2014

The civic engagement of social media users in air quality issues in Beijing, China

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by

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A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Sociology

Program of Study Committee:
Lois Wright Morton Major Professor
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Iowa State University

Ames, Iowa

2014

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ABSTRACT

This research examined the level of civic engagement in environmental issues in China, especially focused on air quality issues in Beijing. To measure the severity of air quality issues and people's environmental awareness and response, an online survey was designed and distributed through social media in 2013 summer. After the data analysis process, air pollution in Beijing was proved to be the most serious problem resulted from industrialization and modernization. Three sets of regress models were created and analyzed to test the significance of possible predictors of the frequency of engagement in general discussion/online participation/offline participation of air quality issues. Social media use has proved to be important for environmental communication and education, which raised the participatory frequency of local citizens. Based on the impacts of social media on environmental engagement, strategies can be better developed by environmental groups and other stakeholders for civic engagement in environmental issues in countries like China in the future.

CHAPTER 1. INTRODUCTION

China's air quality issues

China is transitioning into an urbanized, modern, and rapidly industrialized country. Environmental challenges have resulted with modernization which are associated with industrialization, social change and development processes. Air pollution is one of the greatest environmental problems facing China today. The extent of air quality concerns became evident especially as China prepared for the 2008 Beijing Olympic Games. As awareness of air quality and other environmental issues have become more public, a growing number of Chinese citizens have begun to express their concern about environmental pollution and the need to raise public awareness, engage one another about this common problem, and organize environmental movements to address the ecological degradation and harm to humans. New technologies and social media have been particularly useful for connecting people with similar environmental concerns and provide a forum for mobilizing citizens to take action to address these difficult problems.

Western economies have also experienced similar environmental issues as they became industrialized and their populations grew. London was formerly the infamous foggy city of the world, and California also suffered from smog in the 1960s.[1] There has been a long history of air pollution events occurring in Western countries since the 19th century, followed by a history of air pollution legislation as solutions. Notable environmental incidents in the United States (U.S.), such as the publication of *Silent spring* by Rachel

[1]http://www.theguardian.com/environment/2012/apr/10/internet-beijing-dirty-air-pollution
http://www.eh-resources.org/timeline/timeline_industrial.html
http://english.peopledaily.com.cn/90882/8100134.html

Carson in 1962, have illustrated the harm to the environment as economies developed without taking into account the side effects of industrialization to the natural environment. Environmental movements triggered by the "Love Canal" incident in the U.S. in the late 1970s provide examples of a successful environmental activism occurring in response to buried toxic chemical waste which was deleterious to human health. The decline of the environment in Western countries resulting from rapid expansion of industry has resulted in increased public awareness and demands by society on the government to implement environmental protection legislation in response to pollution caused by industry. In the 20th century, growing environmental movements have focused on limited energy resources and concerns for excessive energy consumption along with the need to adopt sustainable lifestyles. The "car free movement" in the U.K. and the "anti-nuclear movement" in Japan represent two efforts resulting from civic engagement that highlight the growing concern worldwide to combat the effects of industrial growth on national and global natural resources.

Chinese modernization

The urbanization and modernization of China was planned and initiated by the central government with substantial financial and policy support commencing in the 1980s (Mol, 2006). In the context of a developing country experiencing rapid economic development, there has been an accumulation of wealth based on industrial growth in the large cities such as Beijing which has occurred exponentially. According to the World Bank database (2013), the annual GDP growth in China was approximately 10% in 1973 and has increased steadily since that time. Industry began to develop under the profit drive of a free market which

increased the manufacturing sectors and employed more workers as they grew. For example, according to a recent Mckinsey report, China's massive auto industry had annual growth rates during the years of 2007-2012 that varied from 7% to 52%.[2] The value added in manufacturing has witnessed a continuous annual growth every year according to the World Bank database (see Table 1.1). Increases in exported goods and services have also revealed the same trend (see Table 1.1).

Growth in the manufacturing sectors resulted in an increase in production which requires more energy consumption. During the process of industrialization, China has adopted an extensive economic development mode which resulted in high energy consumption and high pollution with an inefficient economic output. As shown in Table 1.1, the energy consumption increased from 590,000 in 1978 to 2.7 million kt of oil equivalence in 2011. Among all energy sources, coal has been promoted by the government due to its low cost, regardless of its negative environmental effects. The rapid cycle of industrial growth has encouraged demand for an inexpensive and abundant energy resource. China has abundant coal resources and imports a large amount of coal every year for power generation. According to a recent governmental report on climate , coal accounts for 70% of the energy used in China today and has been responsible for approximately three fourths of electricity generation. From 2005-2009, China added 510 new 600-megawatt coal plants. From 2010-2013, China again added half the coal generation of the entire U.S. During peak production, from 2005-2011, China added approximately two 600-megawatt coal plants a week, for

[2]Source:http://www.mckinsey.com/insights/manufacturing/a_new_era_for_manufacturing_in_china

seven years straight. In addition, according to U.S. governmental projections, China will add yet another U.S. worth of coal plants over the next 10 years, or the equivalent of a new 600-

Table 1.1. Energy consumption in China

Indicator	1978	1980	1985	1990	1995	2000	2005	2010	2011
Energy use (kt of oil equivalent)	590,454.29	598,340.33	691,666.13	870,667.07	1,044,454.63	1,161,353.13	1,775,677.25	2,516,731.20	2,727,727.65
Manufacturing, value added (annual % growth)	18.66	10.96	17.31	2.44	12.51	10.77	9.47	9	
Exports of goods and services (annual % growth)		6.78	27.86	33.32	5.503	32.04	22.42	26.57	3.96
GDP growth (annual %)	11.7	7.8	13.5	3.8	10.9	8.4	11.3	10.4	9.3

Source: World Bank (2013), from http://data.worldbank.org/data-catalog/world-development-indicator

Table 1.2. Population growth in China

Indicator	1978	1980	1985	1990	1995	2000	2005	2010
Population in largest cities	5,630,964	6,846,765	7,822,912	10,170,783	13,224,272	15,184,194	16,575,110	17,060,364
Urban population	177,605,736	240,414,890	300,165,617	373,035,157	452,999,147	554,367,818	658,498,663	699,330,440

Source: World Bank (2013), from http://data.worldbank.org/data-catalog/world-development-indicator

megawatt plant every 10 days for 10 years (Larson, 2014).[3] Although coal-fired power generation growth has slowed down from previous growth rates of over 9% in 2010 and 2011, to 0.8% in 2012 and 2.6% during the first half of 2013, nevertheless, due to increased coal use in heavy industry, the total coal use has continued to increase over 6% in 2012, while decreasing to 1.8% during the first half of 2013. The development of manufacturing based on coal consumption has become an important source of air pollution problems (Greenpeace, 2013). The rapid industrial development has demanded more extraction of market value from the ecosystem, which has resulted in increased coal burning practices and air pollution.

On the level of individual consumption, emissions have increased due to transportation and consumption waste resulting from daily living. To fill increased openings for manufacturing and other jobs in its cities, many workers have migrated from different parts of China, resulting in a problem of overpopulation due to a limited infrastructure capacity. Statistics from the World Bank have shown an increase in the population in China's largest cities, from 5.6 million in 1978 to 17 million in 2010. In addition, during this period the urban population has increased from 177.6 million to 699.3 million, revealing a steady annual growth rate of approximately 3% (see Table 1.2).

As a result, total consumption expenditures and total household consumption expenditures in China have also experienced continuous growth since the 1980s. The final consumption expenditures revealed an average annual growth of 7%, which was similar to

[3]Source:http://www.climatecentral.org/blogs/chinas-growing-coal-use-is-worlds-growing-problem-16999

the annual growth of total household consumption expenditures. The increasing population as well as human desire to consume more as wealth accumulates has resulted in increased

consumption of daily products, which has led to an acceleration in waste emissions. The rapid increase in car ownership use has resulted in increased automobile emissions and provides an example of how an increase in energy consumption results from lifestyle changes following the accumulation of wealth. The poor air quality in China's big cities has been largely due to the expansion of private transport sectors, especially the growth in the number of motor and automobile vehicles (Greenpeace, 2013). According to recent World Bank statistics (see Table 1.3), the road density (km of road per 100 sq. km of land area) has increased from 35 in 2005 to 41.75 in 2010. The number of vehicles per km of road also increased from 9 in 2005 to 19.26 in 2010. The extensive manner in which China deals with increased daily life wastes, such as burning in landfills without the process of recycling and reusing, has also resulted in a substantial air pollution problem. The current way people deal with daily life wastes has led to an increase in CO2 emissions which has raised the level of smog hovering over China's largest cities.

Table 1.3. Consumption expenditures in China

Indicator	1978	1980	1985	1990	1995	2000	2005	2010	2011	2012
Final consumption expenditure, (annual % growth)		7.62	7.16	2.46	9.06	7.76	4.84	2.52	10.90	8.69
Household final consumption expenditure (annual % growth)	5.55	7.82	15.42	1.47	11.07	7.75	6.15	8.26	11.11	7.82

Source: World Bank, 2013; http://data.worldbank.org/data-catalog/world-development-indicator

There are past and current risks from air pollutants in urban areas in China's big cities. Past risks included indoor air pollution from combustion of coal and wood for heat and cooking. Current risks that are associated with industrialization and urbanization, include outdoor air pollution from cars and industrial waste from burning coal. These risks co-existed

with several emerging risk factors, such as climate change and international transport of air pollutants, which have led to greater challenges for resolving the air pollution problem (Zhang et al, 2010). These risks have posed increased health threats for people who live in China. Based on recent statistics from the WHO (World Health Organization) GBD 2010 Study[4], the number of Chinese who die from lung disease has increased from 13th place among all causes to Lost Life Years in China in 1990 to 5th place among all causes, with a percentage of 5.8%. In addition to health and public safety problems associated with the rise in pollution, poor air quality has also affected people's lifestyle and quality of life. Local citizens cannot participate in outdoor activities when the air quality is bad. The number of days with polluted air was 189 days in 2013 based on a recent report of the Beijing Environmental Bureau.[5]

Role of the state

Faced with public perception of these environmental risks, the state has played a double-edged role, which has been to slow down the treadmill of production while sustaining economic development. Accumulation of wealth is planned and strongly supported by the developmental blueprint of the state; therefore, environmental deterioration may be attributed to the lack of regulation and supervision regarding environmental protection of the state during economic development. However, after acknowledging the importance of environmental protection, the government began to draft new plans to promote an environmentally-friendly economic development in the 1990s. China's reform and input into environmental regulation and management are essential to solve the problem, which is also

[4]Source:http://ehs.sph.berkeley.edu/krsmith/Presentations/2013/CRAES%20Mar%2013.pdf
[5]Source:http://www.globaltimes.cn/content/835484.shtml#.UxVwK8akpfQ

strongly demanded by a growing number of environmental groups and emerging civil society in its big cities. There are environmental laws and strict rules formulated to regulate environmental pollution (Fugui et al., 2008). The Chinese central government made efforts to influence local policymaking to include environmental considerations by pursuing a Green GDP (Gross Domestic Product) and other environmental performance evaluation projects in the 2000s (Li &Higgins, 2011). To adopt development strategies of low energy consumption and low pollution and high economic output, the government has set up new guidelines pursuing a circular economy mode for industrial development. The social security system has also been improved to cope with health problems as well as the overpopulation problem in big cities.

Using Beijing as an example to reveal past efforts made by the state to solve the air quality problem, the central Chinese government and Beijing local government invested approximately 27 billion dollars to improve air quality in Beijing before the 2008 Olympics. Policies were carried out, such as imposing restrictions on automobile usage, shifting the polluting coal factories to outside of Beijing and closing down the polluting factories in Beijing, shifting habits of using coal for warmth, and building more infrastructures for transportation. The local Beijing government had also planned and implemented different regulations and policies to improve environment management (Fugui et al., 2008). In preparation for the Olympics, the Beijing residents were led by the government and local environmental groups to adopt a more environmentally friendly lifestyle such as increasing people's usage of public transportation to create a positive image of the city's environment and welcome foreign athletes. After the strict regulation and improvement policies, the

pollutants in Beijing were decreased by 60%, and the central and local government achieved their goals by 2008.[6]

However, after the 2008 Olympics, no additional strict regulations and management practices were placed on the air pollutants and the government ceased to put a sustainable goal over its rapid economic development. In 2011, citizens in Beijing started to receive monitoring statistics revealing the air quality index from the twitter account of the U.S. Embassy in Beijing which distributed them on Chinese social media sites. This resurfaced the problem of air quality and online accessible statistics of PM 2.5, encouraged daily discussion of the Beijing residents about air quality. Since that time, the central government has announced a state plan for air pollution control action and funds for 277 billion dollars to solve the air pollution problems in China.[7] China's State Council released its Action Plan for Air Pollution Prevention and Control (Action Plan) on September 12, 2013, eight months after the widely-reported air pollution episode that occurred in January 2013.[8]

According to Mol (2006), the problems of state-led environmental protection were as follows: (a) scarce environmental monitoring (most environmental monitoring needs to be funded by the local governments who have limited budgets); (b) distortion in information processing; (c) secrecy of environmental data from large segments of society; (d) absence of a right-to-know code, legislation or practice; and (e) limited publication and availability of non-secret data (due to poor reporting, limited internet use and access) (Mol, 2006). These

[6] Source:http://2008.qq.com/a/20080723/003096.htm
[7] Sources from these Chinese websites: http://www.gov.cn/zwgk/2013-09/12/content_2486773.htm
http://www.gov.cn/jrzg/2013-08/17/content_2468960.htm
http://www.gov.cn/jrzg/2013-08/17/content_2468960.htm
https://www.chinadialogue.net/blog/6255-Will-Beijing-s-277-billion-air-pollution-plan-work-/en
[8] Source:http://cleanairinitiative.org/portal/node/12066

problems revealed a lack of information resources for environmental communication and education. The air pollution situation continued to worsen resulting from increased problems of unclear fuel consumption and overpopulation lacking consistent monitoring and regulation from the state.

Rapid industrialization has seen mass environmental movements emerge in many developing countries, especially in East Asia (Mol, 2006; Mol & Van Buren, 2003). Mol and Carter (2006) studied China's transitional environmental governance using ecological modernization theory. They pointed out that ecological modernization is taking place in tandem with political modernization, which they characterized as the replacement of a rigid, hierarchical, command-and-control system of environmental governance by more decentralized and flexible systems (Ji et al., 2009). In China, rapid economic transition has not brought about a radical turn towards a Western-style democracy based on open and public participation in the political process. Instead, the Chinese leadership has confined its political reform to political decentralization, development of technocracy, improvement of governance, smoothing out the leadership transitions, and efforts to separate the government from the Party (Wang & Wong, 1999). China's environmental governance has also undergone a transformation since the late 1970s (Ji et al., 2009). In their attempt to recognize and moderate the environmental impact of China's rapid urbanization and development, national environmental regulators have shown an unusual willingness to incorporate civil society into their dialogue and regulatory regime (Alford & Liebman, 2001).

Civic engagement

Although there has been no radical turn towards a Western-style democracy on the national level, many Chinese citizens have begun to experience open public participation in the pursuit of profit in the free market during industrialization. The pursuit of free market along with the experience of an increasingly unrestricted market has enabled Chinese citizens to express their own market choices and rights. During the process of industrialization, there was market expansion. While the concept of free markets was adopted to increase profits; the control of the government over market and other social spheres has been weakened. Thus, based on their limited new freedoms, the Chinese citizens have started to express their own ideas and demands for rights in social spheres in addition to the economic sphere. There has been a growing trend among the Chinese people, who have also become important stakeholders, to confront environmental issues as well as the market and state.

When reviewing the history of civic engagement related to air pollution in Beijing, one can observe the increasing autonomy of local citizens to deal with air pollution. The 2008 Beijing Olympics heightened concern domestically and worldwide as international media expressed concern about air quality issues in Beijing. As conscientious citizens have become aware of the seriousness of environmental pollution, especially air pollution, environmental programs on air quality issues have been developed and pursued by environment groups. Initially, civic participation to improve air quality was led by community programs organized by the state and environmental groups. Increasingly, social media has enabled increased numbers of civic-minded Chinese to participate in air-related activities. The U.S. Embassy in Beijing started to monitor the air quality index in 2011, which has enabled numerous Beijing residents to become knowledgeable about the air quality indicator and specific air pollutants to which they are exposed on a daily basis. As

citizens have come to understand the health hazards and economic costs related to air pollution, they have started to voice their concerns openly about environmental issues in China. As a new segment of the Chinese population has accumulated wealth, these new middle and upper-class citizens have looked to improve health and safety to be able to enjoy the new lifestyle benefits that accompany wealth.

In the 1990s, environmental groups began to emerge as important stakeholders and organizers of environmental civic engagement to solve the increasing environmental problems. According to a study conducted by the All-China Environment Federation, by the end of 2005, there were 2,768 environmental groups with 224,000 members. Chinese environmental groups can be classified approximately into three major types: (a) student environmental groups; (b) government-organized NGOs (GO-NGOs); and (c) civic environmental groups. (Cooper, 2006; Jin, 2001; Knup, 1997; Schwartz, 2004). The environmental NGOs have made great strides to increase awareness and generate action by providing environmental education and communication programs as well as other community-based programs which have a specific goal to generate a public green sphere and empower an emerging civil society. The main priority of these environmental groups is to work together along with the media and research institutions to distribute information, organize activities, make demands related to environmental issues. By enabling people to become aware of ongoing environmental problems, these groups hope to get more citizens engaged in environmental activism.

A main goal of these environmental groups is to create a growing public sphere for environmental discussion and action. However, limited by the restricted role of these environmental groups can play under the inspection of the Chinese government, the growth

of civic engagement in China has been slow but steady. Nevertheless, these environmental groups have worked tirelessly to increase awareness about the green public sphere and greenspeak in Chinese society as a strong cause for cooperation with the government.

Ideologies and cultural frames for environmental movements have begun to crystallize in China that are similar to Western countries, with the institutionalization of processes, new positions, and roles. Nevertheless, the "political sphere" for a Western-style environmental movement appears to continue to be limited in China (Mol, 2006). Instead of positioning themselves on the periphery, or even outside, the central decision-making institutions, environmental movements have been involved increasingly in decision-making processes within the state and, to a lesser extent, the market (Mol, 2000; Sonnenfeld, 2002). Environmental norms, values, and discourses have gained influence by disseminating information and concern far beyond the professionals and core supporters of environmental NGOs, a process that has been paralleled by their reformulation. Environmental NGOs in China have been traditionally limited in number. They are generally not adversarial or confrontational; rather, they provide expert or awareness-raising organizations.

With the rise of social media and mobile applications (apps), new communication technologies have enabled the creation of platforms for people to receive and compare updated environmental information, discuss environmental issues, and make demands on the state to improve a situation. Realizing their limited resources of organizing environmental activism in China, conscientious citizens have embraced social media and mobile apps to create an online public sphere for raising social awareness. This strategy has resulted in

approximately 10,000 daily downloads of air quality index mobile apps in January, 2013.[9] Discussions about air quality issues have become a heated topic in different social media sites. [10]

Creating awareness of environmental pollution in China has elicited governmental action. Recently, in response to increasing public awareness of the air quality in Beijing, the government issued new policies to mandate reform on air quality issues. Governmental solutions to improve Beijing's air quality issues have included the following: (a) increase usage of public transportation to 46% by 2013; (b) increase usage of Condensed Natural Gas (CNG) for taxi fuel by 2013; and decrease usage of coal by 5% by 2013. The economic and political support from the government showed determination to solve the severe air pollution problem under the demand of the local citizens and international demand.

This research study examines the formation of air quality issues in China utilizing the context of Schnaiberg's (1980) treadmill of production and how Chinese social media has helped to raise the level of environmental awareness as well as increased civic engagement under a growing Chinese civil society. While previous studies have looked at civic engagement to improve environmental issues in China, few have focused on the process of industrialization and modernization in China, and its effect on the environment. Examination of Chinese production and consumption patterns offers a framework for understanding the air quality problems in Beijing and to reveal the roles industry, state, and citizens, especially environmental groups, have played regarding the environment. Further, little is known about the role social media can play in creating an online public sphere for environmental activism.

[9]Source:http://news.idg.no/cw/art.cfm?id=9ED5355D-F1D4-DEBE-2366540778DA4C28
[10]Source:http://www.theguardian.com/environment/2012/apr/10/internet-beijing-dirty-air-pollution

Chapter 2 of the thesis first presents a literature review of China's air quality problem as a result of manufacturing expansion and growth in population consumption and then discusses green public spheres and how social media has become an information resource to increase environmental awareness and social activism. Patterns and impacts of economic modernization are used to explain the formation of civic engagement and stakeholder mobilization in response to air quality concerns. Then research questions and several hypotheses are proposed for testing. In Chapter 3, the methodology for answering research questions is presented. A survey instrument was developed to conduct an online survey using the Qualtrics website. Social media was used to target Beijing, China residents and invite them to participate in the questionnaire and submit their responses in July, 2013. Descriptive statistics and three linear regression models were used to analyze the survey data. The results of these analyses are presented in Chapter 4. Chapter 5 discusses the implications of findings and conclusion.

CHAPTER 2. LITERATURE REVIEW

China's Air Quality Problem and Treadmill of Production

The first chapter provided an overview of the emergence of air quality problems and related environmental issues in China, more specifically in Beijing, as well as the role industry, state, environmental groups, and new social media technology have played to create awareness and action. The context of the treadmill of production (Schnaiberg, 1980) can be usedto understand why civic engagement responses associated with air quality issues in China might increase (see Figure 2.1).

According to Schnaiberg's theory (1980), environmental impacts of production were viewed in these analyses as outcomes derived from changing relationships between capital owners, workers, and the state. He described how environmental harms are the direct result of the process of economic production, economic growth and capital accumulation under the capitalist mode of production. Furthermore, Schnaiberg, Pellow & Weinberg (2004) explained the five axes of treadmill of production theory: 1) Economic expansion. Economic expansion was generally viewed as the core of any viable social, economic, or environmental policy. 2) Increased consumption. If economic growth were to come about through increased production of the amount of goods, consumers needed to have the disposable income to purchase the goods, which would ensure a continued cycle of production and consumption. 3) Solving social and ecological problems by speeding up the treadmill. Social and ecological problems were thought to be best solved "through the market." Thus, there arose an untenable, almost magical, sense that any type of economic expansion will reduce social and ecological problems. 4) Economic

expansion via large firms. Economic expansion was seen as fostered primarily through the growth of large firms, and 5) Alliances among capital, labor, and governments. The state has severe internal conflicts around environmental issues. It has a dual role as both a facilitator of capital accumulation and economic growth, and as a social legitimator of the socioeconomic structure for the citizenry (O'Connor, 1973, 1988).These axes can be found in China as manufacturing sectors developed.

Among these axes, the situation of alliances among capital, labor, and governments has been improved in the 21th century in China. Citizens and environmental groups also joined in the alliance with the help of social media. The development of civic participation in environmental issues based on the use of recent communication methods has allowed citizens to place demands on the state's role and environmental groups to disseminate information to seek change leading to improvement of the environment. These three stakeholders, state, environment group and conscientious citizens are connected in the structure of treadmill of production. They have played key roles in the formation and function of the treadmill of production of air pollution in China.

The political economy of China differs from Western countries. Nevertheless, the theory of treadmill of production (Schnaiberg, 1980), continues to be applicable and provide a perspective for exploring the environmental problems in China during a similar process of industrialization and urbanization following that of Western countries, especially the air pollution problem in Beijing. According to Schnaiberg (1980), production causes environmental problems, and the demand for production never rests – nor do resulting environmental problems. Figure 2.1 shows the complex structure of treadmill of production in air quality issues in current China.

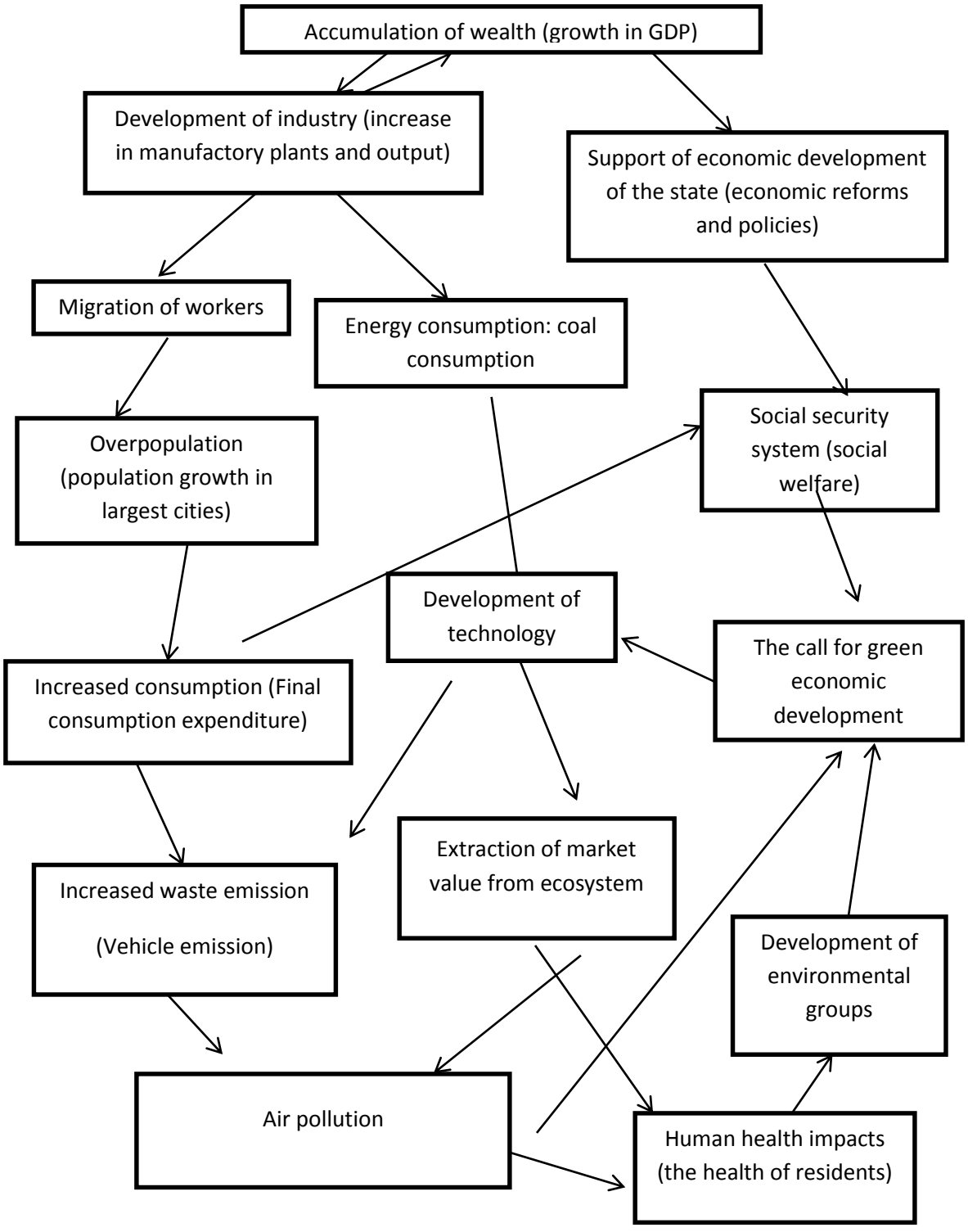
Accumulation of wealth (growth in GDP)
Development of industry (increase in manufactory plants and output)
Support of economic development of the state (economic reforms and policies)
Migration of workers
Energy consumption: coal consumption
Overpopulation (population growth in largest cities)
Social security system (social welfare)
Development of technology
The call for green economic development
Increased consumption (Final consumption expenditure)
Extraction of market value from ecosystem
Increased waste emission (Vehicle emission)
Development of environmental groups
Air pollution
Human health impacts (the health of residents)

Figure 2.1. Treadmill of production of air pollution in China

In the case of China, production was initiated and derived from the accumulation of wealth. According to statistics regarding the growth in Chinese GDP (see Table 1.1), China experienced rapid development of industry from 2005-2011. However, that industrial development was based on high energy consumption and high pollution while resulted in low economic efficiency as the outcome.[11] The efficiency in energy especially coal use was low which produced great amount of industrial emission. Along with the development of industrialization, there was population migration to the big cities which challenged the city carrying capacity and posed a threat of environmental pollution (Table 1.2). The total consumption expenditure (Table 1.3) increased along with waste emissions and the desire to adopt better lifestyles. The use of automobiles increased with increased transport emissions. Solid waste emissions increased with the absence of recycling. The extraction of natural resources from the ecosystem, based on extensive economic development during the process of industrialization and urbanization, triggered air pollution problems in big cities of China such as Beijing. As planners and supporters of this extensive industrial development, the state improved its guidelines of economic development to advocate economic growth following the principle of low energy consumption, low pollution, and high economic efficiency. [12]However, health hazards rising from air pollution were not addressed

[11] Source:http://www.chinausfocus.com/energy-environment/pollution-forces-china-to-transform-its-mode-of-economic-growth/
[12] Source: http://www.nisd.cass.cn/news/727435.htm (Chinese)

sufficiently and caught the attention of both the state and its civil society.[13] As a result, the state began to expand the social security and welfare system to cover health issues.

Just as Western environmental movements when faced with severe air pollution mobilized citizens, Chinese citizens looked to the Western example to raise concern about pollution and to seek a forum among the environmentally conscious to form environmental awareness/action groups. Newly developed social media were used to make the environment a platform for communication and education. As a two-way communication method, citizens were educated by environmental groups through online and offline environmental programs; at the same time, citizens started to express their own ideas and make demands on the role of environmental groups as well as the state. The development of social media has connected the role and responsibility of the state, environmental groups, and citizens. Social media has served as resource for rapid mobilization and civic engagement.

Air Quality and Pollution in China

As revealed in the application of the treadmill of production in China, the outcome has been a serious air quality problem (Figure 2.1). According to the definition provided by the Australia EPA（Environmental Protection Agency) on its website, air quality refers to the condition of the air we breathe. Air quality can be investigated by measuring levels of common pollutants such as ozone, carbon monoxide, etc.[14] Air pollution occurs when the air contains gases, dust, fumes or odor in harmful amounts. That is, amounts which could be harmful to the health or comfort of humans and animals or which could cause damage to

[13] Source: http://www.dissentmagazine.org/online_articles/the-pollution-crisis-and-environmental-activism-in-china-a-qa-with-anthropologist-ralph-litzinger
[14]Source: http://www.epa.vic.gov.au/air/aq4kids/glossary/air_quality.asp

plants and materials. The substances that cause air pollution are called pollutants. Pollutants that are pumped into our atmosphere and directly pollute the air are called primary pollutants. Examples of primary pollutants include carbon monoxide from car exhausts and sulfur dioxide from the combustion of coal.[15] The 2005 Air Quality Guideline published by WHO sets a clear standard to define air pollutants and measure different levels of air pollution. However, the air quality standard used in China is different from the common international standard. With the publication of new ambient quality standards, which were adopted by China on February 29, 2012, fine particulate matters were added to pollutants to be monitored. In addition, monitored items were reclassified into a group of basic items to be monitored mandatorily nationwide, and another group of other pollutants to be monitored discretionally, with a maximum concentration for each of the two categories in the areas that were set (You, 2013).

Air pollution in Beijing has a history of concern since the 1990s, which has largely been due to the result of pollution from coal burning plants creating energy for industrial and residential consumption as well as automobile emissions. Chinese industry has a history of coal dependence on power generation. The nation consumed more than 3.43 billion tons of coal in 2011, according to official figures, and half of that was burned for power generation.[16] Due to its low cost, coal remains the most widely used energy source in China—the country is the largest user of coal electricity in the world. Along with its own vast coal resources – approximately 114 billion tons produced as of 2011 according to the World Coal Association – China also imports large quantities of coal, since the country's

[15]Source: http://www.epa.vic.gov.au/air/aq4kids/pollution.asp
[16] The nation consumed more than 3.43 billion tons of coal in 2011, according to official figures, and half of that was burned for power generation.

coal-mining regions are often far from the areas where it is in demand.[17] Coal use for heating and industry has been a key factor for air pollution in the North China plain where Beijing is located. A recent health impacts assessment report, unveiled by Greenpeace (2011) and delivered to selected media[18] estimated that China's operating coal-fired power plants released polluting emissions that killed 260,000 people.

On an individual level, with increases in manufacturing and industrial jobs and higher wages, many Chinese can now afford a personal automobile. The increase in the number of automobiles has brought about higher levels of automobile emissions. This rapid economic development not only led to an increased discharge of air pollutants, but it also changed the constituent pattern of air pollutants. The increased number of motor vehicles and other factors resulted in an ever growing consumption of fossil fuel (Figure 2.2). Fine PM (particulate matter) became an increasingly important air pollutant (You, 2013). Jiang and Shi (2010) noted that motor vehicle exhaust is gradually becoming one of the main factors that influence air quality in cities, and suggested to first control the emission of vehicle exhaust systems to improve air quality. In addition to vehicle emission, based on the research of Bin Zhao et al (2013), other pollutants such as industrial combustion and power plants have provided the main sources of air pollution.

The problem of air pollution first gained awareness among Chinese citizens domestically in 2008. Beijing was scheduled to hold the Summer Olympics; however, at the end of 2007, the IOC (International Olympic Committee) and UN (United Nations) published

[17] Coal remains the most widely used energy source in China due to its low cost – the country is the largest user of coal electricity in the world. Along with its own vast coal resources – about 114 billion tons produced as of 2011 according to the World Coal Association – China also imports large quantities of coal, since the country's coal-mining regions are often far from the areas where it is in demand.

[18] Source: http://www.eenews.net/stories/1059991738

a report claiming that the air pollution in Beijing would pose threat for the breathing system of the athletes.[19] The report also indicated that China's air quality standard was different from the global standard, and proposed measurement for controlling policies to solve the air pollution problem. The report provided statistics for monitoring air pollutants and provided an analysis of the annual air quality trends. Following publication of this report, increasing global demands and pressures were made for the Chinese government to clean its air and improve air conditions before the start of the 2008 Olympics. Traditional media such as TV and newspapers were used by the state to distribute environmental information, broadcast new environmental regulations, and raise the public's environmental awareness of air quality issues.

After policy implementations improved prior to and during the 2008 Olympics, the monitoring systems became loose, and air quality problems reemerged and continued to deteriorate.[20] In 2011, the policy became more environmentally focused in response participating stakeholders who had raised awareness and demanded results. Rather than reinstituting the clean air action policy of 2008 led by the state to make demands on the community, the 2011 policy included provisions that were demanded by environmental groups and educated citizens who called for more reform on policy and regulation by the community. Since 2008, environmental groups had been growing and starting to lead environmental communication and education programs on air quality issues. Since the widespread use of social media, such as platforms to check the daily air quality index and

[19] Source: Independent Environmental Assessment: Beijing 2008 Olympic Games, published by the United Nations Environment Programme (UNEP) in February 2009, available at http://www.unep.org/pdf/BEIJING_REPORT_COMPLETE.pdf

[20] Source: http://mybocog.beijing2008.cn/home.php?mod=space&uid=2595&do=blog&id=13696

receive information about the daily air pollution, the local citizens started to post their reflections on social media sites and initiate discussions about how to better protect themselves from air pollution and related health concerns. Through the use of social media, local residents increased their air quality knowledge, and started to express their ideas and feelings regarding the bad air quality situation.[21] Thus, a green public sphere was created by using social media to exchange and share information, and have discussions about air quality issues.

[21] Source: http://www.dissentmagazine.org/online_articles/the-pollution-crisis-and-environmental-activism-in-china-a-qa-with-anthropologist-ralph-litzinger

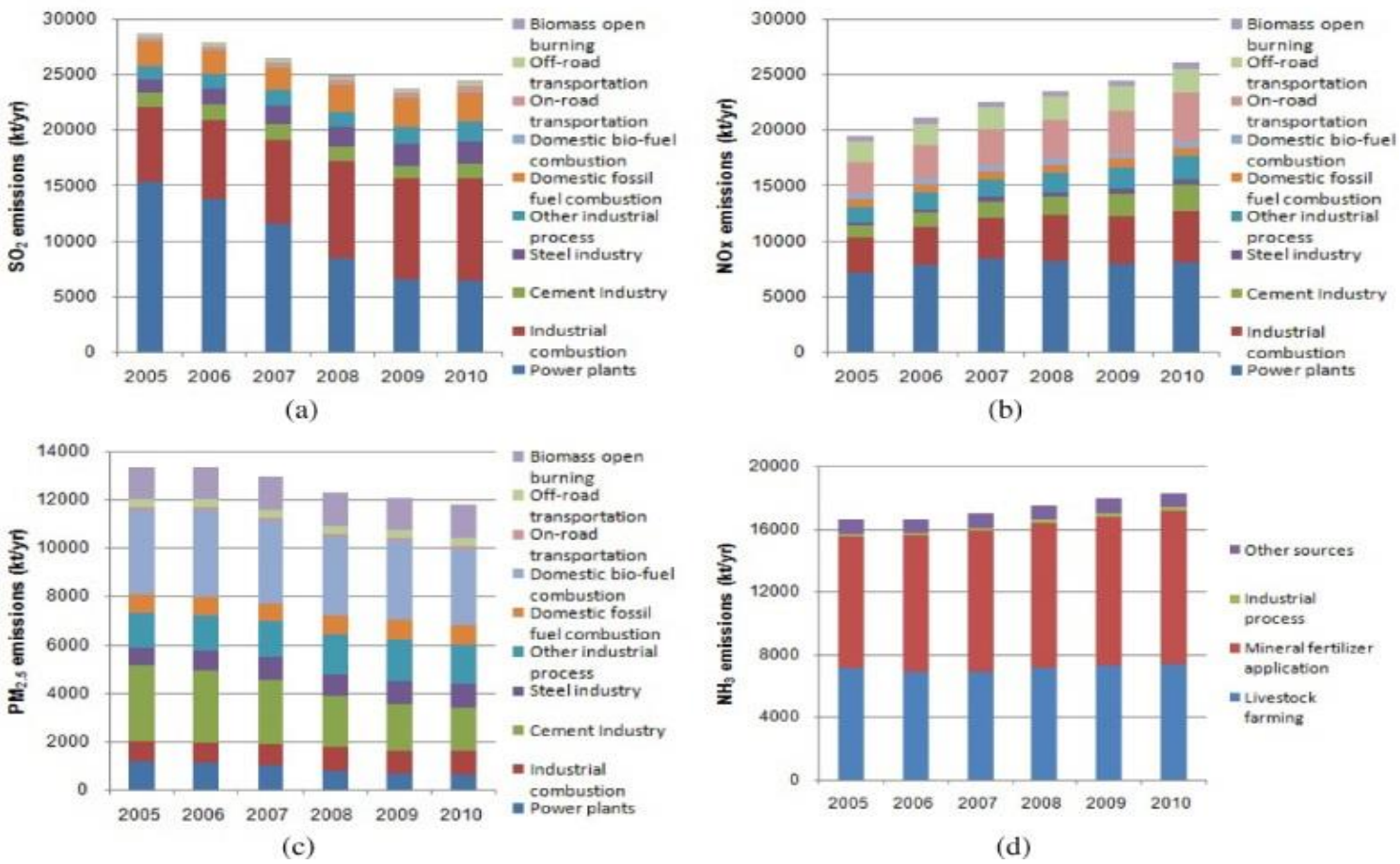

Figure 2.2. Sources of air pollution in China

Source: Bin Zhao et al. (2013). Atmospheric environment. *Environmental Research Letters, 8.*

Green Public Sphere and Strategies

The concept of a green public sphere and greenspeak in China is defined by Yang (2007), who based his argument on Harbermas's public sphere theory and broadened the concept to explain the situations occurring in China. Habermas (1989) initially defined "public sphere" as "…a domain of our social life in which such a thing as public opinion can be formed" (p. 231). Access to this domain is "…open in principle to all citizens" who may "…assemble and unite freely, and express and publicize their opinions freely" (p. 231). Yang (2007) provided a broad conception of the public sphere as that of a space for public discourse and communication. According to Yang, the emerging green sphere in China has the following basic elements: (1) an environmental discourse or greenspeak; (2) individual citizens and environmental groups that produce or consume greenspeak; and (3) media used for producing and circulating greenspeak.

The demand for a growing green public sphere fits with a call for introducing the emerging civil society to fight against environmental pollution problems and slow down the treadmill of production. According to Diamond (1999), "…civil society involves citizens acting collectively in a public sphere to express their interests, passions, preferences, and ideas, to exchange information, to achieve collective goals, to make demands on the state, to improve the structure and functioning of the state, and to hold state officials accountable" (p. 221). To develop a civil society which can work towards a collective goal, environmental groups have made efforts to become significantly involved in China's environmental management. In this process, to be regarded as an indispensable power to slow down the

treadmill of production, citizens have adopted resource mobilization strategies as resource mobilization theory and political process theory predict (Jin, 2007).

Mobilization theory emphasizes the internal structure of social movements. According to resource mobilization theorists, the distribution of resources within any society is unequal (Jin, 2007). Marginalized groups often lack sufficient resources to launch collective actions. Therefore, movement activists have to attract support and mobilize resources from outside (Jenkins, 1983). Environmental groups based in big cities like Beijing, learn to acquire resources through the process of globalization. These cities essentially learn and adapt their policy through prior experiences of international environmental groups in raising campaigns and participating in the process of policy making and implementation, as well as developing programs related to science communication and education which they will adapt to their own needs. As a result, Beijing's environmental activism has developed rapidly and vividly in terms of membership, number of issues addressed, and the role they play in national environmental campaigns as a leading power (Xie, 2009).

Political process theory explores the external conditions of social movements. Assuming discontent continuingly exists, change in a political opportunity structure would open the door for a movement to emerge (Jin, 2007). In order for Chinese environmental groups to achieve greater power in the political power structure, they generally do not orient themselves against the state but, rather, are situated in a grey area between state and society where multiple actors and stakeholders interact (Zhu & Ho, 2008).

Based on movement strategies, Chinese environmental groups have designed empowerment programs to encourage local residents to participate in local control of environmental pollution and establish sustainable household practices. When initially faced with the air pollution problem, Beijing residents tended to adopt a "not in my backyard" strategy to deal with air pollution. Rather than working with other people to solve the air pollution problem and improve the situation, they merely chose the "inverted quarantine" strategy, which is described in the book, *Shopping Our Way to Safety* (Szasz, 2007) when faced with the risks of air pollution. They believed that the entire air pollution issue is too severe to be solved by themselves. Thus, they sought to protect themselves through individual actions such as purchasing air purifiers and protection marks. However, through educational and empowerment programs by environmental groups, more residents have realized the importance of their participation and the resources they can mobilize as a community.

According to Jin (2007), besides the internal and external factors which environmental groups are dealing with, recent social movement literature attempts to add an additional factor—culture and ideology—by developing analytical concepts of framing and repertoire. An indigenous environmental identity has developed in China based on the country's cultural heritage and traditional moral education to solve this environmental problem which was resulted from the treadmill of production. "In Beijing's case, the formed collective identity is combined with the sense of social responsibility. It strongly strengthens the mobilization of masses and resources, and helps to preserve the movement's autonomy from international NGOs as their funding organizations".(Xie, 2009, p.18).

Information Resource, Social Media, and Environmental Awareness

Among all the strategies environmental groups have employed to combat social issues, the access to informational resource has become increasing crucial to grassroots mobilization (Jin, 2007), especially under the development of new communication technologies such as the internet and social media. Recent studies have revealed that increasing visibility of environmentalism in cyberspace in which information and communication technologies play a significant role in the emergence of environmental activism (Yang, 2005; Sullivan & Xie, 2009). The growing popularity of the internet has led researchers to explore its role in empowering social movement groups and helping activists initiate social changes (Kahn & Kellner, 2004). Based on various applications and features of the internet, people at the grassroots level are now able to not only demonstrate dynamic power and adopt more sophisticated strategies and change their society, but also to send out their messages to potential audiences (Best & Kellner, 2001). An increasing number of protests and self-organizing activities are now performed by online activist communities worldwide.

In societies like China, a precondition for an environmental movement is the availability of information about environmental conditions, regulations and behaviors, and a space in which to discuss these issues, or democratic precondition (Janicke, 1990, 2006). In a government-dominated country like China, the freedom of the mass media is tied closely to its degree of democracy (Ji et al., 2009).

As a new form of mass media, the internet has played an important role in sharing information and communication. As a network of people (Gurak & Logie, 2003), the internet

has a close relationship with democratic movements (Kidd, 2003). Although the Chinese government continually monitors the use of and access to the internet, and filters out many web sites, cyberspace is a much freer social space in the Chinese public sphere than any other medium. In other words, the internet allows for cheap and easy complaints from the public on environmental issues, which is a reason for a significant increment in the number of "letters", whereas the number of "visits" merely increased slightly over the same period. The rapid rise in complaints on environmental issues is vital to China's democratizing environmental governance, which reflects the emerging interactions between China's environmental protection bureaus and the public.

The dramatic growth in China's internet population has been well documented, Internet users have reached 298 million across the country, and the internet penetration rate has reached 22.6% (Yang, 2003). In some demographic sectors, particularly educated urban youth, the level of internet usage is high. According to Yang (2009), online activists are mostly young and urban, but reflect diversity in age and occupation (p. 32). Yang added that a highly heterogeneous set of internet constituencies include "…homeowners, pensioners, migrants, hepatitis-B carriers, ant farmers, consumers, even computer gamers and pet owners" (p. 27). The data from World Bank's development indicator database has also indicated that the number of internet users per 1,000 people has increased rapidly, from 0.005 in 1995 to 42.3 in 2012 (see Table 2.1). At the same time, mobile cellular subscriptions have also increased rapidly, from 18,319 to 1,100,000,000 in 2012 (see Table 2.1).

Table 2.1. Internet users and mobile subscription

Indicator Name	1990	1995	2000	2005	2010	2011	2012
Internet users (per 100 people	0	0.005	1.776	8.523	34.3	38.3	42.3
Mobile subscriptions	18,319	3,629,000	85,260,000	393,406,000	859,003,000	986,253,000	1,100,000,000

Source: World Bank, 2013: http://data.worldbank.org/data-catalog/world-development-indicator

The increase of social media users has risen with the increased number of internet users and the widespread use of social media platforms. According to eMarketer data (Feb 2012), more than 1.2 billion internet users access social media websites at least one time per month. It is estimated that the number of Chinese social media users will reach over 300 million by 2014 (an increase of 16.6% compared to the previous year, a staggering 55.7% of all Chinese internet users) (Digital Jungle, 2013).

When analyzing the roles of social media, there are various forms of social media which have different demographics of its users. Social media environmental organizations' use for empowerment can mainly be categorized into:

1. *Weibo (microblogs like twitter) e.g., Sina Weibo:* Incredibly popular with the youthful demographic, particularly ages 20-40. These sites are used, much like twitter, to share information, generate gossip, exchange idea and follow breaking news stories.
2. *Online entertainment community (e.g., Douban):* Generally used by a youthful demographic, particularly ages 20-30 for entertainment purposes, whether this is sharing the latest trends or communicating with others who share a common interest.

3. *Scientific communication site (e.g. GuoKe):* Built on the specification of interest of its users. Most of them are online scientific education programs which are aimed at distributing scientific messages.
4. *Question & Answer site (e.g. Zhihu):* Used to pose questions or answer others' questions. Environmental organizations and other conscious citizens can utilize these sites to find questions and topics that their organization or their individual knowledge is either a relevant source of information, or can help solve any queries.
5. *Social Network sites:* Often termed as "Facebook Clones", operating within a profile page model and with the majority of users aging between18-30. These sites are developed based on their users' real social network offline. Students and white collar workers often use these sites as a way of contacting friends, establishing relationships, or sharing experiences and content that they like.

Altogether, these social media platforms can be used to create an online community for its users to: express their interests, passions, preferences, and ideas; exchange information; achieve collective goals; make demands on the state; improve the structure and functioning of the state; and hold state officials accountable.

Previous studies on the role social media has played in environmental activism are based largely on social networking sites such as Facebook in Western countries. According to a study by Hemmi and Crowther (2013) on learning environmental activism through social networking sites, SNS (Social Network Site) allows users to construct and communicate representations of their identities online. As Coleman and Blumler (2009) argued, users may be contributing to the internet and providing a means for an online "civic commons", an

organized open forum for deliberative democracy, or at least an online manifestation of Habermas' (1989) public sphere in which issues can be discussed freely. Unlike the largely unidirectional information flow of conventional websites, social networking sites operate through user-generated content which offers the possibility to create a discursive online public sphere.

As an interactive media, social media can provide channels for social movements to take digital content from supporters and from other sources, which can then be juxtaposed, re-contextualized and distributed (Loader, 2008). For example, the communications between a movement organization and its supporters is two-directional. Therefore, while the organization can publish material offered by supporters, their supporters can do likewise.

According to the current political constraints in China, more people choose to participate in online discussions via social media rather than attending offline activities. People funnel their emotions of fear and anger into online protests and campaigns. Environmental groups and active environmentalists have also discovered the great potential for using social media being important to organize environmental discussions online and mobilize resources to run environmental activities offline. There are several examples of achievements made by environmental groups and conscious citizens with the help of social media as a tool for resource mobilization and gaining more political opportunity. In December, 2011, a citizen-led campaign over urban air pollution in China played out on Weibo. The health effects and dimensions related to air quality issues were heatedly discussed by the participants since it harms people's health rights, which attracted more people to participate in online discussion. Millions of urbanities took social media platforms

to express outrage at the air pollution in Beijing. Public anger rose regarding fudged government statistics, which excluded data on key pollutants and painted a determinedly rosy picture of Chinese urban air quality, and served as an important impetus. An online poll revealed tens of thousands call for the government to release more accurate measurement (Boyd, 2013, p. 61-71) .The call was aimed at requesting to include more air quality indicators which can provide a more accurate estimate of the actual air pollution condition. Thus, mobile apps have been developed to provide the air quality index in big cities in China. These apps contain various resources that provide statistics of air quality indicators for people to compare the readings provided by the U.S. embassy and the Chinese government.

Under demands from environmental groups and the emerging civil society generated from social media, the government has also established laws to regulate the transparency of environmental issues to the public. Environmental issues, including qualities, standards, regulations, programs and plans, and examination and approval of EIA (Environment Information Assessment) paperwork, have been required to be made accessible to the public by environmental administration departments at all levels of government (Fugui et al., 2008) The state of open government information reflects the delicate balancing act that defines governance in China today between the pressure for greater openness and public oversight, while maintaining stability through high rates of economic growth. In January, 2012, Beijing's government had started to release trial PM 2.5 data and standards on air pollution that are more in line with World Health Organization levels. This has been "milestone" achievement for public participation in environmental governance (Boyd, 2013, p. 41-46).

Under pressure from online requests raised by conscious citizens and environmental groups, Beijing's government has also worked to improve accessibility and transparency of environmental information. When a severe air pollution situation is detected, the government currently informs the public and carries out emergency measures to curb pollution, such as ordering cars off the roads and factories to shut down, and warning citizens to avoid activity outside. These governmental activities have confirmed the effects of civic engagement in air quality issues in China, and have likewise created more political opportunities for Chinese residents to engage in activities to slow down the treadmill of production.

Under the growing offline and online public spheres, campaigns, especially online campaigns, are being used as an effective tactic by NGOs to publicize environmental issues. These campaigns help to concentrate public attention on specific issues by creating media visibility and public discussions. Some grass-roots tactics have directly influenced policies. In places where mass protests occurred in 2013—Ningbo, Dalian, Qidong (immediately North of Shanghai), Guangzhou—an incredible amount of knowledge was shared via social networking sites about chemical plants, long-term health effects, toxic runoff, and shady deals city leaders have made with the companies that hoped to build and expand these plants. This knowledge was shared rapidly, and protests were mobilized in what often seemed to be instantaneously.[22]

In turn, the government also used these same social networking sites to disseminate its own information, as well as to plea for harmony and social order. During that time, online activists mocked and ridiculed these government postings. The protests on the street, the use

[22] Source: http://www.dissentmagazine.org/online_articles/the-pollution-crisis-and-environmental-activism-in-china-a-qa-with-anthropologist-ralph-litzinger

of web-based social networking platforms, and the government security apparatus were in constant play during these events. This result revealed the great power of social media users to protect their environmental rights and express their environmental needs. With the help of social media technology, they were able to play an increasing role to make demands on the government for slowing down the treadmill of production. Although their access to data online is still constrained by the state and their online activities are under the inspection of the state, their ideas and opinions can be better distributed and reached the government officials efficiently through online social media sites.

Based on an analysis of the causes of air quality issues and how methods of discourse have been generated in China, a theoretical framework is provided in Figure 2.2 that can be used to analyze the formation and stakeholders of environmental discourse on air quality.

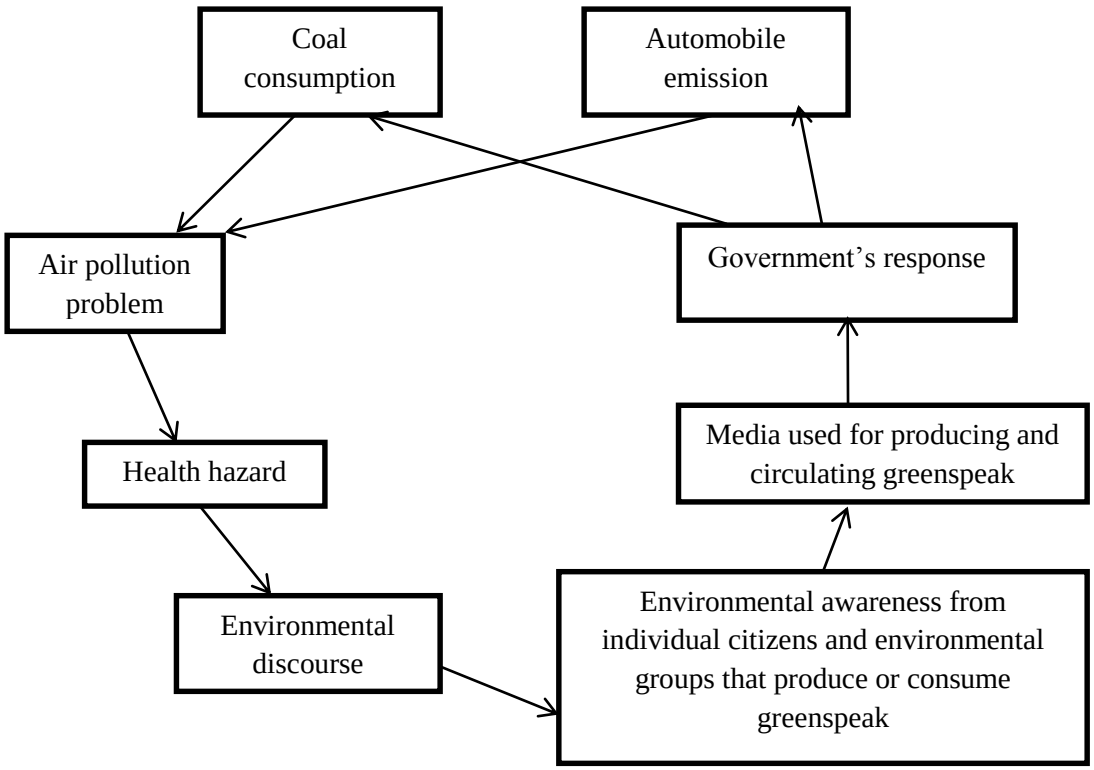

Figure 2.2. Formation and stakeholders of an environmental discourse on air quality

Concerns over health hazards resulting from air pollution have made environmental discourse of air quality issues possible in China. On this basis, environmental awareness from individual citizens and environmental groups can be used to develop, produce, or consume greenspeak. Conscientious individual citizens and environmental groups can employ media, especially social media, for producing and circulating greenspeak for civic engagement in air quality issues. Under demands of civic engagement, the state new policies and potential solutions can be developed to solve air quality problems in China.

Research Questions

When analyzing the role of government, environmental groups and social media technology have played regarding the process of treadmill of production, one can observe the emerging importance of social media users in civic engagement of environmental issues. Social media has become an important platform for the emerging civil society to participate with other stakeholders such as government and environmental groups. It also has been employed by the state and environmental groups to fulfill their goals on environmental issues. However, there has been little research on the intervention of social media users in civic engagement on air quality issues. The survey method was used in this research to provide a comprehensive understanding of the views and action of users of social media on air quality issues. The formation of treadmill of production was used in this study to provide a greater understanding of the causes of air quality pollution and civic engagement generated by social media. The following research questions and hypotheses were used to guide this study:

1. What proportion of Chinese social media users view air quality as a severe environmental problem in China? Because it has been established that more than half of Chinese social media users view air quality as a severe environmental problem in China; therefore, I hypothesized that…

   H1: Beijing social media users will more likely rate air quality problem as the most serious environmental problem in Beijing.

2. What proportion of Chinese social media users are engaged in environmental activism because of the perceived problem with air quality in China? It has been established that Chinese social media users engage in different types of environmental activities; thus, I hypothesized that …

   H2: Beijing social media users will use social medial as a public sphere to initiate environmental discussion and activities.

Nevertheless, the frequency of social media users engaged in environmental activism through social media remains low. For change to happen, the level of citizen participation in addressing environmental issues such as air quality needs to be much higher. Loader (2008) noted that online communication was perceived as being a weaker commitment than face-to-face interaction. Those using Social Network Sites (SNS) could acquire a sense of belonging to an imagined environmental community. As argued by Gladwell (2010), although online activism is low commitment activism, the growth of "social media activism" may be misleading as it may merely express how individuals are constructing their own identities rather than expressing strong commitments to social movement goals. The transforming of

the online discussion and offline participations are great challenges for environmental groups.

Different categories of social media platforms have users with different demographics and different specification of interest; therefore, it is also important to compare the effectiveness of different social media platforms in organizing environmental activism activities. Thus, the 3rd, and overarching research question, concerns how demographics and environmental awareness correlates with engagement in environmental activism activities.

The following research sub-questions and hypotheses guided the study:

3a. What demographics and levels of awareness influence the likelihood of engaging in discussions about *general environmental issues*?

H3a1: Younger social media users will be more likely to *engage in discussion on general environmental issues.*

H3a2: Higher income social media users will be likely to *engage in discussion on general environmental issues.*

H3a3: The higher the education of a social media user, the more they are likely to *engage in discussion on general environmental issues.*

H3a4: *Female* social media users will be more likely than male social media users to engage in discussion on general environmental issues.

H3a5: Higher levels of environmental awareness social media users will be likely to *engage in discussion on general environmental issues.*

3.b. What demographics and levels of awareness are associated with the likelihood of participating in *online discussion on air quality issues?*

H3b1: Younger social media users will be more likely to participate in *online discussion on air quality issues.*

H3b2: Higher income social media users will be likely to participate in *online discussion on air quality issues.*

H3b3: The higher the education of a social media user, the more they are likely to participate in *online discussion on air quality issues*.

H3b4: *Female social media users* will be more likely than male social media users to participate in online discussion on air quality issues.

H3b5: Higher levels of environmental awareness social media users will be likely to participate in *online discussion on air quality issues.*

3.c. What demographics and levels of awareness are associated with the likelihood of participating in *offline environmental programs about air quality?*

H3c1: Younger social media users will be more likely to participate in *offline environmental programs about air quality.*

H3c2: Higher income social media users will be likely to participate in *offline environmental programs about air quality.*

H3c3: The higher the education of a social media user, the more they are likely to participate in *offline environmental programs about air quality.*

H3c4: *Female social media users* will be more likely than male social media users to participate in offline environmental programs about air quality.

H3c5: Higher levels of environmental awareness social media users will be likely to willing to participate in *offline environmental programs about air quality*.

3.d. How does use of different *platforms of social media* correlate with different frequencies of different types of environmental engagement?

H3d1: Social media platforms with more general discussion forums compared to specialized social media sites will have users that are more likely to engage in an environmental discussion.

This chapter reviewed the development of social media in response to China's air pollution policies. Three research questions and related hypotheses were presented that guided the research. Chapter 3 will present and discuss the methodology used to conduct this study.

CHAPTER 3. METHODOLOGY

The purpose of this research was to study air pollution in China and to explore relationships among civic engagement, social media use, and environmental issues. This chapter is divided into two parts: (a) survey design methods which talks about the development of survey methods and sampling process; and (b) variable operationalization which talks about the coding process and variable analysis.

Survey Design and survey process

This research was intended to ascertain environmental awareness, attitudes, and behaviors of Beijing, China residents. Since air pollution is an emerging social problem, there is no existing data set, thus a survey was needed to collect enough quantitative data to answer the research questions which focused on the current environmental perceptions of Beijing residents. Numerous environmental issues are debated broadly on social media platforms. As a result, many residents in cities have become users of different social media. Social media offered a convenient platform to reach the Beijing residents and conduct my research study on their environmental awareness.

In order to reach the study population, a poster was designed that could be disseminated through social media platforms. Then I posted it on three of my personal social media websites: Weibo, Douban and Renren, with a picture of the air pollution situation in Beijing, and an introduction to the survey.

These three platforms were selected due to their potential impact on the study population in China. Weibo (Sina Weibo) is a similar Chinese version of twitter. It had acquired more than 0.5 billion registered users by the end of 2012. Currently, a population of

42.6 million uses it daily. Approximately 100 million messages are posted every day on Sina Weibo. Some information of registered users provide public access; for example, the residential locations of users. Thus, Sina Webo can be used as a sampling frame that contains registered users from Beijing. A poster of the survey was posted on my Weibo account to be spread around to Bejing users.

Douban is a kind of social media whose main users are people from 18-40 years of age who live in the same urban area. It has more than 62 million registered users, and has some online groups to connect people together who live in the same residential locations through online and offline activities. Online activities such as online discussion can be created for its users to participate and share information with their online connections. The information of the survey was posted on my Douban account as well as some online groups of Beijing residents to invite individuals to participate in the survey via Douban. An online survey activity was also created in Douban which directly leads to the website address of the online survey.

Renren is a similar Chinese version of Facebook, but its main users are college students in China. It has more than 137 million registered users based on their offline connections at different schools. Information of the survey was also posted on the Renren for people to forward and distribute.

In addition, to reach more people who fall into the category of this study population, two environmental organizations, Friends of Nature (FON) and Greenpeace, which both have an office in Beijing, were contacted in advance to help distribute the poster and information of the survey on their social media accounts. Since the Weibo account of these two

organizations have the most followers compared to their other social accounts, these two organizations helped spread the information of the survey on their Weibo accounts. The Weibo account of FONs has about 42 thousand followers; whereas, the Weibo account has more than 100 thousand followers. During the survey period, Green Beagle Institute, a formally registered NGO in Beijing which focuses on environment protection including environment impact monitoring, environmental accidents investigations, public dissemination of environmental knowledge also helped distribute the information of my survey on its social media accounts on Weibo. It had more than 11 thousand followers by the time the survey was started.

The survey questionnaire, the poster of the survey, and the letter of introduction which was posted on the survey website was first designed in English and then translated into Chinese. The entire survey and instruments were designed from May to June, 2013, and the application for Institutional Review Board (IRB) were approved on June 24, 2013, and assigned an IRB ID of 13-292. The online survey was created using Qualtrics. After allowing several days for pilot testing with Chinese speakers, it was activated on July 2nd. The entire period of data collection lasted for approximately one month, from July 2nd to August 7th.

The sampling process attempted to mimic how information flows via social media. In the first week of my data collection, I relied on the data collection process to be carried out by individuals to voluntarily forwarded and distributed the survey information on social media to attract participants. This process did not reach a measurable response number. Therefore, in order to connect with a larger study population, the sampling strategies were slightly modified during the following weeks. Since the registered residential information on

Weibo and Douban can be used to form sampling frames for this study, person-to-person messages with the poster and introduction of the survey were sent to contact the potential participants directly using Weibo and Douban. To initiate the contacting process, a search of the list of people whose residential location is Beijing was done in Weibo. Having the list of Beijing residents as a sampling frame in Weibo, registered users were selected by convenience and a message was sent to individuals to invite them to participate in the survey. In addition, since Douban also offers the residential locations of its users, a similar process was also used to select people who live in Beijing as a sample of convenience and send them a message. In total, approximately 3,000 messages in Weibo and 1,000 messages in Douban were sent during the survey period. This method of sending out invitations through direct message via social media worked well, and there were increasing numbers of participants in the survey. During the entire survey period, 764 people started the survey by clicking the website address via invitations from social media. Based on a meta-analysis of 45 studies examining differences in the response rate between web surveys and other survey modes, it is estimated that the response rate in the web survey on average is approximately 11% lower than that of other survey modes (Manfreda et al, 2008). The completed response rate of this survey is about 19.1%, which is higher than the normal web survey.

Table 3.1 the average response in each screen

Screen number	Average response rate
1	95%
2	90%
3	90%

Table 3.1 the average response in each screen continued

Screen number	Average response rate
4	88%
5	86%
6	86%
7	81%
8	81%
9	79%
11	65%
12	68%
13	72%
14	72%
15	72%
16	71%

Since the survey is an online screen with 16 screens (except for the screen for the introduction and qualifying question), there were changes in the response rate among each screen of the survey (see Table 3.1). With the exception of some screens, the majority of the screens were comprised of 3-5 single-option, optional questions. In the first 6 screen, the response decreased from 95% to 86%. After two multiple choice questions on the Screen 7, the response rate decreased a little in the following screens, from 86% to 79%. However, after a required fill-in question in Screen 10, there was a dramatic decrease in the response rate of approximately 65% in the next screen. Apparently, some people did not have the patience to fill in that question and immediately dropped out of the online survey. After the

questions in Screen 11, the response rate even rose a little in the following questions, resulting in a final response rate of 71%. There was also a special question which had a response rate of 36.6% on the last screen of the survey, whereas the remaining two questions on the same screen had a response rate of approximately 71%.

The question with the lowest response rate asked about how many years the respondents have lived in Beijing. The reason for the low response rate on this particular question might be due to the high mobility of Beijing residents. Beijing is a migration city, with a lot of migrants from other parts of China mobilizing into Beijing on a daily basis. A probable reason a large number of survey participants skipped this question might be it was hard for them to calculate a specific number of years they lived in Beijing. The changes in response rate reveal the types of the questions as well as the amount of questions will tend to affect participation by the respondents during an online survey. In addition, some questions may have a lower response rate because it is difficult to operationalize an answer without clearer instructions from the designer.

Using social media to reach and invite survey participants has some advantages. Different from a normal web survey, social media has the resident's demographic information with public access to it; for example, the age, residential location, and other information. Its users are real individuals. Social media enables one to create a platform for researchers to make contact with potential participants who meet the qualifications for the survey population through an online message. By sending messages directly to the users in social media, researchers are more likely to persuade and convince people to participate in their research. In addition, potential participants can also access some basic information

about the researchers via social media, which makes it easier for the researchers to build trust with the potential participants. The distribution and forwarding of some authoritative organizations on social media (e.g., environmental NGOs in this case) also make it easier to convince more people to participate.

Nevertheless, online surveys based on the distribution of information and direct invitation via social media have some weakness. The sample population is basically the people who will use their social media account at a certain frequency during the survey period. In this case, the participants must check their social media account during the survey period to get information about the survey. Some might be active users of social media, which may create bias in the sample population for the survey. Although my research questions of this study were basically focused on the perceptions and behaviors of social media users in Beijing, the characteristic of most social media users would have an influence on my research question about how demographics and environmental awareness will correlate with engagement with the environmental activism activities. In addition, my sampling strategies for the social media users who would receive the invitation to the research was based on convenience sampling, which can also lead to bias problems regarding the entire population of social media users.

The survey was published on the site of Qualtrics with a letter of introduction. The letter of introduction stated that all of the responses collected by the online survey would be kept completely confidential and all resulting data would be reported and analyzed in aggregate form. After participants completed the survey, they simply needed to click the

"submit" button to quit the survey. Their consent to participate in this study was implied by their submission of the survey.

In the survey, two qualifying questions were created in the first screen of the survey to ensure the participants are Beijing residents, and over 18 years old, by asking them whether they are over 18 years old now and whether they are currently living in Beijing. The responses to these two questions were either *yes* or *no*. If the response was no, then the respondent was thanked for participating but no further responses were required of that individual. Following the instruction of Dillman (2009) on designing the online survey, great attention was paid to the display of the questions and options as well as the format of screens. After reading the introduction letter and answering the two qualifying questions, the participants were ready to start answering the survey questions.

The survey questions basically covered the following parts: (1) Basic knowledge and understanding of the environmental issues especially air quality; (2) Participation history in the environmental programs; (3) Participants' attitudes towards participating in environmental movements; (4) Usage of social media and apps; and (5) demographics.

Coding and Analysis

Based on the theoretical framework of the formation and stakeholders of environmental discourse, the indicators were designed to explore the role of social media in civic engagement of air quality issues including: (1) the environmental discourse on air quality issues; (2) participation in environmental issues; (3) environmental awareness; (4) usage of social media and mobile apps; and (5) demographics (See Appendix A for survey instrument).

The first group of data used for analysis was Beijing social media users' environmental discourse of the air quality issues. To test environmental awareness of air quality issues of Beijing social media users, first it is important to know their perceptions about the most serious environmental problem in China, in Beijing, and in their neighborhood. Three single-choice paralleling questions were designed with different types of environmental pollution from which the respondents could choose. Options varied from air pollution or water pollution to other important environmental hazards in China. The statistics from this data set revealed the perception of the severity of air pollution problems was a priority problem of Chinese social media users compared to other environmental problems.

To predict the relationship between engagement in environmental issues through different platforms as the dependent variables and the possible factors such as environmental awareness as the independent variables, models were created to analyze the relationships as revealed in the findings of this research. The three dependent indicators representing the levels of environmental engagement were the frequency of: (a) general discussion of environmental issues with friends; (b) participation in online discussion about air quality; and (c) participation in offline activities about air quality. Each was analyzed as the dependent variable using a separate regression model. All were recoded from 1-5 Likert scales to 0-4 Likert scales from 0=never, 1=several times a year, 2=monthly, 3=weekly to 4=daily.

The descriptive statistics of the independent variables of these three models were the same. The independent variables were categorized into groups: (1) environmental awareness; (2) the usage of social media and mobile apps; and (3) demographics. Under the categories of

usage of social media and mobile apps, the subgroups were: (1) usage frequency of different social media; (2) frequency of different usage types of social media; and (3) knowledge of mobile apps. Under the category of demographics, the subgroup of former volunteer/member experience of any environmental groups in Beijing was included for analysis.

For the indicators of environmental awareness, four global environmental incidents which focused on climate change, energy consumption, and environmental pollution were chosen as predictors: (1) The film of An Inconvenient Truth by Al Gore; (2) Anti-nuclear power movement in Japan; (3) Car-free movement in the U.K.; (4)Rachel Carson's novel, "Silent Spring". Each of these four incidents is related to air quality issues. With the exception of the publication of "Silent Spring", the other three incidents occurred in the 21th century. They also covered environmental practices in different developed countries in different regions. These indicators can be used to assess the awareness of global environmental issues and movements of social media users. In the coding and analyzing process, all these four international incidents were recoded from 1-5 Likert scales to 0-4 Likert scales from 0=don't know, 1=know little, 2=know some, 3=know well to 4=know all the details.

Four Chinese domestic environmental incidents were also used as indicators to assess the awareness of domestic air pollution incidents: (1) Kunming PX Incident (2013); (2) Burning of Straw incident in the suburban area of Chengdu (2012); (3) Pollution from coal burning in Pingshuo (2009); and (4) Pollution from the power plant in Humeng (2010). Each of these incidents occurred and were reported in recent years by different media sources with great social impact. Thus, they were deemed to be a good set of indicators to measure

domestic awareness of air pollution issues. In the coding and analyzing process, all these four domestic incidents were recoded from 1-5 Likert scales to 0-4 Likert scales from 0=don't know, 1=know little, 2=know some, 3=know well to 4=know all the details.

Some policies in Beijing were used as indicators to measure familiarity with the latest policies which were enacted to resolve the air pollution problems in Beijing: (1) Increase usage of public transportation in Beijing to 46% by 2013; (2) Increase taxi fuel usage of Condensed Natural Gas (CNG) in Beijing by 2013; (3) Decrease the usage of coal in Beijing by 5% by 2013. Each of these local policies for measuring the environmental awareness was recoded from 1-5 Likert scales to 0-4 Likert scales from 0=don't know, 1=know little, 2=know some, 3=know well to 4=know all the details.

When considering usage frequency of different social media, four types of social media platform were chosen as indicators based on their popularity in China: (1) Weibo (Sina Weibo); (2) Douban; (3) Zhihu; (4) Guoke; and (5) Renren. The frequency of usage was recoded from 1-5 Likert scales to 0-4 Likert scales from 0=never, 1=several times a year, 2=monthly, 3=weekly to 4=daily.

When considering the frequency of different usage for types of social media, four different usage types were chosen to represent online activities representing different engagement levels: (1) reading another's post; (2) clicking on an external link; (3) making comments on another's post; and (4) posting (or forwarding) on their account. The frequency of different usage types were also recoded from 1-5 Likert scales to 0-4 Likert scales from 0=never, 1=several times a year, 2=monthly, 3=weekly to 4=daily.

Knowledge of app use was examined based on the usage. Respondents were asked whether they had heard about the app on air quality issues or had already installed it. The answers to the question were coded into a 0-2 Likert scale, with 0 representing the choice that they didn't know about this kind of app; whereas 1 showed that they had only heard of it and 2 showed that they had already installed it.

When considering the demographics, the indicators chosen for the regression model were: (1) gender, which was recoded into a 0-1 categorical variable with meanings of 0 representing male and 1 representing female; (2) age, which was used as a continuous variable; (3) highest educational background, which was coded into a 1-5 scale (1=less than high school, 2=high school, 3=bachelor, 4=master, 5=PhD); and (4) household income per month which was also coded into a 1-5 scale (1=less than 2,000 rmb, 2=2,000~6,000 rmb, 3=6,000~8,000 rmb, 4=10,000~20,000 rmb, 5=20,000 ~30,000 rmb, 6=30,000~40,000 rmb, 7=more than 40,000 rmb). These demographic indicators were chosen to provide a better understanding of the characteristics of social media users. The mean of gender was 0.59. The mean of age was 27.59 with a standard deviation of 7.214. All of the aforementioned predicators were used in examining and comparing the three paralleling research questions.

The volunteer/member experience of any environmental groups in Beijing was simply based on the question asking about whether or not social media users have volunteer/member experience. The answer was recoded into two categories with the indicator 0 representing no and 1 representing yes.

Three linear regression models were created to examine the relationship between the dependent and independent variables. They were:

Model 1: Frequency of engagement in discussion on general environmental issues=f(demographics, environmental awareness, usage frequency of different social media, frequency of different usage types of social media, mobile apps knowledge and usage frequency, volunteer experience)

M2: Frequency of participation in online discussion on air quality issues=f(demographics, environmental awareness, usage frequency of different social media, frequency of different usage types of social media, mobile apps knowledge and usage frequency, volunteer experience)

M3: Frequency of participation in offline environmental programs about air quality=f(demographics, environmental awareness, usage frequency of different social media, frequency of different usage types of social media, mobile apps knowledge and usage frequency, volunteer experience)

According to the hypotheses, demographics should have a significant impact on the frequency of participation in environmental issues, so the group of demographic predictors are entered as the first block in the regression model, followed by the group of environmental awareness and social media use. Since this data collected for this survey is through Weibo and Douban, there is bias in the frequency of uses of different social media sites, so only the frequency of Weibo use and Douban use are analyzed as potential predictors. It is entered in the third block, followed by the different frequency of different social media usage type. Volunteer experience is entered as the last block. For each of the three models, there are five blocks of independent variables entered in the regression model. So for each participatory model, there are partial models which showed the impacts of different independent variables.

Each of these three linear models answered following the research questions.

RQ3a. What demographics and levels of awareness influence the likelihood of engaging in discussions about general environmental issues?

RQ3b. What demographics and levels of awareness are associated with the likelihood of participating in online discussion on air quality issue?

RQ3c. What demographics and levels of awareness are associated with the likelihood of participating in offline environmental programs about air quality?

Summary

Each of the variables of the study that were included in the analyses were presented in this chapter. Information was also provided regarding the development of the survey instruments, sampling methods and process, the questionnaire construction, the operationalization and coding process of the variables to test the hypotheses as well as selected basic descriptive statistics of these independent and dependent variables. Chapter 4 will present the results based on statistical analysis.

CHAPTER 4. RESULTS

A summer 2013 survey of Beijing social media users offers a view of who is using social media to follow and discuss Chinese environmental problems. Beijing social media users were asked if they cared about Beijing and China's environmental problems and what they thought they could do to learn more about and to address some of these issues. Findings of the survey are presented in this chapter to answer the research questions, 1) who are the residents of Beijing who are aware of environmental and air quality issues, 2) how concerned and engaged are they about Chinese environmental problems, 3) how do they use social media to learn about and discuss environmental concerns, and 4) what is the relationship between use of social media and active engagement in addressing environmental issues?

The human health-related air pollution problems are an example of the current treadmill of production which is going on in China. As efforts are made to slow down it, environmental groups in China have worked with the growing civic society and media to address the severity of air pollution problems. The government also has become more willing to share environmental information and introduce new environmental policies with the public. Discussion about air quality issues and announcement of air quality index from different environmental groups are allowed online, which created an online public sphere for environmental education and communication. Many social media users are educated and encouraged to participate more on air quality issues.

Social media users of Beijing who responded to the survey

The result of the survey showed some characteristics of the social media users of Beijing who responded to the survey. The average age of the respondents is 28.37 years old with a standard deviation of 8.326. When coded the continuous answer into different age groups, 67% of them fell in the category of 18-29, 25.2% of them were in the group from 30-39, 4.5% of them were in the group of 40-49, 2.7% of them were in the group of 50-59, and only 0.6 of the respondents were over 60 years old. This trend fits in with the age distribution of Chinese social media users. As reported by China Internet Network Information Center (CNNIC), 34.1% of Chinese social media users are in the age group of 20-29, 22.7% of Chinese social media users are in the age group of 30-39, 10.5% of Chinese social media users aged from 40 to 49 and 3% of social media users aged from 50 to 59. Only 0.7% of them are over 60 years old (CNNIC, 2012). From the result, I conclude that 41.2% of the Beijing respondents are male while the rest are female, which is different with the distribution of gender of Chinese social media users. According to a report published by CNNIC (China Internet Network Information Center), 53.7% of Chinese social media users are male while the rest are female[23] (CNNIC, 2012). Compared to the average educational background of Beijing residents, the social media users seem to be more educated. More than 66% of the social media respondents had a bachelor's degree as highest education background, 24.6% of them had a master degree, and 3.6% of them even had a PhD degree, while 5.6% of them had a high school degree. Among the respondents, 59.3% of them are employed or self-employed, and 26.7% are student. The employment status of the

[23] However, the global average gender distribution of social media users is 48.75% male, 51.25% female worldwide. http://argylesocial.com/blog/2012/10/30/age-gender-and-social-media-strategy-audience-analytics-for-b2b.html

respondents is also partly reflected in the reported current household income per month. Almost 28% of the respondents reported an household income of 2,000-6,000 RMB per month, 24.9% of the respondents reported an household income of 6,000-10,000RMB per month and 22.1% of them reported an income of 10,000-20,000RMB per month.

What is notable among all the demographic indicators is that the question asking how many years respondents have lived in Beijing only has a response rate of 36.6% possibly reflecting the high mobility of the Beijing residents. Beijing is a migration city with a lot of migrants from other parts of China mobilizing into Beijing every day. So one reason why there is a large number of social media users who skipped this question might be it is hard for them to calculate a certain number of years they have lived in Beijing. In total, the average years of social media users lived in Beijing is 15.53 years with a standard deviation of 12.537. After I coded the response into 5 groups (0-1 year, 2-5 years, 6-10 years, 11-20 years, >= 21 years), 36% of the respondents of this question had lived in Beijing for 2-5years, 23.3% of them had lived in Beijing for 2-5 years, 21.6% of them had lived in Beijing for 11-20 years, while 15.2% of them had lived in Beijing less than 1 year and 4% of them had lived more than 21 years. When asked about the province of family origin, 52.9% of the residents' answered Beijing or the provinces closely nearby. Among all the social media users, 91.3% of respondents had an identity as an urban resident on their ID card in the population registration system.

According to the census result, 51.6% of Beijing residents were male, 48.4% were female. The population group of people aged from 20-35 covered 33.7% of the whole population, 17.7% of Beijing residents were in the group of 30-39, 17% of Beijing residents

were in the group of 40-49, 13.2% aged from 50-59 ad 13.8% were above 60 years old. About 22% of the residents had a high school diploma as the highest educational background, 29.0 % of them had graduated from college as the highest educational background, 3.1% of them had a master degree. Among the Beijing residents, 86% of them lived in the urban area while the rest 14% lived in the rural area.

Comparing the demographics of the social media users with the Beijing residents, we can notice a concentration of young and educated Beijing population who lived in the urban area of Beijing as the active social media users in this survey. This is result from the characteristic of Beijing social media users, especially the active users of Weibo and Douban.

Beijing social media users' awareness about Chinese environmental and air quality issues

To understand how Beijing social media users view environmental and air quality issues, I examined responses to a list of potential environmental concerns at different scales ---nearby living area, Beijing and China, Air quality concerns, compared to water, soil, radioactive contamination and noise pollution, are substantively the greatest concern to respondents at all scales. Table 4.1.1 presents the proportions of Beijing social media users who viewed air quality as the most serious environmental problem in different geographic scales. Almost 86% of the users reported that air pollution was the environmental problem that affects them the most. An even greater percent, (92.2%) perceived that air pollution was the most serious environmental problems in Beijing and 46% of them reported that the air pollution was the most serious environmental problem in China. The second most highly rated pollution concern was water quality, although it was substantially lower in personal

impact (5.8%) or perceived affecting on Beijing residents (2.4%). However, almost 40% respondents perceived that water quality was a serious concern for their country, only 6.2 percentage points below the 46% who rated air pollution as the most serious environmental problem for China overall. This suggests substantive agreement that air pollution was a high priority in Beijing and throughout much of China.

Table4.2.1 frequency of engage others (talk, email, attend meetings, etc) about the environment

		Valid Percent	Cumulative Percent
Valid	Daily	8.5	8.5
	Weekly	36.2	44.8
	Monthly	21.9	66.7
	several times a year	21.7	88.4
	Never	11.6	100.0
	Total	100.0	
Missing	System		
Total			

Although my data do not extend to other Chinese cities, there are reports that find air pollution is a Chinese city problem that reflects the fast growth in manufacturing and industries with high levels of air particle release. Last year, China Daily reported more than 100 cities in China had an average of 29.9 smoggy days, which was a 52-year high.[24]Chinese news organizations reported that December was the worst month for air pollution in 2013. More than 80 percent of the cities with official air monitoring devices failed to meet the

[24] Source: http://www.chinadaily.com.cn/china/fightairpollution/

national air quality standard for half of December.[25] The information from official air monitoring devices was open to the Chinese public as one of the government's action to fight air pollution problems. The extent to which air quality information is available to social media users on a daily basis is evidence that public health agencies and the government recognize this as a population health concern and are making effort to increase public awareness. For example, there are organizational accounts which provide the daily air quality index of different locations on social media and that's likely one reason why air pollution attracts the attention of the social media users.

Engaging in environmental issues

Civic engagement can take many forms including discussing environmental issues with peers and participating as a member of an environmental group. Different forms of participation showed different engagement levels and can be affected by the ability of resource mobilization, knowledge and awareness, and access to different social networks of the social media users. Different types of active engagement also represents the different methods of using social media. As hypothesized in Chapter 2, the environmental awareness, former volunteer/member experience and different methods of using social media as well as demographics will affect the levels of engagement in environmental issues through different participatory ways.

For analyzing the different frequency levels of different participatory ways, the indicators are: 1) frequency of discussion of general environmental issues with peers; 2) what

[25] Source: http://www.nytimes.com/2014/02/14/world/asia/china-to-reward-localities-for-improving-air-quality.html

kinds of general activities of any environmental groups that they participated; 3) frequency of participation in online discussion on air quality issue; 4) frequency of participation in offline environmental programs about air quality; and 5) the frequency of different usage types of social media and the frequency of different social media uses. The first two groups of indicators provided a general picture of social media users' engagement in different kinds of general activities; while the last three groups of indicators focused on the environmental activities achieved through social media.

In the past year, 88.4% Beijing social media user respondents reported discussing general environmental issues with peers. Almost 9% of social media users engaged others in the general discussion about the environment daily; 36.2% of them engaged others weekly; 21.9% of them engaged others monthly and 21.7% of them engaged others several times a year (see Table 4.2.1). The result showed that most social media users had engaged in general environmental activism at different levels of frequency, which may have prepared them to engage in some type of collective environmental activism.

Table4.2.1 frequency of engage others (talk, email, attend meetings, etc) about the environment

		Valid Percent	Cumulative Percent
Valid	Daily	8.5	8.5
	Weekly	36.2	44.8
	Monthly	21.9	66.7
	several times a year	21.7	88.4
	Never	11.6	100.0
	Total	100.0	

Examining the proportion of different types of engagement in environmental activities of any environmental groups, about 81% of social media users reported that they had exchanged information and expressed their interests, passions and ideas about the environmental issues over the last year (see Table 4.2.2). About 3-6% of respondents reported working with others to address environmental concerns or calling attention to government agencies. This reveals a willingness to discuss environmental issues with others. However, most social media users report stopping at the "talk" level and didn't move on to act together with others to address environmental problems. This suggests that this group of social media users are not yet interested, do not have time, or do not have easy access to an environmental group to join. The drop in the frequency of different participatory activities shows there is a gap between environmental discourse (e.g. Exchanged information about the environmental issues; Expressed interests, passions and ideas about the environmental issues) and environmental actions (e.g. Worked with others to achieve collective goals about the environmental issues; Made demands on the government about the environmental issues; Made efforts to improve the structure and functioning of the government about the environmental issues; Made efforts to hold government officials accountable about the environmental issues) in Chinese society. This gap showed it may be the case that a sense of citizenship is emerging in China; however, an open public sphere without policy restrictions still needs to be developed. To develop a mature social movement on environmental issues, more social media users will need to be involved in environmental activities at a collective level. More research is needed to understand the underlying reasons for the gap between talking about environmental issues and willingness to act collectively on these concerns. And

it would be interesting to explore if there is any characteristics shared by the group of people who participate in environmental actions, which might be different from the characteristics of the group of people who only participated in creating environmental discourse.

Table 4.2.2 the percentage of the environmental activism at different levels

13. In the last year, have you participated in the following activities of any environmental groups? (Circle all the options that apply)	
Answer	%
a. Exchanged information about the environmental issues	81%
b. Expressed interests, passions and ideas about the environmental issues	81%
c. Worked with others to achieve collective goals about the environmental issues	6%
d. Made demands on the government about the environmental issues	5%
e. Made efforts to improve the structure and functioning of the government about the environmental issues	3%
f. Made efforts to hold government officials accountable about the environmental issues	4%

Social Media Use to Discuss Environmental Concerns

Social media is increasingly popular as one method of online discussion. It connects people through online and offline social networks to share and exchange information and feelings. As one method of participating in online discussion, social media use can give us an example to show the difference of its user's engagement in environmental issues through different online and offline participation.

Using the frequency of participation in online discussion on air quality issue as a measurement, 78.4% of social media users had the experience of participating in online discussions about air quality issues (see Table 4.2.3). About 18% of them participated in online discussions weekly, 25% of them participated in online discussions monthly, 31.4% of them participated in online discussions several times a year while only 3.6% of them participated in online participation daily. This suggests that environmental issues are topics of online discussion and there is an online public sphere for people to discuss environmental issues more freely and actively.

Table 4.2.3 frequency participated in online discussion

		Valid Percent	Cumulative Percent
Valid	daily	3.6	3.6
	weekly	18.4	22.0
	monthly	25.0	47.0
	several times a year	31.4	78.4
	Never	21.6	100.0
	Total	100.0	

Comparing the frequency of offline participation with online participation, these social media users showed that they were not so active in offline environmental activities (see Table 4.2.4). Only 37.5% of social media users had experienced attending offline air quality activities while 62.5% of them never had the experience. Among the people who had experienced offline activities, more than half of them only participated several times a year. In general, social media users are less active in participation of offline activities compared to online environmental activism, which might be caused by the lack of social capital and

political capital to organize some collective activity. Besides, there is not much space for the citizens to express their environmental thoughts and discuss with the government or other people in charge in the public sphere.

Table 4.2.4 frequency of attending air quality programs offline

		Valid Percent	Cumulative Percent
Valid	Daily	1.3	1.3
	Weekly	5.0	6.3
	Monthly	7.4	13.7
	several times a year	23.8	37.5
	Never	62.5	100.0
	Total	100.0	

To get a better understanding of the proportion of social media users in different types of online activities, the frequency of different usage types of social media to talk about air quality issues is used as an indicator. About 97% of social media users had read other's post on air quality issues (see Table 4.2.5), 94.2% of them had the experience of clicking on an external link on air quality issues via social media (see Table 4.2.6), 90.1% of them had the experience of making comments on other's post about air quality issues (see Table 4.2.7) and 82.8% of them had the experience of posting (or forwarding) on their account about air quality issues (see Table 4.2.8). Comparing these four types of activities in different engagement level, the proportion of social media users who did these activities as daily routine decreased from reading other's post to clicking on an external links, followed by posting (or forwarding) on their accounts and making comments on other's posts. This trend

fits in with the common trend of the varying frequency of different types of engagement using social media.

Table 4.2.5 frequency of reading other's post

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	103	15.1	21.6	21.6
	weekly	172	25.2	36.1	57.7
	monthly	109	16.0	22.9	80.5
	several times a year	77	11.3	16.1	96.6
	never	16	2.3	3.4	100.0
	Total	477	69.8	100.0	

Table 4.2.6 frequency of clicking on an external link via social media

		Valid Percent	Cumulative Percent
Valid	daily	11.4	11.4
	weekly	39.2	50.6
	monthly	25.4	76.1
	several times a year	18.1	94.2
	Never	5.8	100.0
	Total	100.0	
Missing	System		
Total			

Table 4.2.7 frequency of making comments on other's post via social media

		Valid Percent	Cumulative Percent
Valid	daily	7.7	7.7
	weekly	30.8	38.5
	monthly	26.7	65.2
	several times a year	24.9	90.1
	never	9.9	100.0
	Total	100.0	

Table 4.2.8 frequency of Posted (including forwarded) on your social media account

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	37	5.4	8.1	8.1
	weekly	87	12.7	19.0	27.0
	monthly	116	17.0	25.3	52.3
	several times a year	140	20.5	30.5	82.8
	never	79	11.6	17.2	100.0
	Total	459	67.2	100.0	

According to the descriptive results, 84% of the respondents used Weibo daily and only 1.6% of the respondents didn't have a Weibo account (see Table 4.3.1); 28.2% of them used Douban daily and 18.6% of them didn't have a Douban account (see Table 4.3.2); 20.7% of them used Renren daily and only 18.4% of them didn't have a Renren account (see Table 4.3.3). The other social media didn't have so many active daily users as well as registered users, only 3.6% of the respondents used Zhihu daily and 57.3% of them didn't have a Zhihu account(see Table 4.3.4); only 2.8% of the respondents used Guoke daily and

47.4% of them didn't have a Guoke account (see Table 4.3.5). There're differences in the characteristics of the registered users of these types of social media as well as overlaps. In the next section I will discuss this further.

Table 4.3.1 the usage frequency of Weibo (Chinese version of twitter)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily	416	60.9	84.0	84.0
	Weekly	45	6.6	9.1	93.1
	Monthly	14	2.0	2.8	96.0
	several times a year	8	1.2	1.6	97.6
	Never	4	.6	.8	98.4
	I don't have an account	8	1.2	1.6	100.0
	Total	495	72.5	100.0	
Missing	System	188	27.5		
Total		683	100.0		

Table 4.3.2 the usage frequency of Douban (a social media organizing offline activities)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	124	18.2	28.2	28.2
	weekly	93	13.6	21.1	49.3
	monthly	61	8.9	13.9	63.2
	several times a year	57	8.3	13.0	76.1
	never	23	3.4	5.2	81.4
	I don't have an account	82	12.0	18.6	100.0
	Total	440	64.4	100.0	
Missing	System	243	35.6		
Total		683	100.0		

Table 4.3.3 the usage frequency of Renren (Chinese version of Facebook)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	92	13.5	20.7	20.7
	weekly	71	10.4	16.0	36.6
	monthly	48	7.0	10.8	47.4
	several times a year	102	14.9	22.9	70.3
	never	50	7.3	11.2	81.6
	I don't have an account	82	12.0	18.4	100.0
	Total	445	65.2	100.0	
Missing	System	238	34.8		
Total		683	100.0		

Table 4.3.4 the usage frequency of Zhihu (Chinese version of Quora)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	15	2.2	3.6	3.6
	weekly	40	5.9	9.5	13.0
	monthly	39	5.7	9.2	22.3
	several times a year	30	4.4	7.1	29.4
	never	56	8.2	13.3	42.7
	I don't have an account	242	35.4	57.3	100.0
	Total	422	61.8	100.0	
Missing	System	261	38.2		
Total		683	100.0		

Table 4.3.5 the usage frequency of Guoke (a social media exchanging science information)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	12	1.8	2.8	2.8
	weekly	50	7.3	11.7	14.5
	monthly	57	8.3	13.3	27.8
	several times a year	54	7.9	12.6	40.4
	never	52	7.6	12.1	52.6
	I don't have an account	203	29.7	47.4	100.0
	Total	428	62.7	100.0	
Missing	System	255	37.3		
Total		683	100.0		

Relationships between demographics, environmental awareness, use of social media and active engagement in addressing environmental issues

Although a large number of the social media users shared some demographic characteristics, there was still difference in their environmental awareness. They also have different habits of using different social media platforms at different levels of frequency. The different knowledge and ways of using social media to get environment-related information can affect their participation in both online and offline environmental activities as well as general environmental discussion. Besides, their previous volunteer experience with environmental groups can also be an indicator of the frequency of participation in different environmental activities.

Table 4.4 Descriptive Statistics of variables in the three models

	Mean	Std. Deviation	N
Dependent variable: Frequency of general participation: 0-never, 1-several times a year, 2-monthly, 3-weekly, 4-daily	2.18	1.157	381
Independent variables: Demographics			
Gender: 0-male, 1-female	.59	.493	381
age	27.59	7.214	381
What is your highest education background: 1-less than high school, 2-high school, 3-bachelor, 4-master, 5-PhD	3.31	.607	381
household income per month: 1-less than 2,000 rmb, 2-2,000~6,000 rmb, 3-6,000~8,000 rmb, 4-10,000~20,000 rmb, 5-20,000 ~30,000 rmb, 6-30,000~40,000 rmb, 7-more than 40,000 rmb	3.29	1.499	381
Environmental awareness: 0-don't know, 1- know little, 2-know some, 3-know well, 4-know all the details			
The film of An Inconvenient Truth by Al Gore	1.18	1.389	381
Anti-nuclear power movement in Japan	1.83	1.122	381
Car-free movement in UK	1.26	1.104	381
Rachel Carson "Silent Spring"	1.18	1.392	381
Kunming PX Incident(2013)	2.34	1.336	381
Burning of Straw incident in the suburban area of Chengdu(2012)	1.83	1.272	381
The pollution of coal burning in Pingshuo(2009)	1.44	1.235	381
The pollution of power plant in Humeng(2010)	1.14	1.097	381
Increase the usage of public transportation to 46% by 2013 in Beijing	1.54	1.274	381
Increase taxi fuel usage of Condensed Natural Gas (CNG) by 2013 in Beijing	1.57	1.267	381
Decrease the usage of coal by 5% by 2013 in Beijing	1.30	1.219	381
Usage frequency of different social media: 0-never, 1-several times a year, 2-monthly, 3-weekly, 4-daily			
frequency of weibo	3.70	.808	381
frequency of douban	2.10	1.549	381
Frequency of different usage types of social media: 0-never, 1-several times a year, 2-monthly, 3-weekly, 4-daily			
frequency of read	2.57	1.104	381
frequency of click	2.32	1.058	381
frequency of comment	2.01	1.097	381
frequency of post and forward	1.68	1.185	381

app knowledge: 0-don't know, 1-heard of it, 2-installed it	1.08	.777	381
volunteer/member experience of any environmental groups in Beijing:0-no,1-yes	0.10	.304	381

Based on the analysis of all the variables included in the models (See table 4.4), the frequency of participation in general environmental discussion has a mean of 2.21 with a standard deviation of 1.157. The frequency of participation in online discussion about air quality issues has a mean of 1.57 with a standard deviation of 1.114. The frequency of participation in offline activities has a mean of 0.64 and a standard deviation of 0.956.

The average age of social media users is 27.59. The mean of highest educational background of social media users is 3.31, whereas the mean of household income is 3.29.The mean for awareness of Al Gore's film of them is 1.18 with a standard deviation of 1.389. Their awareness of the book "Silent Spring" has the same mean as the film, while the standard deviation is 1.392. Their wareness of the anti-nuclear power movement in Japan has the highest mean of 1.83 and a standard deviation of 1.122. Their awareness of the car-free movement in the U.K. has a mean of 1.26 and a standard deviation of 1.104.

Awareness of the Kunming PX incident of social media users has the highest mean of 2.34 and a standard deviation of 1.336. Next is their awareness of straw burning in Chengdu, which has a mean of 1.83 and a standard deviation of 1.272. Awareness of coal burning in Pingshuo is in third place, with a mean of 1.44 and a standard deviation of 1.235. Their wareness of pollution from the power plant in Humeng has the lowest mean, of 1.14 and a standard deviation of 1.097.

Familiarity with the increase in usage of public transportation of these users has a mean of 1.54 and a standard deviation of 1.274. Their familiarity with the increase in CNG for taxi fuel has a mean of 1.57 and a standard deviation of 1.267. Familiarity with the

decrease in coal usage has a mean of 1.30 and a standard deviation of 1.219, which is the lowest.

The frequency of Weibo usage of social media users is the highest, with a mean of 3.70, while the mean of the frequency of Douban usage is 2.10.

The frequency for reading has the highest mean of 2.57, followed by the mean of 2.32 for frequency of clicking and the mean of 2.01 for frequency of commenting. The frequency of posingt and forwarding has the lowest mean of 1.08. The respondents who has already installed the app on air quality issues are predicted to be the ones who would engage more actively in environmental activism. The mean of the overall app knowledge of the social eida users is 1.08. The mean of their volunteer/member experience is 0.10.

The descriptive table 4.4 lists of the groups of independent variables utilized to test the three models. In each of the three models, there are partial models based on the entry order of these groups of independent variables. Using these indicators, I next examine and analyze the significances of each independent variable in the three regression models.

Table 4.5 Model A. Predictors of frequency of general discussion on environmental issues with peers

General discussion model	A1			A2			A3			A4			A5		
	beta	t	Sig.	beta	t	Sig.	beta	t	Sig.	beta	t	Sig.	beta	t	Sig.
gender	-.021	-.370	.712	-.020	-.328	.743	-.010	-.168	.867	.025	.434	.664	.023	.397	.692
Age	.111	1.874	**.062#**	.106	1.725	**.086#**	.097	1.535	.126	.125	2.073	**.039***	.126	2.081	**.038***
Education background	.070	1.240	.216	.056	.962	.337	.058	.987	.324	.072	1.273	.204	.074	1.300	.194
Income	.103	1.777	.077	.100	1.652	.100	.106	1.748	**.082#**	.079	1.351	.178	.079	1.356	.176
film by Al Gore				.027	.403	.687	.034	.503	.615	-.007	-.114	.909	-.010	-.146	.884
anti-nuclear JPN				-.004	-.057	.954	-.005	-.070	.944	.007	.109	.914	.008	.122	.903
car free UK				-.008	-.115	.909	-.009	-.135	.893	-.020	-.319	.750	-.020	-.321	.749
silent spring				.068	1.052	.294	.079	1.225	.222	.062	.994	.321	.059	.945	.346
Kunming PX				.008	.118	.906	.004	.053	.958	-.030	-.468	.640	-.030	-.454	.650
straw burning Chengdu				.038	.485	.628	.042	.536	.593	-.001	-.011	.991	.000	.003	.998
coal burning Pingshuo				.069	.751	.453	.069	.753	.452	.025	.283	.777	.025	.274	.784
power plant humeng				-.011	-.146	.884	-.018	-.224	.823	-.012	-.160	.873	-.014	-.186	.853
Increase the usage of public transportation				.049	.580	.562	.041	.483	.629	.019	.243	.808	.022	.268	.789
Increase taxi fuel usage of CNG				-.067	-.859	.391	-.077	-.977	.329	-.033	-.441	.659	-.032	-.425	.671
Decrease the usage of coal by 5% by 2013				-.059	-.725	.469	-.054	-.659	.510	-.068	-.863	.389	-.071	-.896	.371
Weibo							.074	1.298	.195	-.063	-1.057	.291	-.064	-1.064	.288
Douban							-.037	-.626	.532	-.003	-.057	.955	-.004	-.073	.941
Read										.101	1.302	.194	.101	1.305	.193
Click										.015	.194	.846	.013	.165	.869
Comment										.086	1.122	.263	.087	1.134	.258
Post										.170	2.467	**.014***	.169	2.443	**.015***
app knowledge										.155	2.679	**.008****	.156	2.680	**.008****
volunteer experience													.025	.459	.646
R-square	.028			.011			.011			.104			.101		
Sig.	**.011**			.247			.257			**.000**			**.000**		

Significance level: ***=.001 **=.01 *=.05 #=.10

For Model A whose dependent variable is the frequency of general participation in environmental discussion, the overall model has an F statistics of 2.556 which is significant under α=0.05 level of significance (see Table 4.5). The overall statistics of the model which examines the effects of different predictors to the frequency of general participation is significant and has an adjusted R square of 0.101.

There are five partial models which examine the impact of certain indicators to the whole model. Demographic indicators are significant in model A1 with an adjusted R square of 0.028. Among the demographic indicators, age and household income show their significance under the significance level of 0.10. When entering the indicators of awareness into the regression model, as shows in model A2, the adjusted R square decreases and model becomes non-significant. When entering the indicators of frequency of Weibo and Douban use, there's no increase in the adjusted R-square. After entering the indicators of frequency of different types of social media use the adjusted R-square increases to 0.104. In the partial model A4, the indicator of age, the online activity of posting are significant under the level of 0.05 and app knowledge is significant under the level of 0.01. The overall model of general participation in environmental discussion, Model A5, is also significant.

For the impacts of demographics, age and income are significant in the partial model. The difference in age and income shows the difference in environmental awareness and ability of participation in environmental actions of social media users. This finding proves our hypothesis that higher income social media users will be likely to engage in discussion on general environmental issues. But the hypothesis of younger social media users will be

more likely to engage in discussion on general environmental issues turns out to have an opposite conclusion, which is older social media users will be more likely to engage in discussion on general environmental issues.

For the indicators representing environmental awareness of social media users, all the predictors about the familiarity with foreign environmental incidents are not significant. It is easy to understand that Chinese people are not so familiar with foreign environmental events. The mean of the familiarity with the 4 chosen events is below 1.5, which is one of the reasons why these indicators are not significant. Besides, event like the book of Silent Spring is published in the 1970s, which is prior to the birth of most Chinese social media users. Both of the two reasons offer good explanations for the non-significance.

When looking at the indicators of familiarity with domestic air pollution events, they are not significant. Since the average awareness of these domestic air pollution events is lower than expected, this may explain why there is no significance in their impacts on the general participation in environmental discussions. The predictors indicating familiarity with local policies on improving the air pollution situations also turns out to be not significant with the general participation. In China, although the government has finally realized and acknowledged the air pollution problem, the reform in regulations and policies is still limited. Further, most of the time, local citizens are not involved in the process of policy making and implementation. The process of decision making on environmental issues is not transparent. All of these reasons may explain the non-significance of the policy indicators.

For predictors representing different usage frequency of different social media, the usage frequency of Weibo and Douban are not significant. However, the predictors of

frequency of different usage types of social media have some significance both for the partial model and the overall model. Among the predictors of frequency of different usage types of social media, the frequency of post becomes a significant predictor. It is corresponding to the different characteristics of usage types. People will find it easy to read and click on environmental issues, but only when they start to give feedback on other's ideas or express their own ideas, they are participating at an interactive level, with potential for active civic environmental engagement. So the online activity of posting their own ideas shows their concerns on environmental issues and their willingness to do something to help solve the environmental problems. As predicted, the predictor of mobile apps knowledge become significant, shows evidence that with the development of apps, more people tend to participate in general environmental discussions. The development of apps provides more instant information about air quality news and air quality index readings for users to check. The users can be aware of the latest air quality information and take protections themselves.

When analyzing the impact of prior volunteer/member experience, it proves to be significant. With the experience of being a volunteer or a member, one can be trained with environmental knowledge and awareness. Those people tend to know better about how to get better resources for participating in environmental issues.

Table 4.6 Model B. Predictors of frequency of online participation in air quality issues

Online participation model	B1			B2			B3			B4			B5		
	beta	t	Sig.	beta	t	Sig.	beta	t	Sig.	beta	t	Sig.	beta	t	Sig.
gender	-.139	-2.467	**.014***	-.119	-2.071	**.039***	-.101	-1.772	**.077#**	-.042	-.822	.412	-.046	-.894	.372
Age	.085	1.428	.154	.066	1.114	.266	.053	.887	.376	.082	1.528	.128	.083	1.552	.122
Education background	-.023	-.402	.688	-.047	-.832	.406	-.046	-.831	.406	-.028	-.564	.573	-.025	-.495	.621
Income	.025	.433	.666	.002	.040	.968	.016	.277	.782	-.002	-.029	.977	-.001	-.014	.989
film by Al Gore				.052	.798	.425	.065	1.024	.307	.027	.469	.640	.023	.399	.690
anti-nuclear JPN				.043	.675	.500	.039	.629	.530	.064	1.150	.251	.066	1.178	.240
car free UK				-.058	-.904	.367	-.059	-.934	.351	-.059	-1.048	.296	-.059	-1.051	.294
silent spring				.133	2.144	**.033***	.165	2.686	**.008****	.130	2.363	**.019***	.125	2.260	**.025***
Kunming PX				.106	1.629	.104	.093	1.452	.148	.064	1.108	.269	.065	1.133	.258
straw burning Chengdu				.042	.559	.576	.053	.727	.468	.006	.095	.924	.008	.124	.902
coal burning Pingshuo				.104	1.178	.240	.100	1.153	.250	.012	.148	.883	.010	.128	.898
power plant humeng				.062	.819	.414	.047	.636	.525	.046	.683	.495	.042	.627	.531
Increase the usage of public transportation				.057	.703	.483	.035	.440	.660	.012	.175	.861	.016	.229	.819
Increase taxi fuel usage of CNG				-.080	-1.066	.287	-.101	-1.356	.176	-.041	-.618	.537	-.039	-.584	.559
Decrease the usage of coal by 5% by 2013				-.087	-1.097	.274	-.071	-.909	.364	-.085	-1.217	.224	-.090	-1.291	.198
weibo							.203	3.761	**.000*****	.016	.310	.756	.015	.293	.770
douban							-.055	-.975	.330	-.026	-.515	.607	-.028	-.550	.583
read										.148	2.154	**.032***	.148	2.165	**.031***
click										-.007	-.100	.920	-.011	-.160	.873
comment										.231	3.425	**.001*****	.233	3.453	**.001*****
post										.194	3.177	**.002****	.191	3.134	**.002****
app knowledge										.086	1.669	**.096#**	.086	1.677	**.095****
volunteer experience													.047	.963	.336
R-square	.019			.079			.117			.298			.297		
Sig.	**.042**			**.000**			**.000**			**.000**			**.000**		

Significance level: ***=.001 **=.01 *=.05 #=.10

The overall Model B (see Table 4.6) examining the frequency of online participation, has an overall F statistics of 6.854, which is significant under the significant level of 0.05. All four partial models (Model B1, B2, B3 and B4) are significant. The adjusted R-square when only entering the demographic indicators is 0.019. After entering the indicators of environmental awareness, the adjusted R-square increased to 0.079. The adjusted R-square of Model B3 continued to increase with the entry of Weibo and Douban use to 0.114 and the adjusted R-square of Model B4 becomes the highest among all the models in the set of Model B. It has a value of 0.298, with the entry of frequency of different types of social media use. The adjust R-square of the overall model is 0.297.

Gender and income is significant in Model B1. And gender continues to be significant in Model B2 under the significant level of 0.05 and in Model B3 under the significant level of 0.1. However, in the model of B4 and B5, it is not significant, which showed the effects of other indicators in the overall model. Because of the negative coefficient of gender, in China, male social media users are more likely to participate in online discussion about air quality issues, which is different from what is hypothesized. Based on the finding of Model B1, it is supported that social media users with higher income are more likely to participate in online discussion about air quality issues in China.

In the groups of indicators representing the awareness with foreign events, Rachel Carson's "Silent Spring" turns out to be a significant indicator of the frequency of online participation for all four models (Model B2, B3, B4 and B5). "Silent Spring" deals with the negative impacts of environmental contaminations on the human body. In the case of air

pollution, it also deals with the human health problems. Knowledge about “Silent spring” may give expert knowledge of environmental pollutions and the practice of environment movements, which can serve as an important message to be spread online to raise people’s awareness. That might be the reason why it stood out to be significant.

For the group of indicators about awareness of domestic air pollution events, none of them were significant for all the models under Model B. There is no significant indicator in the group of local policy on air pollution either. Different from the foreign environmental events which are introduced and spread mostly online through other traditional communication sources like TV, people get environmental information about domestic events and local policies through all kinds of communication sources including traditional ones. People can discuss air quality issues in their work place, people to people or other traditional methods. That might explain why the familiarity with domestic environmental events and local policies don’t indicate the frequency of online participation in air quality issues.

The indicators about the different usage frequency of Weibo turns out to be significant only in Model B3. But three indicators about the frequency of different usage types of social media (read, comment and post) are significant for the two models which included them (Model B4 and B5) to predict the frequency of online participation in air quality issues. The different results of different indicating groups of social media usage shows that the frequency of different usage types of social media is more important than usage frequency of different social media when we try to analyze the frequency of online participation. For online participation, all the social media sites are important platforms for discussion and information spreading, however, different usage types seems to influence the

engagement and interactive levels towards a collective goal. So it is vital for the frequency of online participation. The reason why only the frequency of click was not significant may be that a lot of people are used to click on a link without finally reading the content of it. In this situation, reading, commenting, posting and forwarding show a higher level of engagement in online environmental participation. The knowledge of apps also turns to be a significant predictor for online participation in Model B4 and B5 under the significant level of 0.1.

It is interesting to see the volunteer/member experiences with environmental groups is not significant for predicting the frequency of online discussion. There might be a gap between online participation and offline participation in air quality issues in China. The failure to prove the hypothesis that social media users with the experience as a volunteer/member of environmental groups could be an interesting question to be explored in the future.

Table 4.7 Model C. Predictors of frequency of offline participation in air quality

Offline participation model	C1			C2			C3			C4			C5		
	beta	t	Sig.	beta	t	Sig.	beta	t	Sig.	beta	t	Sig.	beta	t	Sig.
gender	-.007	-.131	.896	.022	.374	.709	.039	.653	.514	.067	1.133	.258	.053	.896	.371
Age	-.042	-.694	.488	-.057	-.938	.349	-.075	-1.205	.229	-.066	-1.066	.287	-.061	-.998	.319
Education background	-.102	-1.768	**.078#**	-.115	-1.956	**.051***	-.111	-1.895	**.059#**	-.093	-1.607	.109	-.080	-1.401	.162
income	.102	1.737	**.083#**	.081	1.347	.179	.093	1.544	.124	.097	1.625	.105	.100	1.706	**.089#**
film by Al Gore				.048	.711	.478	.061	.903	.367	.037	.552	.581	.022	.330	.741
anti-nuclear JPN				.046	.707	.480	.046	.706	.481	.056	.866	.387	.062	.978	.329
car free UK				.085	1.283	.200	.085	1.279	.202	.085	1.306	.193	.085	1.320	.188
silent spring				.071	1.102	.271	.086	1.334	.183	.063	.995	.321	.044	.695	.488
Kunming PX				-.040	-.588	.557	-.041	-.608	.543	-.049	-.732	.465	-.043	-.650	.516
straw burning Chengdu				.108	1.382	.168	.109	1.394	.164	.093	1.210	.227	.100	1.322	.187
coal burning Pingshuo				-.081	-.872	.384	-.081	-.869	.386	-.125	-1.348	.179	-.131	-1.438	.151
power plant humeng				.047	.589	.557	.042	.528	.598	.024	.301	.764	.010	.126	.900
Increase the usage of public transportation				-.043	-.517	.605	-.056	-.663	.508	-.061	-.739	.461	-.046	-.570	.569
Increase taxi fuel usage of CNG				-.038	-.490	.624	-.059	-.750	.454	-.024	-.314	.754	-.016	-.212	.832
Decrease the usage of coal by 5% by 2013				.078	.951	.343	.087	1.062	.289	.083	1.020	.309	.062	.775	.439
weibo							.102	1.779	**.076#**	.011	.177	.859	.008	.134	.893
douban							-.076	-1.287	.199	-.070	-1.190	.235	-.076	-1.326	.186
read										.135	1.710	**.088#**	.139	1.779	**.076#**
click										.052	.645	.519	.036	.446	.656
comment										.064	.805	.421	.071	.915	.361
post										.080	1.134	.258	.071	1.018	.309
app knowledge										-.047	-.800	.424	-.046	-.786	.433
volunteer experience													.180	3.258	**.001***
R-square		.008			.014			.024			.066			.095	
Sig.		.163			.196			.113			**.005**			**.000**	

Significance level: ***=.001 **=.01 *=.05 #=.10

Model C (see Table 4.7) has an overall F statistics of 2.449, which was significant for the whole model. The adjusted R-square for Model C1, which only included the demographic indicators is 0.008. The adjusted R-square increases to 0.014 in Model C2 with the entry of environmental awareness and continues to increase to 0.024 in Model C3 with the entry of frequency of Weibo and Douban use. Different from the first three partial models which don't have a significant F statistics, Model C4 has an adjusted R-square of 0.066 and a significant F statistics of 2.012 with the entry of different types of social media use.

The factor of demographics became significant in this model. Educational background and income turns out to be significant under the significant level of 0.1 in Model C1. Educational background continues to be significant in Model C2 under the significant of 0.05. In Model C3, it is significant under the significant level of 0.1. However, in Model C4 and C5, it is not significant anymore. But the indicator of income happens to be significant for Model C5. This change showed the interference of the other indicators to the impacts of demographics in the overall model.

Among all the indicators of environmental awareness, the indicators of foreign environmental events are not significant for all the models. It is the same situation that when analyzing the significance of the groups of indicators representing domestic air pollution events and local policies, they turned about to be not-significant. This showed the gap between environmental awareness and environmental activism. Although the familiarity with environmental issues may increase the probability of action, there are other requirements which are vital for civic engagement to occur around air quality issues in China.

The frequency of Weibo use is significant in Model C3, however, it is not significant in Model C4 and C5. Compared to that, the frequency of read is significant both in Model C4 and C5 under the significant level of 0.1. This finding shows that, since the data were collected via Weibo and Douban, it might have bias. Based on that, it is not so important which social media site has been used, but what online activities via social media sites are more effective in predicting the offline participation in air quality issues.

The indicator of app knowledge is not significant. The people who installed apps on air quality issues are not necessarily the people who will attend offline environmental programs to work towards a collective goal. Some people may have the sense of "Not in my Backyard" strategy and don't share a collective environmental goal at a broader level.

Volunteer/member experience continued to be significant in this model under the significant level of 0.001. It is obvious that as being a volunteer/member of environmental groups will surely bring more chances and opportunities for offline participation. It also seems to be a responsibility for these people to attend offline environmental programs.

Comparison of the three participatory models

It is interesting to compare the three different models. They have the same independent variables, the groups of indicators are entered with the same block order; however, their significance varies by the different dependent variables. For the same dependent variables, the indicators also have different significant levels based on different partial models following the entry order of the blocks. The mean of frequency of general environmental discussion is 2.18, while the mean of frequency of online participation is 1.57 and the mean of frequency of offline participation is 0.64. The offline participation is the

hardest one for most of the people and the people who participated in offline environmental programs don't necessarily attend online discussions. There still remained a gap between online participation and offline attendance.

Since the three participatory models have the same independent variables, it is important to compare the significance of each independent variable across these three models to conclude the similarity and differences. When comparing the significances of different indicators in the model, there are differences in the significant groups of indicators as well as specific significant indicators.

When comparing the significant impacts of different demographic indicators, there are difference between different models. Age and income are significant in predicting the participation in general discussion. Gender is significant for predicting the participation in online discussion. Education and income show significant impacts on the participation in offline air quality programs.

The levels of awareness of foreign environmental events seem to be not significant for frequency of general participation and offline participation, but it is significant for online participation, especially the indictor of Silent Spring by Richard Carson. Different from what is expected, the familiarity of domestic environmental issues stood out to be not significant for all three participation model. This may due to the limited access on the information of environmental incidents in China and the problem of transparency in the implementation of policy also pose challenge for people's awareness of local policies.

To further the discussion of how the different platforms of social media use correlate with environmental engagement differently, the comparison of the partial models based on the three overall environmental engagements provided evidence about the impacts of Weibo

and Douban use. However, the impacts of different platforms of social media use are less than the impacts of different usage types of social media. When examining the indicators of usage frequencies of Weibo and Douban, there is certain kind of significance for the partial models for the three participatory activities. However, when the usage frequencies of Weibo and Douban are analyzed in the overall model of the three participatory activities, they are not significant at all.

Different from that, the indicators of frequency of different usage types of social media are significant for all the three overall models. The indicator of posting and forwarding is significant for the overall general participation model; the indicators of commenting and posting and forwarding as well as reading are significant for overall online participation frequency; but there is no significant indicator under the same group for predicting the overall offline participation frequency. Since the indicator of commenting and posting and forwarding represented an interactive level of participation, they are significant indicators for both general participation and online participation. The frequency of reading was particularly significant for online participation, which is often the required starting step for online participation.

App knowledge is significant for predicting both general environmental discussion frequency and online participation frequency, however, it is not significant for offline participation. On the contrary, Volunteer experience is only significant for the offline participation model. This finding shows the different requirement of preparing for online discussion and offline participation.

Conclusion

In conclusion, this chapter has presented the perception that air pollution is currently the most serious environmental problems in cities like Beijing in China now. The introduction of different frequencies of participation in different online or offline environmental activities gave us an idea about the levels of environmental activism in Beijing in summer 2013. The description of various online environmental activities through different social media platforms showed the newest trend for environmental communication and education programs online. It also suggests new opportunities for organizing offline environmental programs. The comparisons of the three participatory models showed the similarity and difference in the engagement levels of the three participatory methods. It also pointed out the significant predicators of the engagement frequency for these three participatory methods. The next chapter will discuss the implications of the findings in this chapter.

CHAPTER 5. CONCLUSION

In this section I will conclude the findings of this research by relating it back to the literature and to explain which hypotheses were supported or not and the online civic engagement theory are in analyzing the civic engagement of Beijing residents on air quality issues with the help of social media and mobile apps as the latest communication technology.

This analysis has used the context of modernization and industrialization to explain the formation of air quality problems in big cities like Beijing in China. This context reveals the pathways and relationships between the manufacturing sectors and the state that led to air pollution problem. The production and consumption processes were the mechanisms leading to air pollution which was long neglected during the process of state-lead industrialization. The health hazard resulted from industrialization raised the level of environment discourse in China. To counter the negative environmental impacts of production, the state came up with environmental-related policies and laws, and there were growing civic organizations whose members realized the air pollution problems and want to improve the situation. Some have become advocacy actors to make demands and persuade the manufacturing industries to develop a sustainable plan of energy use and waste emission. Media especially social has been used for producing and circulating greenspeak in China.

As an instrument employed to raise people's awareness of environmental issues as well as to express people's environmental demands to the government, social media and mobile apps have served as the communication and education instrument for environmental NGOs and citizens. Historically in China, people were not used to making their demands on public issues like the environmental issues and were restricted to discussing them in a

constrained public sphere. The latest development of social media and mobile apps has potential to create new public spaces for distributing and exchanging information and ideas on environmental issues efficiently. With the help of social media, air quality issues became widely recognized as the serious environmental issues in China.

In the situation of China, the state planed and encouraged expanding manufacturing development. This showed the structure of industrialization is not linear model, but has an unsustainable complexity. Once the economic growth stopped, the relationships and alliances between the state, environmental groups, and the citizens changed. This complexity posed challenges for environmental movements in China.

Summary of Hypotheses

Based on this understanding of the affinity of social media users and their awareness of the severity of air pollution problems, a set of hypothesis was developed:

H1: Beijing social media users will more likely rate air quality problem as the most serious environmental problem in Beijing.

This hypothesis was proved to be true according to the large proportion of surveyed Beijing social media users who perceived air quality as the most serious environmental problems in Beijing. Although there were no comparative statistics about the recognition of air quality as the most serious environmental problems in China, the findings showed that more than half of Beijing social media users view air quality as a severe environmental problems in Beijing. Besides, these Beijing social media users also rated air quality problem as the most serious environmental problem in their neighborhood as well as in the whole

Chinese society. Based on this understanding, the impact of social media usage to establish environmental discourse and participate in environmental issues were examined by Hypothesis 2.

H2: Beijing social media users will use social medial as a public sphere to initiate environmental discussion and activities.

The result of the findings proved hypothesis 2 with the high frequency of social media users participated in online discussions. Analyzing the engagement levels of the environmental activism, the findings showed the trend that more than 80% of Beijing social media users had engaged others to discuss about the environmental issues several times a year and also had participated in different kinds of environment-related activities in the year 2012. Although there was a gap between talking about environmental issues and willingness to act collectively on these concerns and a gap between online participation and offline attendance, this finding still showed the potential of the growing engagement and participatory levels of environmental activism in China, which is a prerequisite of large-scale environmental movements.

Hypothesis 3a:

3a1Younger social media users will be more likely to willing to engage in discussion on general environmental issues.

3a2Higher income social media users will be likely to willing to engage in discussion on general environmental issues.

3a3The higher the education of a social media user, the more they are likely to engage in discussion on general environmental issues.

3a4 Female social media users will be more likely than male social media users to engage in discussion on general environmental issues.

3a5 Social media users with higher levels of environmental awareness will be likely to willing to engage in discussion on general environmental issues.

This set of hypotheses 3a was designed to examine the affinity relationship between the demographics of social media users and their frequency of environmental engagement using regression Model A. According to partial models and the overall model, age and income are significant in predicting the participation in general discussion. The group of indicators representing environmental awareness are not significant at all. The frequencies of Weibo and Douban use are not significant, however, the frequency of online activities via social media is significant. Among these online activities, the frequency of posting and forwarding are particularly significant in predicting the frequency of general discussion in environmental issues.

Hypothesis 3b:

3b1Younger social media users will be more likely to participate in online discussion on air quality issue.

3b2Higher income social media users will be likely to participate in online discussions on air quality issue.

3b3The higher the education of a social media user, the more they are likely to participate in online discussion on air quality issue.

3b4 Female social media users will be more likely than male social media users to participate in online discussion on air quality issue

3b5 Higher levels of environmental awareness social media users will be likely to participate in online discussion on air quality issue.

Similar to the set of hypotheses 3a, this set of hypotheses 3b was partly supported by the regression model Model B in this research. Gender is significant for predicting the participation in online environmental discussions. The hypothesis that higher levels of environmental awareness social media users will be likely to participate in online discussion on air quality issue was partly proved. Predictors representing the awareness of the important global environmental incidents proved to be significant predictors to estimate the online participation frequency of social media users, while indicators representing awareness of domestic air pollution incidents and familiarity with the local air quality policies were not significant in predicting frequency of participation in online environmental discussion.

Hypothesis 3c:

3c1Younger social media users will be more likely to willing to participate in offline environmental programs about air quality.

3c2Higher income social media users will be likely to willing to participate in offline environmental programs about air quality.

3c3The higher the education of a social media user, the more they are likely to participate in offline environmental programs about air quality.

3c4 Female social media users will be more likely than male social media users to participate in offline environmental programs about air quality.

3c5 Higher levels of environmental awareness social media users will be likely to willing to participate in offline environmental programs about air quality.

In the set of regression Model C, among all the demographic variables, Education and income show significant impacts on the participation in offline air quality programs. When

examining indicators of environmental awareness, there is no indicator of environmental awareness that is significant for predicting the participation in offline air quality programs. Hypothesis 3d: Different platforms of social media use with different types of usage would correlate with environmental engagement differently.

When considering the impacts of the social media usage habits on the frequency of engagement in environmental issues, different usage types of social media and different platforms of social media sites were two important groups of indicators. Although the significance of Weibo and Douban use is proved by partial regression models for the three types of environmental participation, the frequencies of these two social media use is not significant for the overall models.

When talked about the indicators of usage frequency of different social media sites, they were significant for all the overall models predicting the frequency of general participation and online discussion. The activities of commenting, posting and forwarding are especially useful as predicators.

Implications

Although China has undergone the process of industrialization for a long time, there was little study to demonstrate the formation of air quality problems in China. With the supporting statistics and background analysis in the literature review part of this research, the health and environmental impacts of industrializationon air quality issues were revealed. As a response to counter production negative impacts, important stakeholders like local citizens, environmental groups and the state have been connected together with different roles. Based on the increasing environmental discourse in China, civil society and environmental groups have engaged into environmental activities at an increasing level with the help of social

media and mobile apps. The usage of social media and mobile apps helps the distribution and exchange of environmental information, which also helps increase the environmental awareness level in the whole society.

Since there was little former study on the discussion and discourse of air pollution problems on social media platforms in China, this study provided some perspectives to discover the role of social media and mobile apps as tools of environmental education and communication. Social media usage was shown to have a relationship with the levels of people's awareness and environmental engagements. The comparison of the online/offline engagements in air quality issues showed the limited Chinese public sphere of offline environmental discussion and a growing online community for environmental education and communication. Furthermore, the comparison of the impact of different social platforms also tested the affinity relationship of different demographics characteristics of platforms with different frequency of engagement in air quality issues. Different social media platforms attracted social users with different demographics information, and the information which was exchanged and distributed on different sites was also different. To make full use of different social media platforms, it was really important to set up communication and organizational strategies which fit in with the characteristics of potential users. The existence of different social media sites created more opportunities to raise people's awareness and get them involved into environmental related issues. Moreover, comparing to the significant levels of use of different social media sites, the frequencies of different types of social media use are more significant, especially the activities of commenting, posting and forwarding, which show the interactions between social media users towards a collective goal. These

kinds of online interactions could be encouraged in the future and environmental groups could develop some appropriate communication strategies based on that. By utilizing the different functioning of different social media platforms through different online activities, social media users were able to participate into environmental issues at different levels of engagement.

Research on public participation suggests that it is “organized processes adopted by elected officials, government agencies, or other public or private sector organizations to engage the public in environmental assessment, planning, decision making, management, monitoring, and evaluation”(Dietz, 2007). In China, the public participation process is a little different from the western countries. Although the state has made efforts on revising environmental policies to involve people into environmental assessment, planning, decision making, management, monitoring, and evaluation, the access to these environmental activities are limited in the public sphere. With the increasing environmental discourse in the Chinese society, social media and mobile apps provide new platforms for citizens to participate into environmental assessment, planning, decision making, management, monitoring, and evaluation online. The new greenspeak sphere, which was created online, mobilizes the resources and creates opportunities to discuss environmental issues with the state using different social capitals offline on a national even global scale. This research provided some insights on the online civic engagement theories in China. By examining the role of social media in developing greenspeak in China, the scope of public participation has been enlarged to the online community.

In Dietz's article, he illustrated the design principle of public participation, which can also be used as the standards to examine the current online environmental engagement events in China. Relevant principles are: the process must be 1) inclusive, 2) collaborative in problem formulation and process design, 3) transparent, 4) based on good-faith communication (Dietz, 2007). With the help of social media, local residents who are conscious about environmental issues can be involved in the environmental discourse online and collaborate with other citizens or groups for problem formation and process design. When comparing the environmental information from different sources online, the environmental information could be more transparent. By promoting social media as the important drive for exchanging environmental information online and organizing offline activities, it connected the participation of online environmental discourse and offline environmental activities.

This research also has some implications on methodology, especially the data collection designation and process. The way the data were collected for this research was different from the traditional online surveys. I adopted a new sampling strategy to use social media as the sampling framework to reach and contact the study population by social media messages. Demographics information revealed on social media sites provided the sampling frame of study population from the appointed geographical area. This strategy showed the potential of this new data collection method. In this research, the innovative way of using social media as the distributive channels made this research accessible to its study populations. The response rate of 19.1% to the messages sent through social media sites showing the evidence that the messages sent via social media can be served as an alternative

of email for these social media users. However, the response rate still needs to be improved in the future research design. In the research by Watt et al. (2002), the overall response rate for online surveys was 32.6%. Compared to the normal online survey, the response rate we got from this social media survey was lower. The forwarding and distributing function of the social media help spread the invitation letters with related pictures to attract the study population's attention. The message function of the social media sites made it possible for the researchers and the sample population to establish trust and exchange ideas about the survey. This whole process of data collection proved to be efficient and operational.

Limitations and future research

This research was designed to examine the environmental activism of the social media users. Although social media users shared some demographics characteristics, it is definitely different from the general demographics of the local Beijing residents. Although I have compared the demographics of the social media users who participated in this survey and the statistics of the Beijing residents, the representativeness of the study was limited. It might be more comprehensive if there were any future research to investigate the environmental awareness and environmental activism of the Beijing residents and make comparisons with the findings from this research.

Since the research collected data using a convenient sampling in the social media websites, the representativeness of the sample population was also a problem. The active social media users on Weibo and Douban may share some particular demographic characteristics, which may create bias for the study population. A large-scale survey to involve the participation of more Beijing social media users based on random sampling

would be a good improvement of this research design and allow generalization to larger population.

This study only employed the quantitative data to show the development of civic engagement in environmental issues especially air pollution in China. Since a lot of environmental NGOs also played a significant role to work with the state and manufacturing sectors to make environmental demands as well as environmental education and communication for raising the environmental awareness in the whole society, it would be useful to include more information and qualitative data about the efforts made by these environmental groups as well as their experience of using social media methods to promote and organize environmental activities.

There were a number of findings in this research that were different from what was expected like those about demographics indicators. These findings should be investigated more deeply in future research to examine whether there are demographic impacts on civic engagement. The difference between the three regression models also can be tested with more indicators under each group of predictors to measure the theoretical concepts.

There was a gap between environmental awareness and environmental participation, which was reflected on the different participation frequency of the online environmental discussion and offline environmental activities, more research can be done to examine the role of social media on how to make up the gap and how to improve the levels of civic engagement actives. It might be helpful to do some longitudinal study to show the development of civic engagement based on the development of social media usage in the whole society. Besides, since there is emerging civic engagement activities on environmental

issues in China, it is interesting to find the difference of people who participated at different engagement levels and think about strategies to guide and encourage citizens to participate in a more interactive level.

Appendix A: survey instrument

Screens for the questionnaire of the survey on Qualtrics 2013 June11

Title: The civic engagement in environmental issues in Beijing, China

Qualifying question for the survey:

Are you a resident of Beijing, China?

1. Yes (Please continue to take the survey)

2. No (This survey has ended and thanks for your interest)

Screen 1

1) Environment. *Please circle the best answer to the questions unless other instruction is given.*

1. In your opinion, what is the most serious environmental problem in China?

1. Air pollution 2. Water pollution 3. Soil pollution 4. Radioactive contamination 5. Noise pollution 6.Others _____(Please specify)

2. In your opinion, what is the most serious environmental problem in Beijing?

1. Air pollution 2. Water pollution 3. Soil pollution 4. Radioactive contamination 5. Noise pollution 6. Others _____(Please specify)

3. In your opinion, what is the environmental problem that affects <u>you</u> the most?

1. Air pollution 2. Water pollution 3. Soil pollution 4. Radioactive contamination 5. Noise pollution 6.Others _____(Please specify)

4. What is the date of World Environment Day? ___/___(MM/DD) ☐ I don't know

Screen 2

5. To what extent are you familiar with the following environmental issues worldwide?

	Don't know	Know little	Know some	Know well	Know all the details
a. The film of An Inconvenient Truth by Al Gore					
b. Anti-nuclear power movement in Japan					
c. Car-free movement in UK					
d. Love Canal in USA					
e. Rachel Carson "Silent Spring"					

Screen 3

6. How do you rate the air quality where you live?

1.Very Poor 2. Poor 3. Fair 4. Good 5. Very good 6. I don't know

7. In the last year, which month was the air quality the worst where you live? (Select one month)

1. January 2. February 3.March 4. April 5. May 6. June 7. July 8. August 9. September 10. October 11. November 12. December 13. I don't know

8. How harmful to human health is a reading of 41 on the PM2.5 indicator?

1. Not harmful 2. Somewhat harmful 3. Harmful 4. Very harmful 5. I don't know

Screen 4

9. To what extent are you familiar with the following air quality issues in China?

Incidents	1. Don't know	2. Know a little	3. Know some	4. Know well	5. Know all details
a. Kunming PX Incident(2013)					
b. Burning of Straw incident in the suburban area of Chengdu(2012)					
c. The pollution of coal burning in Pingshuo(2009)					
d. The pollution of power plant in Humeng(2010)					

Screen 5

10. How much do you know about the following policies and goals on Beijing air pollution issues?

	Don't know	Know little	Know some	Know well	Know all the details
a. The foundation of the Clean Air alliance of China					
b. Increase the usage of public transportation to 46% by 2013 in Beijing					
c. Increase taxi fuel usage of Condensed Natural Gas (CNG) by 2013 in Beijing					
d. Decrease the usage of coal by 5% by 2013 in Beijing					

Screen 6

2) Environment volunteer. *Please circle the best answer to the questions unless other instruction is given.*

11a. Have you ever been a volunteer/member of any environmental groups in Beijing?

1. Yes 2. No (if no, you can skip to Q12)

11b. How many years you have been a member/volunteer with an environmental group in Beijing?

1. Less than 1 year 2. 1 to 3 years 3. 4 to 5 years 4. 6 to 9 years 5.More than 10 years

12. How frequently do you engage others (talk, email, attend meetings, etc) about the environment?

1. Daily 2. Weekly 3.Monthly 4.Several times a year 5. Never

Screen 7

13. In the last year, have you participated in the following activities of any environmental groups? (Circle all the options that apply)

a. Exchanged information about the environmental issues (e.g. told friends about environmental issues, sent-received media messages on ideas and updates about environmental issues)

b. Expressed interests, passions and ideas about the environmental issues (e.g. posted your idea on the online discussion or offline discussion)

c. Worked with others to achieve collective goals about the environmental issues (e,g, worked together with people in the community to make a collective goal about the environmental issues)

d. Made demands on the government about the environmental issues (e.g. published your request and query about environmental issues on the governmental website, letter to editor, written an opinion essay for publication)

e. Made efforts to improve the structure and functioning of the government about the environmental issues (e.g. participated the discussion meeting organized by the government; offered ideas to the government officials about the process of dealing with environmental issues)

f. Made efforts to hold government officials accountable about the environmental issues (e.g. inspected the information published by the government, requested the transparency for the governmental process of dealing with environmental issues)

14. Where do you get the information about the air quality programs run by environmental groups? (Circle all the options that apply)

a. Their official website b. Their social media accounts c. Their newsletters d. News reports from public media e. Face to face by friends f. Face to face at place of work g. Others_____(please specify)

Screen 8

15. In the last year, how often have you participated in online discussions about air quality issues?

1. Daily 2. Weekly 3. Monthly 4. Several times a year 5. Never

16. In the last year, how often have you attended air quality programs offline conducted by environmental groups?

1. Daily 2. Weekly 3. Monthly 4. Several times a year 5. Never

Screen 9

3) Attitude. *Please circle the best answer to the questions*.

17. To what extent do the air quality programs you have participated in-person help solve the problem in your area?

1. Not helpful at all 2. Not very helpful 3. Somewhat helpful 4. Helpful 5. Very helpful 6. I don't know 7. I didn't participate in any air quality programs

18. To what extent do the other environmental programs you have participated in-person help solve the problem in your area?

1. Not helpful at all 2. Not very helpful 3. Somewhat helpful 4. Helpful 5. Very helpful 6. I don't know 7. I didn't participate in any other programs

19a. In general, would you recommend any environmental programs to your friends?

1. Yes 2. No 3. Maybe

19b. If yes, which ones would you recommend?_____

Screen 10

4) Social media and app usage. *Please circle the best answer to the questions unless other instruction is given.*

20. In the last year, which of the following media sources did you get information on air quality issues in China (Click all that apply)? Approximately what percentage did you use each of them (Should add to 100% of time)?

	a. Radio	_____%
	b. News reports on TV	_____%
	c. Newspaper	_____%
	d. Online news from the Chinese website	_____%
	e. Online news from the foreign website	_____%
	f. Social media (e.g. Weibo, RenRen)	_____%
	g. Face to face by friends	_____%
	h. Face to face at place of work	_____%

100 %

Screen 11

21. In the last year, how often did you use the following social media account?

	1.Daily	**2.Weekly**	**3.Monthly**	**4.Several times a year**	**5.Never**	**6.I don't have an account**
a. Weibo (Chinese version of twitter)						
b. Douban (a social media organizing offline activities)						
c. Zhihu(Chinese version of Quora)						
d. Guoke(a social media exchanging science information)						
e. Renren(Chinese version of Facebook)						

22. Are you currently connected with the account of any environmental groups on Weibo (Chinese version of twitter)?

1. Yes 2. No

Screen 12

23. In the last year, how often have you used social media to talk about air quality issues?

e. I don't have a social media account

	1.Daily	2.Weekly	3.Monthly	4.Several times a year	5.Never
a. Read other's post					
b. Click on an external link					
c. Make comments on other's post					
d. Posted (including forwarded) on your account					

Screen 13

24a. Do you know about mobile apps which offer information on air quality condition (e.g. the app of China air quality index)?

1. I don't know 2. I've heard of it 3. I've installed it

24b. If you have installed this kind of app, in the last year how often do you check it?

1. Daily 2.Weekly 3. Monthly 4. Several times a year 5. Never 6. I haven't installed it

24c. Would you recommend this kind of mobile app to other people?

1. Yes 2. No 3. Maybe

Screen 14

5) Demography.

25. Your age is (as of last birthday) _____ Years

26. What is your gender?

1. Male 2. Female

27. What is your highest education background?

1. Less than high school 2. High school 3. Bachelor 4. Master 5. PhD

Screen 15

28. If you are or have been a university student, what is your major area of study?

1. Human Science 2. Social Science 3. Engineering 4. Natural Science 5. Agriculture and life Science 6. Business 7. Art and design 8.Others_____

29. What's your present employment status?

1. Employed or self-employed on a full-time basis

2. Employed or self-employed on a part-time basis

3. Retired

4. Full-time homemaker

5. Student

6. Unemployed

30. Approximately what's your current household income per month?

1. Less than 2,000 RMB 2. 2,000-6,000 RMB 3. 6,000-10,000 RMB 4. 10,000-20,000RMB 5. 20,000-30,000 RMB 6. 30,000-40,000RMB 7. More than 40,000RMB

Screen 16

31. How many years have you lived in Beijing?_____ Years

32. What's the province of your family origin?

1. Beijing, Tianjin, Hebei, Shanxi, Nei Monggu 2. Heilongjiang, Jiling, Liangning 3.Shandong, Jiangsu, Anhui, Shanghai, Zhejiang, Jiangxi, Fujian 4.Heinan, Hubei, Hunan 5. Guangdong, Guangxi, Hainan 6. Xinjiang, Gansu, Ningxia, Qinghai, Shanxi 7. Chongqing, Xichuan, Guizhou, Yunnan, Xizang 8. HongKong, Macao, Taiwan

33. What's your identity on your ID card?

1. From the rural area 2. From the urban area

Thanks for participating in the survey and all the best.

If you want to get the results of the survey, please leave your e-mail here and I will send to you a summary.

Any questions or comments for the survey?

Appendix B: The poster of survey on social media sites

Do YOU care about Beijing's environment?

Invitation to participate in web survey

https://iastatelas.qualtrics.com/SE/?SID=SV_6fbmoTnPZGGd2dL

What are China's environmental problems? Does it seem that environmental problems where you live have become more and more severe?

What can you do about these problems? Are you part of an environmental group or would you like to learn more about what you can do to help our environment?

Connect. What communication technologies would you use to exchange environmental information?

Click on the web survey https://iastatelas.qualtrics.com/SE/?SID=SV_6fbmoTnPZGGd2dL And tell us what you are thinking about air quality and other environmental concerns facing Beijing.

This survey is conducted by Xinlei Ke, a Master student of Sociology at Iowa State University, Iowa (USA). She has a Bachelor degree of sociology from Nanjing University and a long time interest in how people working together can best address environmental issues. The data collected from the survey will be used for her thesis paper which is focused on finding strategies to help environmental groups in China work together to address these difficult problems. From the information collected by the survey, we will be able to better understand the level of civic engagement in environmental programs in Beijing and the role of new communication technologies. Findings from this study will help environmental groups improve how they encourage people to better work together for the environmental good of China.

Residents of Beijing. Please take this survey https://iastatelas.qualtrics.com/SE/?SID=SV_6fbmoTnPZGGd2dL if you live in Beijing or the surrounding area. This survey is quick and easy, taking less than 15 minutes. Information collected from the survey will not include any identifiable personal information and all the information will be used for academic study. Your confidentiality will be ensured.

If you are willing to participate, please click on the following link and log onto the website to fill in the questionnaire. There will be a letter of introduction on that website; please read it carefully before starting the survey. If you start filling out the survey, it means you have already read the poster and letter of introduction and are informed of the survey.

https://iastatelas.qualtrics.com/SE/?SID=SV_6fbmoTnPZGGd2dL

Your participation is really important and needed. I really appreciate your participation and your time. Thanks a lot and all the best.

If you have any questions or comments regarding the survey or you want to get more information about the whole study, please feel free to contact me through e-mail:xinleike@iastate.edu. Your feedback is highly valued. Thanks.

Xinlei Ke

2013.07

Appendix C: Introductory letter to start the on-line survey

Dear Beijing resident，

I really would like to thank you for participating in this survey. It contains 5 sections and focuses on Chinese environmental issues, environmental groups, and new communication technologies. It should take less than 15 minutes.

Please note that all of your responses will be kept completely confidential and all resulting data will only be reported in the aggregate. When you have completed the survey, click the "submit" button. Your consent to participate in this study is implied by your submission of the survey.

Thank you again for your assistance in advance. If you would like more information or have any questions about the survey, please contact me.

Yours sincerely,

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Appendix D: Response rate and frequency analysis of each screen

Screen 1

Statistics

		1. In your opinion, what is the most serious environmental problem in China?	2. In your opinion, what is the most serious environmental problem in Beijing?	3. In your opinion, what is the environmental problem that affects you the most?	4. Do you know what is the date of World Environment Day?
N	Valid	658	657	635	633
	Missing	25	26	48	50
Response rate		0.9634	0.9619	0.9297	0.9268

1. In your opinion, what is the most serious environmental problem in China?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	air pollution	303	44.4	46.0	46.0
	water pollution	262	38.4	39.8	85.9
	soil pollution	45	6.6	6.8	92.7
	radioactive contamination	1	.1	.2	92.9
	noise pollution	6	.9	.9	93.8
	other	41	6.0	6.2	100.0
	Total	658	96.3	100.0	
Missing	System	25	3.7		
Total		683	100.0		

2. In your opinion, what is the most serious environmental problem in Beijing?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	air pollution	606	88.7	92.2	92.2
	water pollution	16	2.3	2.4	94.7
	soil pollution	2	.3	.3	95.0
	radioactive contamination	1	.1	.2	95.1
	noise pollution	8	1.2	1.2	96.3
	other	24	3.5	3.7	100.0
	Total	657	96.2	100.0	
Missing	System	26	3.8		
Total		683	100.0		

3. In your opinion, what is the environmental problem that affects you the most?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	air pollution	543	79.5	85.5	85.5
	water pollution	37	5.4	5.8	91.3
	soil pollution	6	.9	.9	92.3
	radioactive contamination	4	.6	.6	92.9
	noise pollution	34	5.0	5.4	98.3
	other	11	1.6	1.7	100.0
	Total	635	93.0	100.0	
Missing	System	48	7.0		
Total		683	100.0		

4. Do you know what is the date of World Environment Day?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	158	23.1	25.0	25.0
	no	475	69.5	75.0	100.0
	Total	633	92.7	100.0	
Missing	System	50	7.3		
Total		683	100.0		

Among the people who answered yes, 149 people provided the right date, which covered 23.54% of all the people who answered this question. Some of the people who answered yes with the wrong date get confused of the date of world environment day and the earth day.

Screen 2

5. To what extent are you familiar with the following environmental issues worldwide?

Statistics

		5.a. The film of An Inconvenient Truth by Al Gore	5.b. Anti-nuclear power movement in Japan	5.c. Car-free movement in UK	5.d. Love Canal in USA?	5.e. Rachel Carson "Silent Spring"
N	Valid	614	616	611	611	612
	Missing	69	67	72	72	71
Response rate		0.8990	0.9019	0.8946	0.8946	0.8960

5.a. The film of An Inconvenient Truth by Al Gore

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	321	47.0	52.3	52.3
	know little	84	12.3	13.7	66.0
	know some	100	14.6	16.3	82.2
	know well	52	7.6	8.5	90.7
	know all the details	57	8.3	9.3	100.0
	Total	614	89.9	100.0	
Missing	System	69	10.1		
Total		683	100.0		

5.b. Anti-nuclear power movement in Japan

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	134	19.6	21.8	21.8
	know little	87	12.7	14.1	35.9
	know some	233	34.1	37.8	73.7
	know well	127	18.6	20.6	94.3
	know all the details	35	5.1	5.7	100.0
	Total	616	90.2	100.0	
Missing	System	67	9.8		
Total		683	100.0		

5.c. Car-free movement in UK

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	217	31.8	35.5	35.5
	know little	139	20.4	22.7	58.3
	know some	167	24.5	27.3	85.6
	know well	75	11.0	12.3	97.9
	know all the details	13	1.9	2.1	100.0
	Total	611	89.5	100.0	
Missing	System	72	10.5		
Total		683	100.0		

5.d. Love Canal in USA?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	398	58.3	65.1	65.1
	know little	132	19.3	21.6	86.7
	know some	53	7.8	8.7	95.4
	know well	22	3.2	3.6	99.0
	know all the details	6	.9	1.0	100.0
	Total	611	89.5	100.0	
Missing	System	72	10.5		
Total		683	100.0		

5.e. Rachel Carson "Silent Spring"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	319	46.7	52.1	52.1
	know little	114	16.7	18.6	70.8
	know some	72	10.5	11.8	82.5
	know well	54	7.9	8.8	91.3
	know all the details	53	7.8	8.7	100.0
	Total	612	89.6	100.0	
Missing	System	71	10.4		
Total		683	100.0		

Screen 3

Statistics

		6. How do you rate the air quality where you live?	7. In the last year, which month was the air quality the worst where you live?	8. How harmful to human health is a reading of 41 on the PM2.5 indicator?
N	Valid	613	611	611
	Missing	70	72	72
Response rate		0.8975	0.8946	0.8946

6. How do you rate the air quality where you live?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	very poor	316	46.3	51.5	51.5
	poor	242	35.4	39.5	91.0
	fair	37	5.4	6.0	97.1
	good	16	2.3	2.6	99.7
	very good	1	.1	.2	99.8
	don't know	1	.1	.2	100.0
	Total	613	89.8	100.0	
Missing	System	70	10.2		
Total		683	100.0		

7. In the last year, which month was the air quality the worst where you live?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Jan	118	17.3	19.3	19.3
	April	65	9.5	10.6	30.0
	July	15	2.2	2.5	32.4
	October	8	1.2	1.3	33.7
	don't know	105	15.4	17.2	50.9
	February	58	8.5	9.5	60.4
	May	36	5.3	5.9	66.3
	August	4	.6	.7	66.9
	November	23	3.4	3.8	70.7
	March	74	10.8	12.1	82.8
	June	39	5.7	6.4	89.2
	September	3	.4	.5	89.7
	December	63	9.2	10.3	100.0
	Total	611	89.5	100.0	
Missing	System	72	10.5		
Total		683	100.0		

8. How harmful to human health is a reading of 41 on the PM2.5 indicator?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not harmful	110	16.1	18.0	18.0
	somewhat harmful	162	23.7	26.5	44.5
	harmful	102	14.9	16.7	61.2
	very harmful	135	19.8	22.1	83.3
	don't know	102	14.9	16.7	100.0
	Total	611	89.5	100.0	
Missing	System	72	10.5		
Total		683	100.0		

Screen 4

9. To what extent are you familiar with the following air quality issues in China?

Statistics

		9.a. Kunming PX Incident (2013)	9.b. Burning of Straw incident in the suburban area of Chengdu (2012)	9.c. The pollution of coal burning in Pingshuo (2009)	9.d. The pollution of power plant in Humeng (2010)
N	Valid	604	605	603	600
	Missing	79	78	80	83
Response rate		0.8843	0.8858	0.8829	0.8785

9.a. Kunming PX Incident (2013)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	108	15.8	17.9	17.9
	know little	55	8.1	9.1	27.0
	know some	135	19.8	22.4	49.3
	know well	191	28.0	31.6	81.0
	know all the details	115	16.8	19.0	100.0
	Total	604	88.4	100.0	
Missing	System	79	11.6		
Total		683	100.0		

9.b. Burning of Straw incident in the suburban area of Chengdu (2012)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	131	19.2	21.7	21.7
	know little	112	16.4	18.5	40.2
	know some	168	24.6	27.8	67.9
	know well	141	20.6	23.3	91.2
	know all the details	53	7.8	8.8	100.0
	Total	605	88.6	100.0	
Missing	System	78	11.4		
Total		683	100.0		

9.c. The pollution of coal burning in Pingshuo (2009)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	181	26.5	30.0	30.0
	know little	147	21.5	24.4	54.4
	know some	146	21.4	24.2	78.6
	know well	93	13.6	15.4	94.0
	know all the details	36	5.3	6.0	100.0
	Total	603	88.3	100.0	
Missing	System	80	11.7		
Total		683	100.0		

9.d. The pollution of power plant in Humeng (2010)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	224	32.8	37.3	37.3
	know little	170	24.9	28.3	65.7
	know some	127	18.6	21.2	86.8
	know well	57	8.3	9.5	96.3
	know all the details	22	3.2	3.7	100.0
	Total	600	87.8	100.0	
Missing	System	83	12.2		
Total		683	100.0		

Screen 5

10. How much do you know about the following policies and goals on Beijing air pollution issues?

Statistics

		10.a. The foundation of the Clean Air alliance of China	10.b. Increase the usage of public transportation to 46% by 2013 in Beijing	10.c. Increase taxi fuel usage of Condensed Natural Gas (CNG) by 2013 in Beijing	10.d. Decrease the usage of coal by 5% by 2013 in Beijing
N	Valid	587	588	586	588
	Missing	96	95	97	95
Response rate		0.8594	0.8609	0.8580	0.8609

10.a. The foundation of the Clean Air alliance of China

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	373	54.6	63.5	63.5
	know little	168	24.6	28.6	92.2
	know some	23	3.4	3.9	96.1
	know well	16	2.3	2.7	98.8
	know all the details	7	1.0	1.2	100.0
	Total	587	85.9	100.0	
Missing	System	96	14.1		
Total		683	100.0		

10.b. Increase the usage of public transportation to 46% by 2013 in Beijing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	180	26.4	30.6	30.6
	know little	123	18.0	20.9	51.5
	know some	157	23.0	26.7	78.2
	know well	90	13.2	15.3	93.5
	know all the details	38	5.6	6.5	100.0
	Total	588	86.1	100.0	
Missing	System	95	13.9		
Total		683	100.0		

10.c. Increase taxi fuel usage of Condensed Natural Gas (CNG) by 2013 in Beijing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	164	24.0	28.0	28.0
	know little	135	19.8	23.0	51.0
	know some	151	22.1	25.8	76.8
	know well	94	13.8	16.0	92.8
	know all the details	42	6.1	7.2	100.0
	Total	586	85.8	100.0	
Missing	System	97	14.2		
Total		683	100.0		

10.d. Decrease the usage of coal by 5% by 2013 in Beijing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	198	29.0	33.7	33.7
	know little	157	23.0	26.7	60.4
	know some	130	19.0	22.1	82.5
	know well	75	11.0	12.8	95.2
	know all the details	28	4.1	4.8	100.0
	Total	588	86.1	100.0	
Missing	System	95	13.9		
Total		683	100.0		

Screen 6

Statistics

		11. Have you ever been a volunteer/member of any environmental groups in Beijing??	11b. How many years you have been a member/volunteer with an environmental group in Beijing?	12. In the last one year, how frequently do you engage others (talk, email, attend meetings, etc) about the environment?
N	Valid	593	85	585
	Missing	90	598	98
Response rate		0.8682	**85/89=0.9551**	0.8565

11. Have you ever been a volunteer/member of any environmental groups in Beijing??

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	89	13.0	15.0	15.0
	no	504	73.8	85.0	100.0
	Total	593	86.8	100.0	
Missing	System	90	13.2		
Total		683	100.0		

11b. How many years you have been a member/volunteer with an environmental group in Beijing?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 1 year	54	7.9	63.5	63.5
	1--3 years	21	3.1	24.7	88.2
	4--5 years	6	.9	7.1	95.3
	6--9 years	4	.6	4.7	100.0
	Total	85	12.4	100.0	
Missing	System	598	87.6		
Total		683	100.0		

12. In the last one year, how frequently do you engage others (talk, email, attend meetings, etc) about the environment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	50	7.3	8.5	8.5
	weekly	212	31.0	36.2	44.8
	monthly	128	18.7	21.9	66.7
	several times a year	127	18.6	21.7	88.4
	never	68	10.0	11.6	100.0
	Total	585	85.7	100.0	
Missing	System	98	14.3		
Total		683	100.0		

Screen 7

13. In the last year, have you participated in the following activities of any environmental groups? (Circle all the options that apply)

Answer	Bar	Response	%
a. Exchanged information about the environmental issues	0.809615	421	81%
b. Expressed interests, passions and ideas about the environmental issues	0.805769	419	81%
c. Worked with others to achieve collective goals about the environmental issues	0.057692	30	6%
d. Made demands on the government about the environmental issues	0.051923	27	5%

e. Made efforts to improve the structure and functioning of the government about the environmental issues	0.030769	16	3%
f. Made efforts to hold government officials accountable about the environmental issues	0.044231	23	4%

14. Where do you get the information about the air quality programs run by environmental groups? (Circle all the options that apply)			
Answer	Bar	Response	%
a. Their official website	0.16221	91	16%
d. News reports from public media	0.795009	446	80%
g. Others_____(please specify)	0.057041	32	6%
b. Their social media accounts	0.447415	251	45%
e. Face to face by friends	0.352941	198	35%
c. Their newsletters	0.185383	104	19%
f. Face to face at place of work	0.158645	89	16%

Screen 8

Statistics

		15. In the last year, how often have you participated in online discussions about air quality issues?	16. In the last year, how often have you attended air quality programs offline conducted by environmental groups? ..
N	Valid	555	555
	Missing	128	128
Response rate		0.8126	0.8126

15. In the last year, how often have you participated in online discussions about air quality issues?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	20	2.9	3.6	3.6
	weekly	102	14.9	18.4	22.0
	monthly	139	20.4	25.0	47.0
	several times a year	174	25.5	31.4	78.4
	never	120	17.6	21.6	100.0
	Total	555	81.3	100.0	
Missing	System	128	18.7		
Total		683	100.0		

16. In the last year, how often have you attended air quality programs offline conducted by environmental groups? ..

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	7	1.0	1.3	1.3
	weekly	28	4.1	5.0	6.3
	monthly	41	6.0	7.4	13.7
	several times a year	132	19.3	23.8	37.5
	never	347	50.8	62.5	100.0
	Total	555	81.3	100.0	
Missing	System	128	18.7		
Total		683	100.0		

Screen 9

Statistics

		17. To what extent do the air quality programs you have participated in-person help solve the problem in your area?	18. To what extent do the other environmental programs you have participated in-person help solve the problem in your area?	19. In general, would you recommend any environmental programs to your friends?
N	Valid	540	540	537
	Missing	143	143	146
Response rate		0.7906	0.7906	0.7862

17. To what extent do the air quality programs you have participated in-person help solve the problem in your area?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not helpful at all	84	12.3	15.6	15.6
	not very helpful	126	18.4	23.3	38.9
	somewhat helpful	48	7.0	8.9	47.8
	helpful	9	1.3	1.7	49.4
	very helpful	1	.1	.2	49.6
	don't know	42	6.1	7.8	57.4
	I didn't participate in any air quality programs	230	33.7	42.6	100.0
	Total	540	79.1	100.0	
Missing	System	143	20.9		
Total		683	100.0		

18. To what extent do the other environmental programs you have participated in-person help solve the problem in your area?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not helpful at all	76	11.1	14.1	14.1
	not very helpful	109	16.0	20.2	34.3
	somewhat helpful	66	9.7	12.2	46.5
	helpful	9	1.3	1.7	48.1
	very helpful	1	.1	.2	48.3
	don't know	50	7.3	9.3	57.6
	I didn't participate in any other programs	229	33.5	42.4	100.0
	Total	540	79.1	100.0	
Missing	System	143	20.9		
Total		683	100.0		

19. In general, would you recommend any environmental programs to your friends?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	260	38.1	48.4	48.4
	no	45	6.6	8.4	56.8
	maybe	232	34.0	43.2	100.0
	Total	537	78.6	100.0	
Missing	System	146	21.4		
Total		683	100.0		

187 of the 260 people who would recommend environmental programs answered the following question of which ones would you recommend, the response rate is 0.7192. Among the answers, 7 people just offered the idea they don't know, the rest recommend the environmental programs organized by Greenpeace, Friend of Nature as well as other daily individual environmental friendly activities.

Screen 10

20. In the last year, which of the following media sources did you get information on air quality issues in China (Click all that apply)? Approximately what percentage did you use each of them (Should add to 100% of time)?

Descriptive Statistics

	N	Mean	Std. Deviation
20. f. Social media (e.g. Weibo, RenRen)	500	31.91	25.746
20. d. Online news from the Chinese website	497	20.69	20.596
20. b. News reports on TV	498	18.86	19.070
20. c. Newspaper	499	6.97	9.835
20. g. Face to face by friends	498	6.74	10.621
20. a. Radio	498	5.92	11.198
20. e. Online news from the foreign website	497	4.65	10.663
20. h. Face to face at place of work	496	4.59	9.239
Valid N (listwise)	490		

Screen 11

21. In the last year, how often did you use the following social media account?

Statistics

		21. a. Weibo (Chinese version of twitter)	21. b. Douban (a social media organizing offline activities)	21. c. Zhihu (Chinese version of Quora)	21. d. Guoke (a social media exchanging science information)	21. e. Renren (Chinese version of Facebook)
N	Valid	495	440	422	428	445
	Missing	188	243	261	255	238
Response rate		0.7247	0.6442	0.6179	0.6266	0.6515

21. a. Weibo (Chinese version of twitter)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	416	60.9	84.0	84.0
	weekly	45	6.6	9.1	93.1
	monthly	14	2.0	2.8	96.0
	several times a year	8	1.2	1.6	97.6
	never	4	.6	.8	98.4
	I don't have an account	8	1.2	1.6	100.0
	Total	495	72.5	100.0	
Missing	System	188	27.5		
Total		683	100.0		

21. b. Douban (a social media organizing offline activities)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	124	18.2	28.2	28.2
	weekly	93	13.6	21.1	49.3
	monthly	61	8.9	13.9	63.2
	several times a year	57	8.3	13.0	76.1
	never	23	3.4	5.2	81.4
	I don't have an account	82	12.0	18.6	100.0
	Total	440	64.4	100.0	
Missing	System	243	35.6		
Total		683	100.0		

21. c. Zhihu (Chinese version of Quora)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	15	2.2	3.6	3.6
	weekly	40	5.9	9.5	13.0
	monthly	39	5.7	9.2	22.3
	several times a year	30	4.4	7.1	29.4
	never	56	8.2	13.3	42.7
	I don't have an account	242	35.4	57.3	100.0
	Total	422	61.8	100.0	
Missing	System	261	38.2		
Total		683	100.0		

21. d. Guoke (a social media exchanging science information)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	12	1.8	2.8	2.8
	weekly	50	7.3	11.7	14.5
	monthly	57	8.3	13.3	27.8
	several times a year	54	7.9	12.6	40.4
	never	52	7.6	12.1	52.6
	I don't have an account	203	29.7	47.4	100.0
	Total	428	62.7	100.0	
Missing	System	255	37.3		
Total		683	100.0		

21. e. Renren (Chinese version of Facebook)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	92	13.5	20.7	20.7
	weekly	71	10.4	16.0	36.6
	monthly	48	7.0	10.8	47.4
	several times a year	102	14.9	22.9	70.3
	never	50	7.3	11.2	81.6
	I don't have an account	82	12.0	18.4	100.0
	Total	445	65.2	100.0	
Missing	System	238	34.8		
Total		683	100.0		

Screen 12

Statistics

		22.a. Read other's post	22.b. Click on an external link	22.c. Make comments on other's post	22.d. Posted (including forwarded) on your account	23. Are you currently connected with the account of any environmental groups on Weibo (Chinese version of twitter)?
N	Valid	477	464	465	459	444
	Missing	206	219	218	224	239
Response rate		0.698389	0.679356	0.68082	0.672035	0.650073

22.a. Read other's post

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	103	15.1	21.6	21.6
	weekly	172	25.2	36.1	57.7
	monthly	109	16.0	22.9	80.5
	several times a year	77	11.3	16.1	96.6
	never	16	2.3	3.4	100.0
	Total	477	69.8	100.0	
Missing	System	206	30.2		
Total		683	100.0		

22.b. Click on an external link

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	53	7.8	11.4	11.4
	weekly	182	26.6	39.2	50.6
	monthly	118	17.3	25.4	76.1
	several times a year	84	12.3	18.1	94.2
	never	27	4.0	5.8	100.0
	Total	464	67.9	100.0	
Missing	System	219	32.1		
Total		683	100.0		

22.c. Make comments on other's post

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	36	5.3	7.7	7.7
	weekly	143	20.9	30.8	38.5
	monthly	124	18.2	26.7	65.2
	several times a year	116	17.0	24.9	90.1
	never	46	6.7	9.9	100.0
	Total	465	68.1	100.0	
Missing	System	218	31.9		
Total		683	100.0		

22.d. Posted (including forwarded) on your account

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	37	5.4	8.1	8.1
	weekly	87	12.7	19.0	27.0
	monthly	116	17.0	25.3	52.3
	several times a year	140	20.5	30.5	82.8
	never	79	11.6	17.2	100.0
	Total	459	67.2	100.0	
Missing	System	224	32.8		
Total		683	100.0		

23. Are you currently connected with the account of any environmental groups on Weibo (Chinese version of twitter)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	183	26.8	41.2	41.2
	no	261	38.2	58.8	100.0
	Total	444	65.0	100.0	
Missing	System	239	35.0		
Total		683	100.0		

Screen 13

Statistics

		24. Do you know about mobile apps which offer information on air quality condition (e.g. the app of China air quality index)?	24a. If you have installed this kind of app, in the last year how often do you check it?	24b. Would you recommend this kind of mobile app to other people?
N	Valid	496	160	492
	Missing	187	523	191
Response rate		0.7262	160/160=100%	0.7204

24. Do you know about mobile apps which offer information on air quality condition (e.g. the app of China air quality index)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I don't know	147	21.5	29.6	29.6
	I've heard of it	189	27.7	38.1	67.7
	I've installed it	160	23.4	32.3	100.0
	Total	496	72.6	100.0	
Missing	System	187	27.4		
Total		683	100.0		

24a. If you have installed this kind of app, in the last year how often do you check it?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	79	11.6	49.4	49.4
	weekly	69	10.1	43.1	92.5
	monthly	9	1.3	5.6	98.1
	several times a year	2	.3	1.3	99.4
	never	1	.1	.6	100.0
	Total	160	23.4	100.0	
Missing	System	523	76.6		
Total		683	100.0		

24b. Would you recommend this kind of mobile app to other people?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	179	26.2	36.4	36.4
	no	71	10.4	14.4	50.8
	maybe	242	35.4	49.2	100.0
	Total	492	72.0	100.0	
Missing	System	191	28.0		
Total		683	100.0		

Screen 14

Statistics

		25. What is your age (as of last birthday)?	26. What is your gender?
N	Valid	491	493
	Missing	192	190
Response rate		0.7189	0.7218

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
25. What is your age (as of last birthday)?	491	18	100	28.37	8.326
Valid N (listwise)	491				

25. What is your age in age groups?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-29	327	47.9	67.0	67.0
	30-39	123	18.0	25.2	92.2
	40-49	22	3.2	4.5	96.7
	50-59	13	1.9	2.7	99.4
	>=60	3	.4	.6	100.0
	Total	488	71.4	100.0	
Missing	System	195	28.6		
Total		683	100.0		

26. What is your gender?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	203	29.7	41.2	41.2
	female	290	42.5	58.8	100.0
	Total	493	72.2	100.0	
Missing	System	190	27.8		
Total		683	100.0		

Screen 15

Statistics

		27. What is your highest education background?	28. If you are or have been a university student, what is your major area of study?	29. What's your present employment status?	30. Approximately what's your current household income per month?
N	Valid	496	489	494	493
	Missing	187	194	189	190
Response rate		0.7262	0.7160	0.7233	0.7218

27. What is your highest education background?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	high school	28	4.1	5.6	5.6
	bachelor	328	48.0	66.1	71.8
	master	122	17.9	24.6	96.4
	PhD	18	2.6	3.6	100.0
	Total	496	72.6	100.0	
Missing	System	187	27.4		
Total		683	100.0		

28. If you are or have been a university student, what is your major area of study?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	human science	84	12.3	17.2	17.2
	social science	60	8.8	12.3	29.4
	engineering	118	17.3	24.1	53.6
	natural science	29	4.2	5.9	59.5
	agriculture and life science	8	1.2	1.6	61.1
	business	93	13.6	19.0	80.2
	art and design	53	7.8	10.8	91.0
	others	44	6.4	9.0	100.0
	Total	489	71.6	100.0	
Missing	System	194	28.4		
Total		683	100.0		

29. What's your present employment status?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Employed or self-employed on a full-time basis	293	42.9	59.3	59.3
	Employed or self-employed on a part-time basis	22	3.2	4.5	63.8
	Retired	13	1.9	2.6	66.4
	Full-time homemaker	15	2.2	3.0	69.4
	Student	132	19.3	26.7	96.2
	Unemployed	19	2.8	3.8	100.0
	Total	494	72.3	100.0	
Missing	System	189	27.7		
Total		683	100.0		

30. Approximately what's your current household income per month?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 2,000 RMB	40	5.9	8.1	8.1
	2,000-6,000 RMB	136	19.9	27.6	35.7
	6,000-10,000 RMB	123	18.0	24.9	60.6
	10,000-20,000 RMB	109	16.0	22.1	82.8
	20,000-30,000 RMB	41	6.0	8.3	91.1
	30,000-40,000 RMB	23	3.4	4.7	95.7
	more than 40,000 RMB	21	3.1	4.3	100.0
	Total	493	72.2	100.0	
Missing	System	190	27.8		
Total		683	100.0		

Screen 16

Statistics

		32. What's the province of your family origin?	33. What's your identity on your ID card?	31. How many years have you lived in Beijing?
N	Valid	486	481	387
	Missing	197	202	296
Response rate		0.7116	0.7042	0.3660

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
31. How many years have you lived in Beijing?	387	0	55	15.53	12.537
Valid N (listwise)	387				

31. How many years have you lived in Beijing in groups of year?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-1	38	5.6	15.2	15.2
	2-5	90	13.2	36.0	51.2
	6-10	58	8.5	23.2	74.4
	11-20	54	7.9	21.6	96.0
	>=21	10	1.5	4.0	100.0
	Total	250	36.6	100.0	
Missing	System	433	63.4		
Total		683	100.0		

32. What's the province of your family origin?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Beijing, Tianjin, Hebei, Shanxi, Nei Monggu	257	37.6	52.9	52.9
	Heilongjiang, Jiling, Liangning	53	7.8	10.9	63.8
	Shandong, Jiangsu, Anhui, Shanghai, Zhejiang, Jiangxi, Fujian	76	11.1	15.6	79.4
	Henan, Hubei, Hunan	45	6.6	9.3	88.7
	Guangdong, Guangxi, Hainan	19	2.8	3.9	92.6
	Xinjiang, Gansu, Ningxia, Qinghai, Shanxi	14	2.0	2.9	95.5
	Chongqing, Sichuan, Guizhou, Yunnan, Xizang	21	3.1	4.3	99.8
	HongKong, Macao, Taiwan	1	.1	.2	100.0
	Total	486	71.2	100.0	
Missing	System	197	28.8		
Total		683	100.0		

33. What's your identity on your ID card?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	From the rural area	42	6.1	8.7	8.7
	From the urban area	439	64.3	91.3	100.0
	Total	481	70.4	100.0	
Missing	System	202	29.6		
Total		683	100.0		

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ACKNOWLEDGEMENT

Throughout my graduate program, I have enjoyed encouragement, assistance, and support from numerous individuals making this a memorable journey. Each person kept me focused, inspired, and confident that I could pursue and complete my Master degree.

I would first and foremost like to thank my major professor Lois Wright Morton who has been incredibly patient and understanding for me. She always pointed me forward and kept me challenged, and without her help I would not make so much progress to think and write in a scientist. I would also like to thank my committee Carmen Bain and Michael Dahlstrom for their help and understanding throughout this process.

Many thanks to Renea Miller, who helped me programming the Qualtrics and make it a useful survey instrument. I also need to thank Zhihua Hu, who offered me great ideas in designing and finalizing the survey questionnaire.

Special appreciation is offered to my multiple cohorts of fellow graduate students—your support, good humor, and knowledge have been immeasurable. I enjoyed the time studying and living here with all my fellows and friends in ISU.

Most importantly, thanks to my parents, Zhijun Ke and Feiyan Wang. This effort would not have been possible without the love, support, and patience of them. I love you all very much.