which of the following aspects is NOT a part of the Green Olympics Program?

- A. Forestation
- B. Transportation
- C. Hotel Price
- D. Education
- E. I don't know

3. Which of the following implementation was required by the Beijing Green Olympics program?

- A. Producing artificial rain
- B. Controlling weather conditions
- C. Conducting waste classification and recycling
- D. Purchasing and driving personal automobiles to boost the automobile industry
- E. I don't know

4. Which of the following is a long-term goal for environmental improvement for the 2008 Beijing Olympic Games?

- A. Promote the environment as the third pillar of Olympism
- B. Replace wood with coal resources
- C. Increase community fees for environmental protection
- D. Improve shopping convenience for Beijing residents
- E. I don't know

5. Which of the following was NOT a part of Beijing's Green Olympic bid commitment?

- A. Improve transport infrastructure and construct key roads
- B. Encourage residents to decorate houses with green plants
- C. Improve the water quality of Miyun and Huairou reservoirs
- D. Reduction and control of industrial pollution
- E. I don't know

6. Which of the following was used in Beijing's Olympic venues to host the Green Olympics Program?

- A. Plastic-wooden composite
- B. Energy efficiency lighting

- C. Advanced enclosed water circulation system
- D. All of the above
- E. I don't know

7. Which of the following was a temporary measure in Beijing's environmental plan that was only implemented during the Olympic Games?

- A. Application of stricter emission standards
- B. Use of compressed natural gas public buses
- C. Ban on alternative days the use of cars with even or odd number plates
- D. Promotion of environment awareness
- E. I don't know

8. Which of the following program was included in the education plan for the Green Olympics?

- A. The 'One Day, No Engine Sound' campaign
- B. The 'Green Community and Green Home' campaign
- C. A and B
- D. The 'Impact of Politics on Economy' campaign
- E. I don't know

9. Which of the following items about reforming Beijing's energy structure was included in the Beijing Olympic environmental plan?

- A. Increase the use of coal for heating
- B. Increase the use of personal automobiles
- C. Increase the use of wood to generate electricity
- D. Increase the use of natural gas, wind energy, and solar energy
- E. I don't know

DIRECTION: Please circle True or False for the following statements.

Statement	Answer	
	T	F
1. "Green Olympics" was one of the key principals that guided the planning and implementation of the 2008 Beijing Olympic Games.	T	F
2. The five Olympic mascots were designed to promote environmental awareness.	T	F
3. Beijing reduced the price for subway and public buses during the 2008 Olympic Games.	T	F
4. New cars in Beijing are required to meet the Euro III emission standard.	T	F
5. SO <sub>2</sub> , CO, NO <sub>2</sub> , PM <sub>10</sub> are four major air pollutants that Beijing measures for its daily air quality.	T	F
6. The city of Beijing used trees from the tropical forests of Indonesia for its Olympic venues.	T	F
7. Green coverage in the urban districts of Beijing met the Olympic bid goal by the starting time for hosting the Olympic Games.	T	F
8. The city of Beijing has exceeded its Olympic bid goal for waste classification and recycling.	T	F

DIRECTIONS: You are asked to assess the following statements on a 7-point Likert scale (1 = Strongly Disagree to 7 = Strongly Agree). There is no right or wrong answer. Your sincere response is most important.

<b>Your Perception of Environmental Impacts</b>	Strongly Disagree    strongly Agree
<i>In 2001, Beijing was first selected as the host city of the Olympic Games. When compared to 2001, please indicate how hosting the 2008 Olympic Games has impacted Beijing in the following areas:</i>	
1. Beijing's air quality is now more satisfying.	1 2 3 4 5 6 7
2. Beijing regularly has a clearer sky.	1 2 3 4 5 6 7
3. Beijing is more efficient in the use of clean and renewable energy.	1 2 3 4 5 6 7
4. Beijing has made good progress toward applying energy saving designs and technologies.	1 2 3 4 5 6 7
5. Beijing has more convenient public transportation.	1 2 3 4 5 6 7
6. Beijing has better control of emissions caused by automobiles.	1 2 3 4 5 6 7
7. Beijing has less traffic and parking problems.	1 2 3 4 5 6 7
8. Beijing has enough water to better meet local residents' need.	1 2 3 4 5 6 7
9. Beijing has higher water quality.	1 2 3 4 5 6 7
10. Water sources of Beijing are now better protected.	1 2 3 4 5 6 7
11. Water saving technology is more widely applied in Beijing.	1 2 3 4 5 6 7
12. Beijing has a higher level of forest coverage.	1 2 3 4 5 6 7
13. Beijing has a higher level of grass coverage.	1 2 3 4 5 6 7
14. Beijing has more park and recreation areas for local residents.	1 2 3 4 5 6 7
15. Overall, Beijing has a more beautiful appearance.	1 2 3 4 5 6 7
16. Beijing has better control of noise pollution.	1 2 3 4 5 6 7
17. Beijing has better control of litter pollution.	1 2 3 4 5 6 7
18. Industrial companies in Beijing now more closely follow the "3R" approach (Reduce, Reuse, and Recycle).	1 2 3 4 5 6 7
19. Waste classification and recycling are more routinely adopted by Beijing citizens.	1 2 3 4 5 6 7
20. Beijing has adopted more rules and laws for environmental protection than 8 years ago.	1 2 3 4 5 6 7
21. More environmental education information and programs are now available in Beijing.	1 2 3 4 5 6 7

<b>Your Attitude toward the Olympic Games</b>	Strongly Disagree	Strongly Agree
<i>Green Olympic initiatives mainly refer to the improvement of air quality, energy, green coverage, public transportation, industrial pollution, solid waste management, and environmental education. As a result of Green Olympic programs implemented for the Beijing Olympic Games,</i>		
1. I feel pleased that Beijing hosted 2008 Olympic Games.	1	2 3 4 5 6 7
2. I feel good about the changes planned, initiated and materialized in the city of Beijing for the 2008 Olympic Games.	1	2 3 4 5 6 7
3. I feel sure that the 2008 Olympic Games have benefited both local residents and the city of Beijing in terms of environmental quality.	1	2 3 4 5 6 7
4. I am glad that Beijing was the host city of Olympic Games instead of another city in China.	1	2 3 4 5 6 7
5. I feel happier to live in Beijing now compared to 8 years ago.	1	2 3 4 5 6 7
6. I am in favor of the Green Olympics initiatives	1	2 3 4 5 6 7
7. I think Green Olympic programs should be implemented in all future Olympic Games.	1	2 3 4 5 6 7
8. I think Green Olympic programs are as important as the sport culture of Olympism.	1	2 3 4 5 6 7
9. I am in favor of using Green Olympic programs to promote environmental protection awareness among residents in Beijing.	1	2 3 4 5 6 7
10. Green Olympic programs have been beneficial for the living environment of Beijing.	1	2 3 4 5 6 7
11. I feel satisfied with the environmental changes resulting from the Green Olympics programs.	1	2 3 4 5 6 7
12. The 2008 Olympic Games were held in an environmental-friendly way.	1	2 3 4 5 6 7

<b>Your Intention to Support Future Hosting of Mega Sport Event</b>	Strongly Disagree	Strongly Agree
1. I plan to support the development of sport facilities and services in Beijing.	1	2 3 4 5 6 7
2. I have become an advocate for Beijing as a host city of large-scale sport events.	1	2 3 4 5 6 7
3. I am willing to support bidding and preparing for other mega sport events in Beijing after hosting the 2008 Olympic Games.	1	2 3 4 5 6 7
4. I plan to attend other mega sport events in Beijing.	1	2 3 4 5 6 7
5. I will save money with the goal to spend at large scale sport events in Beijing.	1	2 3 4 5 6 7
6. I plan to recommend others (friends, family members, and co-workers) to support mega sport events in Beijing.	1	2 3 4 5 6 7
7. I plan to continuously support the city to invest in the Green Olympic movement.	1	2 3 4 5 6 7
8. I plan to support other host cities to follow the Green Olympic movement.	1	2 3 4 5 6 7
9. I will try to pay higher price for products that are environment-friendly.	1	2 3 4 5 6 7
10. I plan to encourage other people to take part in Green Olympic programs.	1	2 3 4 5 6 7
11. I plan to support other mega sport events to follow the environment movement.	1	2 3 4 5 6 7

<b>Your Actual Consumption Behavior</b>	Strongly Disagree	Strongly Agree
1. I now make effort to reduce water waste.	1 2 3 4 5 6 7	
2. I now use energy efficiency products.	1 2 3 4 5 6 7	
3. It is now routine for me to recycle paper, plastic, and glass materials.	1 2 3 4 5 6 7	
4. I am now more than ever a supporter of the use of public transportation instead of private car.	1 2 3 4 5 6 7	
5. I now take initiative to positively influence others to gain environmental knowledge.	1 2 3 4 5 6 7	
6. I now check to see if the merchandise is environment-friendly when shopping.	1 2 3 4 5 6 7	
7. Now, I actively seek information about environmental protection.	1 2 3 4 5 6 7	
8. I now support the adoption of Green Olympic programs by other mega sport events.	1 2 3 4 5 6 7	
9. I strongly support Beijing to apply for other mega sport events.	1 2 3 4 5 6 7	
10. I consume healthy and nutritious food.	1 2 3 4 5 6 7	
<i>How often do you engage in the following in a regular year of your life (1—Not at all; 2—Once a year; 3—A few times a year; 4—Once a month; 5—Two or three times a month; 6—Once a week; 7—A few times a week)?</i>		
11. I take part in sport and exercise programs.	1 2 3 4 5 6 7	
12. I attend mega sport events.	1 2 3 4 5 6 7	
13. I watch mega sport events on TV.	1 2 3 4 5 6 7	
14. I follow mega sport events through printed media.	1 2 3 4 5 6 7	
15. I follow mega sport events through online programs.	1 2 3 4 5 6 7	
16. I purchase and use sport merchandise and/or equipment.	1 2 3 4 5 6 7	
17. I volunteer at mega sport events.	1 2 3 4 5 6 7	
18. I make effort to encourage others to lead a healthy life style.	1 2 3 4 5 6 7	

**DEMOGRAPHICS. Please provide the following information by filling out a blank or circling an answer.**

1. Gender: Female    Male
2. Age \_\_\_\_\_
3. Marital status: Single    Married    Divorced    Widowed    other
4. Occupation \_\_\_\_\_
5. How many years have you lived in the city of Beijing? \_\_\_\_\_
6. Where is your location in Beijing?  
 Northeast    Northwest    Southeast    Southwest    Near the Olympic Park
7. What is your highest education level?  
 Primary school    Middle school    High school/Technical school  
 College    Advanced
8. What is the total income of your family every month?  
 ¥2,000-3,999    ¥4,000-5,999    ¥6,000-7,999    ¥8000-9,999  
 ¥10,000-14,999    ¥15,000-19,999    ¥20,000-29,999    ¥30,000 or more
9. How many people in your family? \_\_\_\_\_
10. What is the monthly community management fee for your residence? ¥ \_\_\_\_\_

APPENDIX B  
SAMPLE OF CONSENT FORM FOR PARTICIPANTS

**Dear Participants:**

I am a graduate student majoring in Sport Management at the University of Florida. I am currently conducting a study titled 'Residents' perceptions of environmental impacts of 2008 Beijing Green Olympic Games.' I would respectfully invite you to be a part of this study by completing the attached questionnaire.

This survey measures an individual's knowledge, perception, attitude, behavior intentions, and actual behaviors related to the Green Olympics movement and its programs. It is anticipated that the collected information will help increase understanding of the effectiveness of 2008 Beijing Green Olympics, residents' feelings and attitude, and behaviors, thus enabling the Beijing government to make better decisions to help improve living environment of Beijing.

Your participation in this study is voluntary. It will take approximately 10 to 15 minutes to complete. There are no physical and psychological risks associated with participating in completing this questionnaire. However, you may refuse to answer certain questions or discontinue your participation at any time without penalty. Participants will not receive any benefits by participating in this survey. There is no compensation for participating in this study.

Your return of the survey will indicate your consent to participate in this study. Your responses will be anonymous and there will be no identifying markers that will link you to the questionnaire you complete. The data will be reported as statistical information. I am grateful for your time and deeply appreciated your assistance with this study.

If you have any questions about this research protocol, please contact me at (352) 871-4256 (e-mail: jinliyan2007@ufl.edu) or my faculty supervisor, Dr. James J. Zhang (352-392-0584 x1274; e-mail: jamesz@hhp.ufl.edu). Questions or concerns about your rights as a research participant may be directed to the UFIRB office, University of Florida, Box 112250, Gainesville, FL 32611 (Tel. 352-392-0433).

I have read the procedure described above for the study. I voluntarily agree to participate in the study and I have received a copy of this description.

Participants: \_\_\_\_\_ Date: \_\_\_\_\_  
Principal Investigator: Liyan Jin Date: May 9, 2009

## LIST OF REFERENCES

- Ajzen, I., & Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Allen, L. R., Hafer, H. R., Long, R., & Perdue, R. R. (1993). Rural residents' attitudes toward recreation and tourism development. *Journal of Travel Research*, 31(4), 27–33.
- Allen, R., Long, P., Perdue, R., & Kieselbach, S. (1988). The impact of tourism development on residents' perceptions of community life. *Journal of Travel Research*, 27(1), 16–21.
- Ap, J. (1992). Residents' perceptions on tourism impacts. *Annals of Tourism Research*, 19, 665–90.
- Ap, J., & Crompton, J.L. (1998). Developing and testing a tourism impact scale. *Journal of Travel Research*, 37(2), 120–130.
- Balderstone, S. (2001). *Agenda 21 and IOC requirements*. Retrieved Feb 10, 2009, from [http://multimedia.olympic.org/pdf/en\\_report\\_638.pdf](http://multimedia.olympic.org/pdf/en_report_638.pdf)
- Barker, M., Page, S., & Meyer, D. (2002). Evaluating the impact of the 2000 America's Cup on Auckland, New Zealand. *Event Management*, 7, 79–92.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173–1182.
- Baumgartner, T. A., Jackson, A. S., Mahar, M. T., & Rowe, D. A. (2007). *Measurement for evaluation in physical education and exercise science (8th ed.)*. New York: McGraw-Hill.
- Beijing Daily. (2008). *Beijing's natural gas daily supply capacity increases to 47 million m3 per day*. Retrieved Dec 12, 2008, from <http://www.panva.com.cn/news/138/2008/05/14/83828.html>
- Beijing Evening news. (2008). *Following natural design: Introduction to the Olympic Forest Park*. Retrieved Dec 16, 2008, from <http://2008.sohu.com/20080626/n257762151.shtml>
- Beijing Water Authority. (2007). *2007 Beijing water projects summary*. Retrieved Dec 18, 2008, from <http://www.bjwater.gov.cn/tabid/134/InfoID/13694/frtid/133/Default.aspx>
- Besculides, A., Lee, M. E., & McCormick, P. J. (2002). Residents' perceptions of the cultural benefits of tourism. *Annals of Tourism Research*, 29(2), 303–319.
- Beyer, S. (2006). The Green Olympic Movement: Beijing 2008. *Chinese Journal of International Law*, 5(2), 423–440.

- BOCOG. (2007a). *Beijing put in big money to improve the environment*. Retrieved Dec, 23, 2008, from <http://en.beijing2008.cn/26/44/article214084426.shtml>
- BOCOG. (2007b). *Beijing benefits from recycled water*. Retrieved Dec 20, 2008, from <http://en.beijing2008.cn/58/89/article214028958.shtml>.
- Bradley, J.C., Waliczek, T.M., & ZaJicek, J.M. (1999). Relationship between environmental Knowledge and environmental attitude of high school students. *Journal of Environmental Education*, 30(3), 17.
- Bradsher, K. (2007). *Accelerated ban on refrigerant sought*. Retrieved Dec 21, 2008, from <http://www.iht.com/articles/2007/03/15/business/warm.php?page=2>
- Brunt, P., & Courtney, P. (1999). Host perceptions of sociocultural impacts. *Annals of Tourism Research*, 26(3), 493–515.
- Bryant, E.G., & Napier, T.L. (1981). The Application of Social Exchange Theory to the Study of Satisfaction with Outdoor Recreation Facilities. In *Outdoor Recreation Planning, Perspectives, and Research*, edited by T. L. Napier. Dubuque, IA: Kendall P. Hunt, pp.83–98.
- Cantelon, H., & Letters, M. (2000). The making of the IOC environmental policy as the third dimension of the Olympic Movement. *International Review for the Sociology of Sport*, 35, 294.
- Chalkley, B., & Essex, E. (1999). Urban development through hosting international events: a history of the Olympic Games. *Planning Perspectives*, 14, 369–394.
- Chan, C., Koenig, C., & Rajarethnam, S. (2006). *Beijing 2008: Greening the Games?* Retrieved Dec 21, 2008 from [http://www.umich.edu.lp.hscl.ufl.edu/~ipolicy/china/3\)%20Beijing%202008,%20Greening%20the%20Games.pdf](http://www.umich.edu.lp.hscl.ufl.edu/~ipolicy/china/3)%20Beijing%202008,%20Greening%20the%20Games.pdf)
- Chou, C. P., & Bentler, P. M. (1995). Estimates and tests in structural equation modeling. In R.H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues and applications* (pp. 37-55). Thousand Oaks, CA: Sage.
- Cohen, E. (1988). Tourism and aids in Thailand. *Annals of Tourism Research*, 15(4), 467–486.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of test. *Psychometrika*, 16, 297–334.
- Deccio, C., & Baloglu, S. (2002). Nonhost community resident reactions to the 2002 Winter Olympics: The spillover impacts. *Journal of Travel Research*, 41(1), 46–56.
- Delamere, T. (2001). Development of a scale to measure resident attitudes toward the social impacts of community festivals, Part II: Verification of the scale. *Event Management*, 7, 25–38.

- Eagly, A. H., & Chaiken, S. (1993). *The Psychology of Attitude*. Fort Worth: Harcourt Brace Jovanovich.
- Essex, S., & Chalkley, B. (2004). Mega-sporting events in urban and regional policy: A history of the Winter Olympics. *Planning Perspectives*, 19, 201–232.
- Floria, K., Wolfing, S., & Fuhrer, U. (1999). Environmental attitude and ecological behavior. *Journal of Environmental Psychology*, 19, 1–19.
- Fredline, E., & Faulkner, B. (2000). Host community reactions a cluster analysis. *Annals of Tourism Research*, 27(3), 763–784.
- Fredline, L., Jago, L., & Deery, M. (2003). The development of a generic scale to measure the social impacts of events. *Event Management*, 8, 23–37.
- Fredline, E. (2005). Host and guest relations and sport tourism. *Sport, Culture and Society*, 8(2), 263–279.
- Frey, M., Iraldo, F., & Melis, M. (2008). *The impact of wide-scale sport events on local development: An assessment of the XXth Torino Olympics through the sustainability report*. Retrieved Dec 26, 2008, from [http://portale.unibocconi.it/wps/wcm/connect/resources/file/eb04fc0efc01b1a/WP\\_IEFE\\_10\\_2008.pdf](http://portale.unibocconi.it/wps/wcm/connect/resources/file/eb04fc0efc01b1a/WP_IEFE_10_2008.pdf)
- Gagnon Thompson, S.C., & Barton, M.A. (1994). Ecocentric and anthropocentric attitudes toward the environment. *Journal of Environmental Psychology*, 14, 149–157.
- Getz, D. (1997). *Event management and event tourism*. New York: Cognizant Communication.
- Goeldner, C. R., & Long, P. T. (1987). *The role and impact of mega-events and attractions on tourism development in North America*. Proceedings of the 37th congress of AIEST, 28, 119–131.
- Goudy, W. J. (1982). Further considerations of indicators of community attachment. *Social Indicators Research*, 11, 181–92.
- Greenpeace. (2008). *About Greenpeace*. Retrieved Dec 26, 2008, from <http://www.greenpeace.org/international/about>
- Gursoy, D., Jurowski, C., & Uysal, M. (2002). Residents attitudes: A structural modeling approach. *Annals of Tourism Research*, 29(1), 79–105.
- Gursoy, D., & Kendall, K.W. (2006). Hosting mega events modeling locals' support. *Annals of Tourism Research*, 33(3), 603–623.
- Hall, C. M. (1989). *Hallmark tourist events: Analysis, definition, methodology and review*. In Syme, G. J., Shaw, B. J., Fenton, D.M., & Mueller, W. S. (Eds.), *The planning and evaluation of hallmark events* (pp. 3–40). Sydney, Australia: Avebury.

- Hall, C. M. (1992). *Hallmark tourist events: Impact, management, and planning*. London: Belhaven Press.
- Hall, C. (2001). *Imaging, tourism and sports event fever: The Sydney Olympics and the need for a social charter for mega-events*. In C. Gratton & I. Henry (Eds.), *Sport in the city: the role of sport in economic and social regeneration*. London: Routledge.
- Hall, M. (2004). *Sport tourism and urban regeneration*. In B. Ritchie & D. Adair (Eds.), *Sport tourism: interrelationships, impacts and issues*. Clevedon: Channelview Publications.
- Higham, J. (1999). Sport as an avenue of tourism development: An analysis of the positive and negative impacts of sport tourism. *Current Issues in Tourism*, 2(1), 82–90.
- IOC. (2002a). *Report of the IOC Evaluation Commission*. Retrieved Feb 10, 2009, from [http://multimedia.olympic.org/pdf/en\\_report\\_299.pdf](http://multimedia.olympic.org/pdf/en_report_299.pdf)
- IOC. (2002b). *Report by the IOC Candidature Acceptance Working Group*. Retrieved Feb 10, 2009, from [http://multimedia.olympic.org/pdf/en\\_report\\_287.pdf](http://multimedia.olympic.org/pdf/en_report_287.pdf)
- IOC. (2002c). Manual for candidate cities for the Games of the XXIX Olympiad 2008: part 2 - candidature file - questionnaire. Retrieved Feb 10, 2009, from [http://multimedia.olympic.org/pdf/en\\_report\\_297.pdf](http://multimedia.olympic.org/pdf/en_report_297.pdf)
- IOC. (2007). *Olympic Chapter*. Retrieved Nov 09, 2008, from [http://multimedia.olympic.org/pdf/en\\_report\\_122.pdf](http://multimedia.olympic.org/pdf/en_report_122.pdf)
- IOC. (2008). *International Olympic Committee*. Retrieved Dec 13, 2008, from [http://www.olympic.org/uk/organisation/ioc/index\\_uk.asp](http://www.olympic.org/uk/organisation/ioc/index_uk.asp)
- IOC. (2009a). *2014 candidature acceptance procedure and questionnaire*. Retrieved Feb 10, 2009, from [http://multimedia.olympic.org/pdf/en\\_report\\_945.pdf](http://multimedia.olympic.org/pdf/en_report_945.pdf)
- IOC. (2009b). *Host city contract*. Retrieved Feb 11, 2009, from <http://www.gamesmonitor.org.uk/files/Host%20City%20Contract.pdf>
- IOC. (2009c). *Olympic Movement's Agenda 21*. Retrieved Feb 10, 2009, from [http://multimedia.olympic.org/pdf/en\\_report\\_300.pdf](http://multimedia.olympic.org/pdf/en_report_300.pdf)
- Jagemann, H. (2003). *Sports and the Environment: Ways towards achieving the sustainable development of sport*. Retrieved Feb 11, 2009, from <http://www.thesportjournal.org/article/sports-and-environment-ways-towards-achieving-sustainable-development-sport>
- Japanese Olympic Committee [JOC]. (2009). *History of Japan's bid for the Olympics*. Retrieved Feb 10, 2009, from [http://www.joc.or.jp/english/history\\_japan\\_bid.html](http://www.joc.or.jp/english/history_japan_bid.html)

- Jeong, G. H., & Faulkner, B. (1996). Resident perceptions of mega-event impacts: The Taejon international exposition case. *Festival Management & Event Tourism*, 4(1), 3–11.
- Jiang, B. (2007). *The future of natural gas vs. coal consumption in Beijing, Guangdong and Shanghai: An assessment utilizing MARKAL*. Retrieved Dec, 17, 2008, from [http://iisdb.stanford.edu/pubs/21967/Jiang,\\_China\\_MARKAL,\\_Working\\_Paper\\_62\\_REVISED1.pdf](http://iisdb.stanford.edu/pubs/21967/Jiang,_China_MARKAL,_Working_Paper_62_REVISED1.pdf)
- Jinghua News. (2008). *Ban free plastic bags in grocery stores from Jun 1st*. Retrieved Nov, 28, 2008, from <http://chanye.finance.sina.com.cn/sm/2008-01-09/342772.shtml>
- Jones, D., Jurowski, C., & Uysal, M. (2000). Host community resident's attitudes: A comparison of environmental viewpoints. *International Journal of Hospitality and Tourism Research*, 2, 174–189.
- Jurowski, C. (1994). The interplay of elements affecting host community resident attitudes toward tourism: A path analytic approach. PhD dissertation. Virginia Polytechnic Institute and State University.
- Jurowski, C., Uysal, M., & Williams, D. R. (1997). A theoretical analysis of host community resident reactions to tourism. *Journal of Travel Research*, 36(2), 3–11.
- Jurowski, C., Uysal, M., Williams, R. D., & Noe, F. P. (1993). Environmental attitudes. In *The annual conference proceedings of Travel and Tourism Research Association*, (pp. 242–251). Wheat Ridge CO: TTRA.
- Kang, Y. S., & Perdue, R. (1994). Long-term impact of a mega-event on international tourism to the host country: A conceptual model and the case of the 1988 Seoul Olympics. *Journal of International Consumer Marketing*, 6(3–4), 205–226.
- Kendall, K. W., & Var, T. (1984). *The perceived impact of tourism: the state of the art*. Vancouver: Simon Fraser University.
- Keogh, B. (1990). Public participation in community tourism planning. *Annals of Tourism Research*, 17(3), 449–465.
- Kim, S. S., & Petrick, F. (2005). Residents' perceptions on impacts of the FIFA2002 World Cup: The case of Seoul as a host city. *Tourism Management*, 26, 25–38
- Ko, D., & Stewart, W.P. (2002). A structural equation model of residents' attitudes for tourism development. *Tourism Management*, 23(5), 521–530.
- Kousis, M. (1989). Tourism and the family in a rural Cretan community. *Annals of Tourism Research*, 16(3), 318–332.
- Kuhlemeier, Hans., Bergh, Huub Van Den., & Lagerweij, Nijs. (1999). Environmental knowledge, attitudes and behavior in Dutch secondary education. *Journal of Environmental Education*, 30(2), 4–15.

- Lankford, S. V., & Howard, D. R. (1994). Developing a tourism impact attitude scale. *Annals of Tourism Research*, 21(1), 121–139.
- Li, A. (2008). *Beijing start to apply European IV standard in Mar and pollutant emission will be reduced by 50%*. Retrieved Dec 16, 2008, from <http://www.bjepb.gov.cn/bjhb/tabid/68/InfoID/15381/frtid/426/Default.aspx>
- Li, J. (2004). *Project to increase Beijing's water supply*. Retrieved Dec 22, 2008, from [http://www.chinadaily.com.cn/english/doc/2004-08/19/content\\_366665.htm](http://www.chinadaily.com.cn/english/doc/2004-08/19/content_366665.htm)
- Lindberg, K., & Johnson, R.L. (1997). The economic values of tourism's social impact. *Annals of Tourism Research*, 24(1), 90–116.
- Liu, J. C., & Var, T. (1986). Residents attitudes toward tourism impacts in Hawaii. *Annals of Tourism Research*, 13, 193–214.
- Liu, J. C., Sheldon, P. J., & Var, T. (1987). Residents perceptions of the environmental impacts of tourism. *Annals of Tourism Research*, 14, 17–37.
- Madrigal, R. (1993). A tale of tourism in two cities. *Annals of Tourism Research*, 20(2), 336–353.
- Mangas, Victor J., & Pilar, M. (1997). Analysis of environmental concepts and attitudes among biology degree students. *Journal of Environmental Education*, 29(1), 28–34.
- Mascagni, K. (2008). *First world conference on sport and the environment*. Retrieved Dec 17, 2008, from <http://www.la84foundation.org/OlympicInformationCenter/OlympicReview/1995/oreXXV4/oreXXV4w.pdf>
- Mathisen, O. (1989). *The road to the Olympic Games in Lillehammer Olympics organizing committee*. In K. Romberg (ed.) *Destination Lillehammer*. J.S. Stevensen Forlag A.S.
- McCool, S., & Martin, S. R. (1994). Community attachment and attitudes toward tourism development. *Journal of Travel Research*, 32(3), 29–34.
- Mihalik, B. J., & Cummings, P. (1995). Host perceptions of the 1996 Atlanta Olympics: Support, attendance, benefits and liabilities. *Travel and tourism research association 26th annual proceedings* (pp. 397–400).
- Mihalik, B. J., & Simonette, L. (1998). Resident perceptions of the 1996 Summer Olympic Games—Year II. *Festival Management and Event Tourism*, 5(1), 9–19.
- Murphy, P. E. (1983). Community attitudes to tourism. *Tourism Management*, 2, 189–195.
- Murphy, P. E., & Carmichael, B. A. (1991). Assessing the tourism benefits of an open access sports tournament: The 1989 B.C. Winter Games. *Journal of Travel Research*, 29(3), 32–35.

- n.d. (2007). *Beijing statistic yearbook-2007*. Retrieved Feb 16th, 2010 from <http://www.bjstats.gov.cn/tjnj/2007-tjnj/>
- O'Leary, J. T. (1976). Land use redefinition and the rural community: Disruption of community leisure space. *Journal of Leisure Research*, 8, 263–274.
- Perdue, R. R., Long, P. T., & Allen, L. (1990). Resident support for tourism development. *Annals of Tourism Research*, 17(4), 586–599.
- Perdue, R. R., Long, P. T., & Kang, Y. S. (1999). Boomtown tourism and resident quality of life: The Ritchie, J. R. B. (1984). Assessing the impact of hallmark events conceptual and research issues. *Journal of Travel Research*, 22(1), 2–11.
- Peggy, P., & Korsching, P. F. (1996). Farmers' attitudes and behavior toward sustainable agriculture. *Journal of Environmental Education*, 28(1), 38–45.
- Pizam, A. (1978). Tourism's impacts: The social costs to the destination community as perceived by its residents. *Journal of Travel Research*, 16(4), 8–12.
- Ritchie, B.W., & Inkari, M. (2006). Host community attitudes toward tourism and cultural tourism development: the case of the Lewes District, southern England. *International Journal of Tourism Research*, 8(1), 27–44.
- Ritchie, J. (1984). Assessing the impact of hallmark events: Conceptual and research issues. *Journal of Travel Research*, 22(1), 2–11.
- Ritchie, J. R. B. (1988). Consensus policy formulation in tourism. *Tourism Management*, 9(3), 199–216.
- Ritchie, J. R. B., & Aitken, C. E. (1984). Assessing the impacts of the 1988 Olympic Winter Games: The research program and initial results. *Journal of Travel Research*, 22(3), 17–25.
- Ritchie, J. R. B., & Aitken, C. E. (1985). Olympulse II: Evolving resident attitudes toward the 1988 Olympic Winter Games. *Journal of Travel Research*, 23(1), 28–33.
- Ritchie, J. R. B., & Lyons, M. (1990). Olympulse VI: A post-event assessment of resident reactions to the XV Olympic Winter Games. *Journal of Travel Research*, 28(3), 14–23.
- Ritchie, J. R. B., & Yangzhou, J. (1987). The role and impact of mega-events and attractions on national and regional tourism: A conceptual and methodological overview. Proceedings of the 37th congress of AIEST, 28, 17–57.
- Rosenberg, M. J., & Hovland, C. I. (1960). *Cognitive, affective, and behavioral components of attitudes*. In Attitude Organization and Change, eds. C.I. Hovland & M.J. Rosenberg. New Haven: Yale University Press
- Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: Wiley.

- Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, 7, 147–177.
- Schwartz, R. (2004). *Perception*. Oxford: Blackwell Publishing Ltd.
- Söderlund, M. (2006). Measuring customer loyalty with multi-item scales: A case for caution. *International Journal of Service Industry Management*, 17(1), 76-98.
- The Central People's Government of the People's Republic of China. (2008). *2007 figures for energy consumption per 10, 000 RM GDP*. Retrieved Dec 20, 2008, from [http://www.gov.cn/gzdt/2008-07/14/content\\_1044364.htm](http://www.gov.cn/gzdt/2008-07/14/content_1044364.htm)
- Tosun, C. (2002). Host perceptions of impacts: A comparative tourism study. *Annals of Tourism Research*, 29(1), 231–245.
- Travis, A. S., & Croize, J. C. (1987). The role and impact of mega-events and attractions on tourism development in Europe. Proceedings of the 37th congress of AIEST, 28, 59–101.
- Twynam, G., & Johnston, M. (2004). Changes in host community reactions to a special sporting event. *Current Issues in Tourism*, 7(3), 242–261.
- Um, S., & Crompton, J. L. (1987). Measuring resident's attachment levels in a host community. *Journal of Travel Research*, 26(2), 27–29.
- United Nations Environmental Program (UNEP). (2007). *Beijing 2008 Olympic Games: An Environmental Review*. Nairobi: the UNEP Division of Communications and Public Information
- UNEP. (2008). *Independent environmental assessment: Beijing 2008 Olympic Games*. Retrieved Feb 26, 2009, from [http://www.unep.org/publications/UNEPeBooks/BeijingReport\\_ebook.pdf](http://www.unep.org/publications/UNEPeBooks/BeijingReport_ebook.pdf)
- UNEP. (2009). *Declaration of the United Nations conference on the human environment*. Retrieved Feb 20, 2009, from <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=97&ArticleID=1503>
- Uysal, M., & Gitelson, R. (1994). Assessment of economic impacts: festivals and special events. *Festival Management & Event Tourism*, 2(1), 3–10.
- Williams, J., & Lawson, R. (2001). Community issues and resident opinions of tourism. *Annals of Tourism Research*, 28, 269–290.
- Xinhua. (2008). *Vehicles in Beijing to reach 3.35 million during Olympics*. Retrieved on Dec 25, 2008, from [http://www.chinadaily.com.cn/olympics/2008-03/27/content\\_6571379.htm](http://www.chinadaily.com.cn/olympics/2008-03/27/content_6571379.htm)
- Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (1996). The behavioral consequences of service quality. *Journal of Marketing*, 60(2), 31–46.

Zhang, A. (2008). *Greenpeace*. Retrieved Nov 09, 2008, from [http://www.unep.org/sport\\_env/Olympic\\_Games/Beijing\\_2008/PDF/Olympics%20Assessment%20Report%20ENG.pdf](http://www.unep.org/sport_env/Olympic_Games/Beijing_2008/PDF/Olympics%20Assessment%20Report%20ENG.pdf)

Zimbardo, P. G., Ebbesen, E., & Maslach, C. (1977). *Influencing attitudes and changing behavior*. New York: Random House.

Zimmerman, L. K. (1996). Knowledge, affect, and the environment: 15 years of research (1979-1993). *Journal of Environmental Education*, 27(3), 41–45.

## BIOGRAPHICAL SKETCH

Liyan Jin was born and grew up in Zhejiang, China. She completed her undergraduate study in golf and leisure management at the Jinan University, which is one of the top higher educational institutions in China. After four years in Jinan University, Liyan Jin came to the University of Florida to study sport management in the fall of 2007. As an outstanding graduate student in the Department of Tourism, Recreation and Sport Management, Liyan Jin maintained a superior level of academic performance with 3.90 GPA. She received her master's degree from the University of Florida in the Spring of 2010, and she will continue her doctoral program focusing on sport management in the Department of Tourism, Recreation, and Sport Management at the University of Florida.