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Pei Zheng

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**Setting the Agenda on Air Pollution:
Examining the Traditional and Social Media Agendas and Their
Relationships 2011-2015**

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Dissertation

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To my parents, husband, and our forthcoming daughter

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Abstract

Under the theoretical frameworks of agenda-setting and authoritarian environmentalism, this dissertation examined traditional and social media agendas on the air pollution issue in China from 2011 to 2015. It adopted Granger's causality analysis to test the causal relationships among four traditional media outlets ($N = 1,147$), six types of actors on the Chinese social media platform called Weibo ($N = 4,045$), and between agendas of traditional media outlets and social media actors. The results showed most of news stories were framed under "publicity and government trust" frame between 2011 and 2012, and under "war on pollution" and "science" frames after 2013. Government officials, environmental scientists and researchers dominated media sources. The

state-owned media, *People's Daily*, set the agenda for other local and commercial media outlets. Agendas on social media were fragmented with media setting the agenda for NGOs and verified individual's accounts. Agenda-setting effects existed only between traditional media and media's Weibo accounts, and between traditional media and verified individuals' Weibo accounts. The agendas of ordinary people on Weibo were independent of the agendas other social media actors and of traditional media. The opinion leaders on Weibo were mostly business leaders and celebrities. This dissertation is the first study to provide a holistic view and clear trajectory of agendas on air pollution over five years. It offered a media perspective to authoritarian environmentalism and contributed to agenda-setting theory by capturing the fragmented nature of the social media agenda. Methodologically, this dissertation advanced existing studies by applying a computer-assisted social media data collection method and conducting a more rigorous causality analysis called Granger's causality.

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Chapter 1 Introduction

Polluted air has become a severe concern for people living in China recently. In 2012, 147 out of 365 days were reported as polluted in major Chinese cities (All-China Environment Federation, 2013). In 2013, 59 days were highly polluted in Beijing, the capital of China (Caixin, 2014). Because of the prominence and importance of the topic of air pollution, this dissertation examined five years' worth of media coverage of this issue in traditional media and on social media under the framework of authoritarian environmentalism and agenda-setting. Authoritarian environmentalism highlights the top-down and monolithic decision-making process of China's environmental governance (Gilley, 2012). Agenda-setting theory, which argues media can tell the public what to think about an issue (McCombs & Shaw, 1972), was adopted to test the causal relationship between traditional and social media agenda.

This dissertation aimed to project the trajectory of media presentation of China's air pollution issue over a five-year period with a combination of computer-assisted social media data crawling and a traditional method of data collection. Four newspapers in China, from both commercial and state-own media groups and from the north and south areas of China, were selected to represent the media agenda. The social media agenda was collected on Weibo, a Twitter-like social media platform. Weibo (NASDAQ: WB), which literally means microblogging in Chinese, is the most popular microblogging website in China with more than 200 million subscribers from various social groups nationwide. Quantitative content analysis was employed to examine both the traditional media and social media agendas, and Granger's causality was adopted to test agenda-setting effects among traditional news outlets, social media actors, and between

traditional media outlets and social media actors. Based on this theoretical framework and using these methodologies, the main questions this dissertation sought to answer were: What agendas did traditional media and social media communicate about air pollution? Did these agendas change over the nearly half-decade study period? How did these agendas reflect the changing power structure in China today? Were there agenda-setting effects between traditional and social media? What were the implications of these agendas on the air pollution issue and the current media climate?

Importance of Air Pollution as a Study Topic

The air pollution issue has drawn great media and public attention in the past five years. In China, the air pollution issue is relevant to people's daily life, yet understanding of the issue calls for specialized knowledge that the average person may not have. For this type of issue, the public usually relies on the media for information (Yagade & Dozier, 1990). As a result, media coverage becomes a major social channel where the general public learns about the issue and makes its own judgment. Therefore, it is vital to know how media have covered air pollution over the last few years. China's air pollution issue is also a sophisticated social issue worth studying because it involves a broad spectrum of political, economic, social, and international relation factors. First, China's environmental governance is generally labeled as "authoritarian environmentalism" (Beeson, 2010; Lo, 2015). This means the state dominates policy-making with directives and orders. Second, as a large developing country, China has enjoyed rapid economic development in this decade, but at the same time, its environmental issues have drawn great attention in the country and worldwide. Air pollution is the consequence of this rapid industrialization, modernization, and

urbanization. Economic factors, such as energy structure reform are important to explain and solve the problem. Third, air pollution is a social issue because it causes great concern about health and life quality, and discussing the issue may even expand beyond air pollution to a larger social context, such as discussing trust in government and social inequality. Fourth, China's air pollution issue also involves conflict in international relations between China and the United States since the U.S. embassy first released air-quality data about China on its official social media account right after the 2008 Beijing Olympic Games without permission from the Chinese government, which caused tension in Sino-U.S. diplomatic relations. These complicated factors and inter-related powers are reflected and embedded in media content and journalistic practices, such as newsroom routines and the selection of news sources (Anderson, 2009; Shoemaker & Reese, 2013; Reese, Grant, & Dannian, 1994). Therefore, analyzing the news coverage and news source selection on air pollution issue, as this dissertation does, helps to reveal the dynamics among various powers in current Chinese society.

Importance of Examining Traditional and Social Media Agendas and Their Relationships

A core focus of this dissertation was to examine both the media agenda about air pollution on social media as well as in traditional media and to compare these agendas. This is important because both traditional and social media content are socially and politically constructed. Examining the content not only reveals intervening powers behind the air pollution issue but also the changing dynamics among various actors in today's authoritarian China. Some background on China's news environment is helpful to understanding the relevance of this topic today. China's news environment has shifted its emphasis several times since the end of Cultural Revolution and

the start of economic reform in the late 1970s. Markets and politics have been two driving forces that influence the trajectory of traditional media reform, where political intervention preserves the political legitimacy of the party-state and the market tries to gain the largest commercial profits (He, 1994; Pan, 2010; Zhao, 2008). The connection between politics and capital affects traditional media in two ways. It has strengthened the information control, setting double constraints for media practitioners to monitor government conduct, practice social justice, and speak for the powerless (Pan, 2010; Zhao, 2008). At the same time, however, journalists have more flexibility in covering issues that appeal to corporate entities, as long as they do not threaten their vested interests and social security (Wang & Lee, 2014).

News coverage on air pollution reflects both of these layers of impact. On the one hand, the cumulative public expression about air pollution on social media as well as the huge economic benefits of solving the problem (such as the promotion of clean resource and environmental-friendly technology) legitimizes traditional media's coverage. On the other hand, air pollution is also a political issue. Media are still very cautious in how they frame the issue to avoid potentially harming political legitimacy and social harmony. Understanding the societal role of media is of key importance, as it shows "how an issue gets on the policy agenda, and leads, perhaps, to government policies designed to address or solve a social problem" (Dearing & Rogers, 1996, p. 72). Given the socially constructed nature of media and the unique media environment of China, it is important to examine the traditional media agenda on air pollution to know 1) how the discourse around the issue changes over time and how media adopt different frames reflecting those changes; 2) who dominates the discourse on the air pollution issue and how it affects media selection of news sources; 3) how the policy from central and local governments change over time

and how media approach those changes; and 4) the intervening and conflicting powers behind the policy-making process.

This dissertation also considered how air pollution is discussed on social media because traditional media are generally under state control in China. The Internet, however, offers a relatively free public space for discussion and civic empowerment because messages spread online quickly and traditional gatekeepers can hardly slow the messages (Yang, 2008). Social media specifically activate public discussion and participation in issues relating to personal interests, such as air pollution (W. Chen, Tu, & Zheng, 2017). Tie strength, which relates to how well people know other people in their social networks, also plays a role. Weak ties are relationships people have with strangers and acquaintances, while strong ties are connections between friends or colleagues (Granovetter, 1973). Information diffused through strong ties is perceived as more trustworthy (Krackhardt, Nohria, & Eccles, 2003), and networks diffused through weak ties reach more people, bridging heterogeneous communication into one online space (Granovetter, 1973).

Twenty years of Internet expansion in China has fully embedded the web in the confounding powers of Chinese politics, society, economics, and foreign policies (Yang, 2007). On one hand, heterogeneous online networks involve various actors, so discussions on social media are more dynamic compared with the monolithic traditional media. On the other hand, social media discussions, despite their diversity, are influenced, shaped and constrained by politics and capital as well (Van Dijck, 2013). Consequently, when the air pollution issue became salient in the online sphere, various actors including media, government, experts, and the general public actively participated online to discuss, defend, and define the issue. Therefore, to understand the public agenda on the air pollution issue, it is important to explore the discussion on social media about

the issue that reveals dynamics among various social actors and changing power structure in China's authoritarian regime.

Before social media became popular, it was generally believed that media could tell the public what to think about an issue, which is known as “agenda-setting” theory (McCombs & Shaw, 1972). Agenda-setting theory has been working well within the media-dominated public sphere where public opinion is shaped mainly by traditional media. However, Internet technologies keep challenging the power of traditional media by allowing more actors to participate in the discussion of social issues. Existing studies on social media agenda-setting have yielded mixed results due to different research settings (sampling, time phrase, case selection, context, etc.) and choice of statistical models (Groshek & Groshek, 2010; Kim & Lee, 2014; Metzgar & Marrugi, 2009; Neuman, Guggenheim, Jang, & Bae, 2014). Therefore, how agenda-setting theory works in a new media environment becomes a question worth exploring. In China, existing studies have shown that actors on social media can interact actively with traditional media to push daily agendas on certain issues (Zhou & Moy, 2007). At the same time, government also regards opinion on social media as a barometer for public sentiments and implement policies accordingly (Luo, 2011; Tai, 2006). Existing studies have argued that the online public agenda and traditional media coverage can influence government decision-making. But the government can easily interrupt, alter, or suspend the social and traditional media agenda by giving executive orders, blocking online discussion or censoring topics (Zhou & Moy, 2007). Characteristics of traditional and social media in China discussed above indicate a very different communication pattern compared to the West, making it worthwhile to study the agenda-setting effect among China's traditional media, social media actors and between traditional and social media.

Contributions of This Dissertation

This dissertation made several important theoretical and methodological contributions. First, this study provided a systematic and holistic analysis of both the media and public agendas of the air pollution issue in China. With a significant increase in the coverage of the air pollution issue in recent decades, the media have become significant contributors to the public understanding of scientific and technical controversies surrounding the topic. Despite the fact that air pollution is a controversial discussion topic, only a few studies have examined this issue from a media perspective (e.g., Y. Chen, 2014; W. Chen et al., 2017). Second, this study took into account source adoption with agenda-setting theory, which opened up more room for interpretation and highlighted the power structure within the discourse. Third, this study documented the agenda change regarding the air pollution issue in China over a five-year-period. Existing studies on the air pollution issue usually have focused on a specific event or examined a very short amount of time. For example, Yang's (2016) critical study of the 2015 documentary "Under the Dome" explores the causes and solutions to the air pollution issue. Y. Chen (2014) studied media discourses of air pollution in China that were written in English; Zeng, Dai, and Zheng (2014) examined competing media frames in coverage of air pollution in three newspapers. Therefore, these prior studies did not show the trajectory of the issue. This dissertation filled this gap. Fourth, this study integrated computer-assisted methodology to gather social media data, which provides a more efficient data collection option for others who are seeking to study social media discourse. Fifth, this study adopted Granger's causality to test agenda-setting effects, which is more rigorous

than the widely used cross-lagged correlation. Future studies can follow procedures in this study to test agenda-setting causality.

Dissertation Structure

In Chapter Two, I will review the literature on the significance of studying environmental issues and the air pollution issue in the context of China. Then I will explicate the theoretical frameworks employed in this study, namely environmental authoritarianism, agenda-setting and intermedia agenda-setting theory. Next, I will examine literature on media coverage of the environment and air pollution issues, the media environment in China, and how social media have changed the dynamic of agenda-setting effects. This review of the literature will support my hypotheses and research questions. In Chapter Three, I explain methodologies for this study in detail. Chapter Four to Six provide results of my analyses. Chapter Four presents results about the traditional media agenda of the air pollution issue. Chapter Five presents results about the social media agenda, and Chapter Six shows results of the agenda-setting effects between traditional media outlets and actors on social media. In Chapter Seven, I will interpret my results and situate them within the extant literature, and discuss the implications of this research on theory and methodology.

Chapter 2 Literature Review

This chapter reviews existing studies relating to the air pollution issue in China. First, I will explain the significance of studying the air pollution issue in terms of the current environmental situation in China and also provide background about this issue. Second, I will present the theoretical frameworks adopted in this study -- namely agenda-setting theory, intermedia agenda-setting theory, and environmental authoritarian -- and explain how this study will benefit from and contribute to those theories. Then, I will review literature regarding media agendas, the media environment in China, and social media agendas that are relevant to my study on the air pollution issue. Based on this literature, I will propose specific research questions and hypotheses at the end of this chapter.

Environmental Issues in China

Significance of environmental issues in China. Attention to environmental protection in China started when the People's Republic of China re-entered the international stage and actively participate in international affairs during the 1970s. After returning to the United Nations (UN) in 1971 as the People's Republic of China, China launched its first National Conference on Environmental Protection in the following year (Yong & Gang, 2008). Six years afterward, environmental protection and pollution prevention was written into the constitution (Tsang & Kolk, 2010) and then as a basic national policy (Yong & Gang, 2008).

Environmental issues have both international and domestic agendas. Internationally, China has active participated in global environmental conventions and agreements, such as the Kyoto Protocol (MacBean, 2007). Domestically, starting from 1990s, environmental protection has been

officially listed as one of the top 10 priorities for national sustainable development (Tsang & Kolk, 2010). In the 21st century, in both the 11th and 12th Five-Year-Plan (The Central People's Government of PRC, 2006, 2011), central and local governments of China have set quantitative targets for environmental protection. As articulated by former President Hu Jintao, environmental sustainability is domestically crucial to “building a beautiful country and achieving lasting and sustainable development of the Chinese nation,” and globally significant because “it contributes our share to global ecological security” (Hu, the keynote report during the opening ceremony of the 18th CPC National Congress in 2012)¹.

Significance of air pollution issue in China: The story of PM_{2.5}. Among environmental issues facing China today, air pollution is one of the most salient and obtrusive issue, meaning people encounter it in their everyday lives. The air pollution issue in China is also known as PM_{2.5} issue, which stands for “atmospheric particulate matter with a diameter of 2.5 micrometer or less.” PM_{2.5} are microscopic solid or liquid matter suspended in the Earth's atmosphere. Because of their tiny size, they could easily be breathed into lungs and potentially cause negative health consequences such as asthma, lung disease, and premature death (Region 4: Laboratory and Field Operations – PM_{2.5} Objectives and History. U.S. Environmental Protection Agency, 2008).

The association between air pollution and mortality rates was first documented in *The New England Journal of Medicine* in 1993, with empirical evidence found in six U.S. cities (Dockery, et al., 1993). Air-quality measurements used to vary in different countries. For example, the U.S. did not have a standard measurement until mid-‘90s, and PM_{2.5} concentration was first included

¹ “CPC advocates building “beautiful” China”, retrieved from Xinhua News via http://news.xinhuanet.com/english/special/18cpcnc/2012-11/08/c_131959465.htm

in the Index in 1997² (EPA, 1997). Gradually, in the past 20 years, an Air Quality Index (AQI) based on PM_{2.5} concentration has been adopted in many countries, including by the U.S. Environmental Protection Agency (EPA).

China used to measure air pollution using the Air Pollution Index (API), which did not include PM_{2.5} data until 2012. In fact, residents in China were not aware of the concept of PM_{2.5} before 2012. The story of PM_{2.5} started at the U.S. embassy in Beijing in 2008, who installed an air-quality monitor to measure the level of PM_{2.5}. Right after the 2008 Beijing Olympic Games, the embassy began live-tweeting the PM_{2.5} readings on its official Twitter account *@BeijingAir* and claimed the purpose was to provide information to officers of the U.S. embassy and the larger American community in China (U.S. State Department, 2012). Despite the claim, the U.S. embassy's independent monitoring and public reporting of PM_{2.5} revealed the difference between API and AQI, which captured public attention and thus activated negative reactions from the Chinese government. China's Ministry of Environmental Protection (MEP) and Ministry of Foreign Affairs (MFA) protested and criticized the U.S. embassy's behavior, saying it caused confusion and was insulting, yet the embassy did not stop its PM_{2.5} program but continued live-tweeting the PM_{2.5} readings. Eventually, the issue triggered a dispute between the two governments on June 5, 2012, when a vice minister of MEP responded to a question at the State Council News Office press briefing that "certain country should stop posting air-quality data about China online" as the public posting was "against the Vienna Convention on Consular Relations and environmental regulations in China" (People's Daily, 2012, n.p.). As a response, the U.S.

² PM-2.5 (1997 Standard) Area Information from United States Environmental Protection Agency. Retrieved via <https://www3.epa.gov/airquality/greenbook/qindex.html>

Department of State denied the accusation the following day. Moreover, the U.S. Department of State insisted that the PM2.5 program in China would continue (Congressional-Executive Commission on China, 2012), which is at least partly because of the diplomatic evaluation of the PM2.5 program as “a very constructive and positive initiative” (State Department, 2012).

As mentioned earlier, the Chinese public had little awareness of the risk of PM2.5 before 2012. The dispute between the U.S. and Chinese governments ignited public discussion of PM2.5 online and off. Yet because most people knew little about the existence, causes, and consequences of the problem, netizens criticized the Chinese government for not reporting PM2.5 and tended to distrust their government’s clarification and policy. At the same time, various actors, including environmental experts, researchers, government officials and business leaders, actively participated in the discussion of the air pollution issue, explaining the cause, consequences, and solutions, using their knowledge and expertise.

Soon after the dispute with U.S. embassy, the Chinese government decided to measure and release a PM2.5 report to the public in selected cities and then nationally in 2013. Premier Li Keqiang addressed air pollution as the key issue at the press conference right after the conclusion of the annual legislative session. The air pollution issue also was one of the most prevalent topics at the 12th NPC and CPPCC, as at least 20 deputies gave talks during the meetings about it (NPC & CPPCC Annual Sessions, 2013). In September 2013, the growing salience of the issue urged the State Council to take out the Air Pollution Action Plan. The plan included aggressive targets to reduce PM2.5 emissions, and the solutions included pausing construction of new coal-fired power stations, reducing daily car use, limiting the number of energy-intensive factories, and encouraging new and renewable energy R&D and applications. In 2014, Li declared a “war on

pollution” (Reuters, 2014³), and the year following, right before the annual conference of the 12th NPC and CPPCC, a documentary named “Under the Dome” triggered another wave of national discussion on air pollution with hot debates on what caused the pollution and how to solve it (Under the Dome, 2015). At the 12th NPC, Li addressed that energy efficiency is the key strategy for air cleaning⁴ (Report on the Work of the Government, 2015). Accordingly, both central and local governments set ambitious goals to meet PM2.5 reduction targets, such as the August 2015 amendments to the *Air Pollution Control Law*, which mandated higher penalties for polluters and more stringent requirements for emissions monitoring⁵ (Xinhuanet, 2015).

To conclude, the air pollution issue merged with China’s economic growth, demands, and transitions. The pollution had existed for quite a long time, but it was not until recently that the public and government focused national attention on the issue. The reasons for the air pollution issue gaining salience are worth studying. First, industrialization and urbanization of China in recent years have deteriorated the air quality in urban areas but at the same time improved the quality of life for the general public. This seemingly contradictory consequences have led people in China, especially those of the urban middle class, to pay more attention to personal health, become more sensitive to air pollution, and relate high air quality to their life quality. Second, the story of PM2.5 in China reflected another facet of the issue: The air pollution issue is more than an environmental issue, and environmental issues are by nature social issues. Air pollution first

3 Reuters: “China to 'declare war' on pollution, premier says”, March 4, 2014, retrieved from Reuters via <http://www.reuters.com/article/us-china-parliament-pollution-idUSBREA2405W20140305>

⁴ Full text of Report on the Work of the Government, 2015, retrieved from http://english.gov.cn/archive/publications/2015/03/05/content_281475066179954.htm

⁵ Xinhuanet: “Xinhua Insight: China passes law to control air pollution”, retrieved from http://news.xinhuanet.com/english/2015-08/29/c_134568483.htm

became salient because of the U.S. embassy's tweets, which was part of U.S.'s diplomatic strategy. The discussion of the issue also has various focuses, including government trust, information publicity, and scientific and policy explanations of the causes and solutions to the problem. Even till now, there is still no concrete and single answer to what causes the pollution and what are the most efficient strategies to combat it, partly because of the conflict of interest between economic development and environmental protection in developing countries like China. Therefore, the PM2.5 issue involves dynamics from a broad spectrum of converging and contending forces in contemporary China. Looking at the issue from a media perspective helps uncover existing and emerging power in China, including technological, social, economic, and political, as well as international relations.

Theoretical Frameworks

Authoritarian environmentalism. Authoritarian environmentalism served as the first theoretical framework for this study. It provides insights about the nature of China's environmental problem, and the media perspective of this study provides novel explanation of this theoretical framework. Authoritarian environmentalism is a form of environmental governance model that "concentrates authority in a few executive agencies manned by capable and uncorrupt elites seeking to improve environmental outcomes" (Gilly, 2012, p. 288). The policy process under "authoritarian environmentalism" is dominated by an autonomous state (Beeson, 2010). The decision-making process, therefore, is characterized as more compliant of top-down orders and less of bottom-up participation.

Authoritarian environmentalism is often contrasted with neoliberal environmentalism, which highlights individual freedom and participation of various social groups in the policy-

making process (Andrew & Cortese, 2013; Gilley, 2012). Opponents of authoritarian environmentalism often criticize its “unaccountable, electorally-unresponsive, top-down” political characteristics (Beason, 2015, p. 521), which they argue, lack deliberative variety and market forces to respond to environmental concerns (Newell, 2012; Bohman, 1998). Yet, other scholars and practitioners see the prospect that China’s state-dominated, command-and-control form of policy-making as more capable to implement major reforms (Beason, 2015). For global environmental issues such as climate change, the world expects the European Union (EU) or the United States – “the West” – to take leadership roles and continue to shape the international order (Patterson, 2009). However, the authoritarian China, instead, has become an unavoidable actor in multilateral forums such as Copenhagen summit and is making big progress in addressing the fundamental environmental challenges of our time (Jakobon & Knox, 2010).

Ironically, China’s authoritarian environmentalism is also characterized by its fragmented nature, specifically in a domestic context (Lieberthal, 1992). As Beason (2015) put it, “China is not immune from precisely the same sort of powerful vested interests that have made addressing climate change so problematic in much of the West.... China’s leaders find themselves having to deal with precisely the same sorts of problems and dilemmas as their counterparts in the West” (p. 523). In China’s case, while the political system may appear monolithic, environmental policy-making and implementation face challenges from both central-local government relationships and conflicting vested interest groups at the same level of governance. For the former, it is not surprising that local governments these days can distort, ignore, or challenge initiatives from central government for the sake of local interests (Lo, 2015). For the latter, the inter-agency rivalries also compete over the nature of environmental policies as economic policy institutions

still dominate and override environmental policy institutions under China's current economic development mode (He et al., 2012).

The air pollution issue examined in this dissertation exactly reflects the paradox of "fragmented" authoritarianism. On the one hand, China is the number one investor in renewable energy worldwide (Crooks 2011), indicating its commitment toward sustainable and ecological development. On the other hand, power companies, the oil industry, and powerful state-owned industries still take great control over policy-making. They oppose energy structure reform by either ignoring the directives of government or playing politics on various committees to cease the reforms (Wong 2013). Studies in the field of government and policy have found environmental policies "schizophrenic and contradictory at times" (Beason, 2015, p. 526) as the result of fragmentation. The media perspective would add up to the understanding of authoritarian environmentalism in two ways. First, media coverage over a long period of time can reflect policy changes over time. Second, source selection in traditional media and the discourse of various actors on social media can reveal factional politics and power relationships embedded in air pollution issue.

Agenda-Setting. This study relied on agenda-setting theory to examine the traditional media agenda and social media agenda regarding air pollution in China and to test causal relationships among these agendas. The theory of agenda-setting can be traced to Walter Lippmann's 1922 classic publication *Public Opinion*, in which he used the metaphor "The pictures in our head" to refer to media effects on the audience (McCombs, 2014). Media create a picture in our heads of what the world looks like, and the public believes the picture even if it is not accurate. In Lippman's view, public opinion does not correspond to the "real world" but to the world

constructed and presented by the news media. With their ground-breaking Chapel Hill study, McCombs and Shaw in 1968 empirically tested the relationship between the media's issue agenda and the public's agenda (McCombs & Shaw, 1972). They compared how undecided voters perceived major issues during the 1968 U.S. presidential election compared with how the news media reported it and found significant correlations between the salience of issues in the newspapers and the salience of the same issues among North Carolina voters. This was the start of agenda-setting research and was labeled later as a "first-level agenda setting theory." The priority hypothesis for first-level agenda-setting theory is: *The salience of an issue addressed by news media is correlated with the salience of an issue as perceived by the public.*

First level agenda-setting theory focuses on the ranking of objects (issues or candidates), and the second level on the salience of attributes. Attributes of objects are "the set of perspectives or frames that journalists and the public employ to think about each object" (McCombs, Llamas, Escobar & Rey, 1997 p. 706). Second-level agenda setting has expanded from the transition of salience of issues to the salience of issue attributes. It compares the array of attributes in the media with the array of attributes in public opinion. Therefore, second-level agenda-setting theory suggests that the media not only tell the public *what to think*, but also *how to think about* public issues. The priority hypothesis for second-level agenda setting is: *There is correlation between the salience of attributes in the media coverage and the salience of attributes perceived by the public* (McCombs & Shaw, 1972; McCombs, Lopez-Escobar & Llamas, 2000). This study focused on a single issue – air pollution; therefore, second-level agenda-setting was adopted as the theoretical framework. For second-level agenda-setting, attributes, or frames, describe the structure and aspects that media choose to present certain issues. Although there are debates about whether

frames are exactly the same as attributes (e.g., Scheufele, 2000), scholars generally agree that attributes and frames share common ground and the basic agenda-setting idea and framing can converge (Waver, Graber, McCombs & Eyal, 1981; Iyengar & Simon, 1993; McCombs & Gahanem, 2001). According to McCombs and Gahanem (2001), “framing is the construction of an agenda with a restricted number of thematically related attributes in order to create a coherent picture of a particular object” (p. 70). Therefore, this dissertation sought to find out how media present air pollution issue in terms of their choice of attributes (frames), and how such frames passes along traditional and social media platforms.

Agenda-building and news source. Agenda-building is connected to agenda-setting theory. Since agenda-setting theory tells us that media coverage can be influential to the public, agenda-building focuses on the media and seeks to find out what affects the media’s choice to cover certain issues as well as how the media decides what is presented in the media coverage. Consistent with agenda-setting, agenda-building at the second level looks at how journalists are influenced to adopt certain attributes and frames in the construction of a single issue (Lancendorfer & Lee, 2010). In this dissertation, the “how” question was answered by examining frames adopted and sources cited in media coverage. While frames and attributes are extensively studied in agenda-setting literature, sources have received little attention. According to Reese et al. (1994):

On the surface of news coverage lie the words and images about the issue, but the social and power structures imbedded in source and attributes reveal how the whole set-up, the “system” itself, is geared toward certain stories and points of views....

Although the media are often said to be powerful, in large part that power derives from media’s ability to amplify the view of certain powerful sources, such as

politicians, government, and other elites and elite organizations. No analysis of news media content is complete without a close look at the sources of that content (p. 87).

Sources, therefore, are important components of the media agenda. The media express views by allowing sources to express theirs (Reese, Grant & Danielian, 1994). Previous studies have found that the media commonly adopt officials (Wanta & Foote, 1994), candidates (Lancendorfer & Lee, 2010), think tanks and interest groups (Huckins, 1999), foreign countries (Manheim & Albritton, 1984) and corporate representatives (Kiousis et al., 2007) as sources in their stories. Those actors receive privileged access to newsrooms (Herman & Chomsky, 1988; Reese et al., 1994) and set the agenda for media and the public. Existing studies also found source adoption varies in different media organizations. For example, Marland (2012) found political leaders had more power to shape news coverage at small, local news outlets than at large, national news organizations. Geographical location also matters, as journalists who are geographically remote from power centers are more likely to be affected by political leaders' agendas than journalists who are distant from power centers (Dunn, 2009). Therefore, it is theoretically interesting for this dissertation to explore who different media outlets – two local and two national, two physically close to central government and two relatively remote – have cited as news source and how sources are different in each media outlet.

Intermedia agenda-setting. This dissertation used intermedia-agenda setting theory to examine intermedia relationships among traditional media outlets and between traditional and social media about the air pollution issue. Intermedia agenda-setting answers the question of “When the media sets the public agenda, who sets the media’s agenda?” (Rogers et al., 1993). It

depicts a dynamic news diffusion process, where the news agenda of one media outlet can influence the agendas of other outlets (Vliegenthart & Walgrave, 2008). Media tend to cover issues similarly, which is largely due to the “co-orientation” in the routinized news selection (Gans, 1979). Co-orientation is a process in which two or more individuals are simultaneously oriented based on the perception of the other’s view to achieve mutual interest (Broom, 2013). Back in days before audience analytics technologies, media professionals had little external criteria to examine the quality of their work. Thus, they relied on co-orientation to reduce uncertainty about what information was newsworthy. Today, the increasing competition for market share and click rates also fosters intermedia agenda-setting (Boczkowski, 2010; Plasser & Lengauer, 2010). Vonbun et al. (2015) summarized four major aspects of intermedia agenda-setting. First, intermedia agenda-setting depends on the production cycles of each media outlet (Shoemaker & Reese, 1996; Vliegenthart & Walgrave, 2008). Second, media differ in expertise and specialties, thus certain media are opinion-leaders on particular issues (Noelle-Neumann & Mathes, 1987). Third, the nature of issues also matters, as some topics are more obtrusive – readily in the public consciousness -- than others (Soroka, 2002; Zucker, 1978). Fourth, proximity between media outlets and issues can have an impact on journalistic co-orientation (Galtung & Ruge, 1965).

Studies have found that national newspapers tend to set the agenda for local newspapers (Reese & Danielian, 1989, Son & Weaver, 2006), and wires service news largely affects local news agendas (Gold & Simmons, 1965). Studies have shown mixed results of agenda-setting effects between broadcast outlets and newspapers. Generally, newspapers influence the agendas of broadcast stations (Vliegenthart & Walgrave, 2008), but Boyle (2001) found political ads on network news might set the agenda for major newspapers. Similarly, elite newspapers and wire

service copy influence tabloid newspapers (Gold & Simmons, 1965; Shaw & Sparrow, 1999), yet Kaltenbrunner's survey of journalists (2010) indicated that tabloid media also have the power to set the news agenda for other media outlets. With the rise of online news and social media, scholars have found newspapers set the agenda for internet bulletin boards (Lee et al., 2005), media outlets and blogs set agenda for each other (Heim, 2013, Wallstern, 2007), and mixed results in social media-traditional media agenda-setting (e.g., Kwak, Park, & Moon, 2010; Kushin & Yamamoto, 2010; Wallstern, 2007). The reasons for these mixed results will be discussed in greater detail in a later section, but these studies illustrate that agenda-setting theory has been a powerful and useful theoretical framework in the past and continues to be informative as it is applied to newer forms of media, such as social media. Therefore, this study will provide additional empirical evidence to test agenda-setting effect.

Media Agenda

This dissertation was based on the premise that the media agenda is constructed. Media are an essential element of an open and democratic society to provide and transfer information and, therefore, the media should be free, independent, and objective (Habermas, 1992). However, as Habermas later found out, in reality, the dominant model of the public media is one that is characterized by "the manipulative deployment of media power to procure mass loyalty, consumer demand, and compliance with systemic imperatives" (Habermas, 1992, p. 452). Media content is always affected by various interrelated factors, including politics, economics, culture, ideology, history, international relations, etc. News production is also the result of a hierarchy of influence from ideologies, nations, institutions, and newsroom routines (Shoemaker & Reese, 2011; Bocykowski, 2010).

Media representation of environmental issues. In this dissertation, media representation of environment issues was the focus of the research questions and hypothesis. Media are important social actors in the construction of environmental issues (Brown, Zavestoski, McCormick, Mandelbaum, & Luebke, 2001). The media play an important role in the communication of science and health information to the general public (Brodie, Hamel, Altman, Blendon, & Benson, 2003; Martinson & Hindman, 2005; Reagan & Collins, 1987). In addition to providing information to the public, the media also establish the salience and relative importance of environmental issues within a broader social context (Brodie et al., 2003). As discussed in previous sections, the media's coverage of social problems is a competitive process involving multiple institutions and groups with various motivations to identify, assign blame, and propose political solutions. All of this occurs within a limited space and time for attracting the public's attention.

Environmental issues are generally unobtrusive in the western context (Ader, 1995), meaning people do not encounter these issues in everyday life. Given that the topic is not involved in daily life and is not likely to generate immediate and personal threat, the public usually 1) lacks knowledge of the issue and relies on the media for information and 2) is largely influenced by the media's portrayal to know what the most salient problems are and how to think about those problems. Western research on environmental issues has a different context than environmental issues in China, where air pollution and other environmental issues are obtrusive, but the experiences drawn from this literature are still relevant to this dissertation. The above six key findings are relevant to the context of China to study environmental issues:

First, media frames of one environmental issue change over time (Henry & Gordon, 2001). For example, in the coverage of climate change, scholars have recorded the selective coverage of

scientific evidence in the media coverage between 1985 and 1990 and the decline of media attention on environmental issues in the following years till the climate change science and politics movement in 1995 (Carvalho, 2005). In the past 20 years, studies identify a tendency toward environmental coverage that focuses on specific events or particular cases, rather than extends to a wider socio-political context (Boykoff & Boykoff 2007; Boykoff & Roberts, 2007; Iyengar, 1990). Another example is the portrayal of nuclear power. At an early stage, media coverage portrayed it as an optimistic technology for military uses (Wynne, 1992; Rosa & Clark, 1999; Flynn, 2003). This frame changed after some major accidents, such as the 1957 Windscale fire in England, the 1979 Three Mile Island in the U.S., and the 1986 Chernobyl disaster in the former Soviet Union (Freudenburg & Rosa, 1984; Van der Pligt, 1992). After these problems with nuclear power, the media tended to cover that issue within the frame of concern, suspicion and as a potential risk to public life (Slovic, Flynn, & Layman, 1991; Kasperson et al., 2001).

Second, environmental issues are generally considered unobtrusive because most people do not spend much time in direct contact with pollution (Behr & Iyengar, 1985; Zucker, 1978). Unobtrusive environmental issues are generally framed as a problem and media cited political and professional elites', such as experts and government officials, to provide solutions to the problem. When the environment is related to obtrusive issues, such as health and medical issues, the media tend to downplay environmental factors contributing to the disease but to focus on personal factors such as diet and genetics (Brown et al., 2001). Accordingly, the public is left to assume that the environment is safe and only the individual is to blame for becoming sick.

Third, political economy factors affect media coverage of environmental issues. Literature from the U.S. suggest that the liberal-leaning media tend to depict climate change as a "Pandora's

box” that generates many complicated problems, while media leaning toward the right tend to adopt “money” and “scientific uncertainty” frames toward climate change coverage (Nisbet & Mooney, 2009). Media ownership and corporate finance also play an important role in editorial decisions. Media corporate interests and advertisers’ viewpoints increase the possibility of bias in media coverage. For example, a large part of newspaper revenue comes from oil companies, air travel, and cars (Monbiot, 2007). As a result, in the case of environmental coverage, oil and car companies have threatened television editors to withdraw ads when the television stations reported the linkage between gasoline consumption and climate change (Gelbspan, 2005). Scholars also have found strong connections between oil giants and think tanks that are skeptical of climate change (Gelbspan, 2004). For example, *Guardian* once revealed that the American Enterprise Institute, funded by Exxon Mobil, paid scientists and economists generously to write report and disseminate to media that undermine the release of an Intergovernmental Panel on Climate Change (IPCC) report (Sample, 2007). In addition, industry groups, special-interest lobbyists, and public relations companies are powerful institutions in the United States to manipulate scientific claims and exploit the news media (e.g. Antilla, 2005). Therefore, all these strategies have played significant roles in driving the direction of media coverage.

Lastly, journalistic routines create “reinforcing frames” in the coverage of environmental issues (Vasterman, 2005). “Reinforcing frames” mean that information that fits more easily into existing news frames are favored by journalists over those that generate new and unfamiliar frames (Hannigan, 2014). It is the product the pressure from vested interest groups to journalistic routines (Reese & Lewis, 2009). This practice has resulted in a biased account of climate change in the U.S. press. Media implied to the public that the scientific community is split on the issue (McCright &

Dunlap, 2003) while in reality almost all scientific experts believe climate change existed. Media frame also has amplified uncertainty among the public (Boykoff & Roberts 2007; Corbett & Durfee 2004; McCright & Dunlap 2003; Moser & Dilling 2004). A reinforcing frame also can be reflected in the choice of information sources. Journalists prefer to go to leaders of organizations and political parties as their prime sources of information. Therefore, institutional sources have an advantage in building relationships with reporters to get their side to the public. As Anderson (2009) put it, “control over the media is as much about the power to silence and suppress issues as it is to publicize them” (p. 173). The dominant voices will further cause the difficulty of the marginalized groups to get their message to the public (McAdam, McCarthy, & Zald, 1996).

To sum up, the portrayal of environmental issues is usually “confusing, chaotic and contradictory” (Ereaut & Segnit, 2006, p. 7). News is a version of reality shaped in significant part by journalistic norms and conventions, with reinforced and internalized frames suggested by features within journalistic texts. Although news is supposed to be a mirror to society, it is actually highly selective. This dissertation built on the same rationale to examine how traditional and social media presented the air pollution issue and what are the powers that shaped and guided news coverage.

Media environment in China. Political economy and constructionism scholars have long argued that media content and practice are largely affected by the joint power of economics and politics. Cultural studies scholars also address the interaction between media practitioners and political/economic factors, and how such interactions are embedded in the media discourse. The following section reviewed the trajectory of journalism in China over the last four decades, which reveals the changing dynamics among politics, economics, and media practitioners. It is important

to review the trajectory of Chinese journalism against the backdrop of party-market relations to interpret and locate more accurately the media coverage on the air pollution issue within the larger picture of the Chinese media environment. Also, understanding the explicit and implicit power dynamics behind the mass media is the first step to interpret media content and the interaction between media and the public.

For example, China's Open Door Policy – which ushered in access to foreign business in 1978⁶ -- started to expose China to a free market. This altered the relationships among state, market, and media practitioners. The first decade after the policy began marked the beginning of commercialization and marketization of media in China with a dual logic under play: The state wanted to stop financial support for some state-owned media and let them operate under market principles, but at the same time it still wants to continue to control and monitor these outlets (Zheng, 2007). The Open Door Policy brought state-owned media freedom in a way China had seldom enjoyed during the 10-year Cultural Revolution that end in 1976. Consequently, in the late 1980s, there was a growing trend for the media to critically reflect on the Cultural Revolution, or even the entire Chinese history and Eastern culture (Kinkley, 1985). This reflection was largely drawn from Western thoughts and philosophy. One example is the documentary made by China Central Television (CCTV) called “River Elegy” in 1988, in which the “river” refers to the “Yellow River,” the symbol of China. The entire documentary criticized Eastern civilization as conservative, silly,

⁶ The Open Door Policy refers to the new policy announced by Deng Xiaoping in December 1978 to open the door to foreign businesses. To boost economy and modernize industry after the Cultural Revolution, Special Economic Zones (SEZ) were set up in 1980 to attract direct foreign investments. It is also the start for the shift from centrally planned economy to free-market economy in China.

and outdated while praised Western civilization as advanced and scientific (Goldman, 2002). It indicated the only way for China to develop was to abandon traditional culture and learn from Western democracy (De Alice, 1989; Gifford, 2007). The longing for Western culture and the criticism and dissatisfaction toward domestic situations reached its peak in 1989, leading to the Tiananmen Square Protest starting April 15 (Gifford, 2007). The protest, also known as '89 Democracy Movement, was organized by college students aiming for democratic reforms against Party corruption as well as freedom of the press and of speech (McCormick, Shu & Xiao, 1992). However, the protest finally ended up as the June Fourth Incident, where the central government sent troops to stop the protest, leading to the arrest of student protesters and even the death of soldiers and protesters. Since then, the government has tightened its control over media and media practitioners. Market became the second priority.

The late 1990s to late 2000s was a golden period for journalists in China. The growing marketization trend with less political control provided the media with unprecedented opportunities. One example was the growing popularity of “investigative journalism” during that period (Wang & Lee, 2014). Investigative journalism, like the CBS news program *60 Minutes* in the U.S., aims to uncover official wrongdoings and shady business practices (Wang & Lee, 2014). Three reasons explain why investigative journalism became popular in that decade: First, the central government needed the media to keep an eye on local governments’ performance. Second, the state had changed the ruling strategy from “brain washing” people with positive news to utilizing choreographed investigative reports to ease social tension (He, 2000a). Third, investigative news leads to market success because it focuses on profound social issues that are of interest to the audience (Pan & Chan, 2009). Both state-owned and commercial news

organizations in China adjusted editorial and marketing strategies in this stage to cater to the audience (Pan, 2000). For example, *Southern Weekly* owned by Southern Daily News Group is the flagship investigative newspaper in China. It was considered the most outspoken newspaper at that time to promote public democratic debate (Tong & Spark, 2009). Its consumer-oriented entertainment news also attracted a large audience. For state-owned news organization, CCTV for example, established the News Commentary Department in 1994 and produced a number of in-depth journalistic programs such as *Oriental Horizon* and *Focus* that had profound impact on Chinese society (Li, 2002).

Investigative journalism, however, reflects an identity crisis for journalists in a market-driven and controlled media system. Trained within the liberal arts tradition, the younger generation of journalists expects media to be a powerful force fighting for social justice and a “watch dog” for government and business misconduct (Wang & Lee, 2014). Yet, the reality in China and in almost every country is that journalism faces censorship and information control implicitly and explicitly (Wang & Lee, 2014). As a result, media practitioners work innovatively and professionally in the party-market media system while they act on the judgment of public interest (Yang, 2008). Sometimes, they use different discourses to shape and legitimize their work under media and social reforms, which was labeled by some scholar as “the arts of resistance” (Scott, 1990)

During late 2000s and early 2010s, the relationship among market, politics, and journalists became what Pan (2010) described as “a state-controlled project in which the party-state authority and media practitioners embark on a joint adventure into some uncharted terrain” with “most of the changes constituting the reforms are characterized as steps by the authoritarian state to co-opt

market forces into its orbit in order to preserve the core of the party-press system” (p. 519). Media expansion at this stage focused on the consumer rather than the citizen side of the public. According to Pan (2010), “state authority and media practitioners negotiate how to manage the tension between market forces and the party-press system, or how to articulate the two” (p. 519). The media’s role, therefore, was more like state-own corporation rather than as open and inclusive public sphere.

Along this line, from the early 2010s to now, the connection between politics and capital tightened. Entertainment and commercialization became the first priority for media practitioners. In-depth and commentary news programs declined dramatically and were replaced by variety shows, talk shows, night shows and celebrity live shows. Celebrities, businessmen, and online grass-roots celebrities who gain fame by live streaming or posting videos of themselves online, were under the spotlight more frequently than ever, and the boundary among them became blurry. Instead of investigating problems within business and government, media organizations were more interested in achieving mutual benefits with government and business leaders (Yang, 2012). Market reaction was the only measurement for media program success. Consequently, the state-corporate mode had gradually kidnapped public interest and served to legitimize social stratification, tightened boundaries of social classes, neglected disadvantaged social groups, glorified wealth, and de-articulated equality and justice (Long & Li, 2017; Shao, 2014; Pan, 2010). Zhao (2008) also critically evaluated this process, as she witnessed the sharp decrease in coverage of rural China and the increasing trend of materialism in overall media coverage. According to Zhao, the change from a social-driven to a money-driven system is the result of the interest-based negotiation between media controllers and practitioners.

To sum up, media policy experienced several rounds of back-and-forth media policy changes. Within each round, there were more nuanced changing dynamics among government, the media, and the market as well. Currently, journalists face shrinking flexibility in their daily practices. On one hand, commercial media are even more market-driven and entertainment-oriented. Official media tend to cover the positive side of the government and society. News organizations become very careful when selecting topics for coverage. On the other hand, the audience tends to pay less attention to serious news or controversial social issues, unless they are relevant to their daily life. They seem to enjoy the entertainment media offer them. Given the current media environment, it is important to understand how an obtrusive social issue, such as air pollution, has been covered by news organizations at different level and discussed by the different social actors. The discourse would contribute to our understanding of current media environment.

Factors affecting the media agenda on air pollution. This dissertation presented and interpreted media agendas on air pollution; therefore, it was important to understand factors affecting the agenda. Media are generally strong supporters of environmental NGOs and their activities (Yang, 2005). It is partly because media are usually sympathetic to environmental movements and share structurally similar positions with environment organizations (Yang, 2005). Accordingly, environmental issues appear on the media agenda quite frequently, and the media tend to adopt a “civil rights” frame, which leans to the public side of how they are fighting for rights when covering environmental protests (Zhou & Yang, 2015).

On top of that, however, media coverage of environmental controversies cannot go beyond the tolerance of government, the bottom line of which is usually the threat to social and political stability. As a result, the media gradually figured out a strategy of “ritualizing” (Lee & Chen, 2010)

environmental issues: After judging the nature of the issue, only those fitting in the ritualized paradigm will get the coverage, and those that do not fit will not be considered. Consequently, issues within the safety zone will gain all the coverage and the emerging issues will always be connected with existing issues to emphasize the consistency (Zhou & Yang, 2015).

Media representation of air pollution issue. With a significant increase in the coverage of the air pollution issue in recent decades, the media has become a significant contributor to public understanding of scientific and technical controversies. Despite the fact that the topic is hotly discussed, only a few studies have examined the issue from the media perspective. Zeng, Dai, and Wang (2014) examined the inter-media framing contest and diffusion on PM2.5 coverage from 2011 to early 2013. They found state owned and commercial media highlighted different frames when covering the issue: While commercial media leaned to the citizen's side, state-owned media emphasized government action. They also found the "scientific frame" gained its salience at the beginning stage, and "fact" and "policy" frames were primed at later stages. Moreover, they found frame diffusion not only among media outlets but also between the media and the public: The media accepted a public agenda and transferred it into a formal media agenda. In other words, there is a dynamic between the media and the public that drives the coverage of air pollution issue.

Y. Chen (2014) examined the English language newspaper in China and demonstrated how the press discursively represents the involvement of Western countries on the issue of environmental crisis at different stages. According to Y. Chen (2014), at the very beginning when air quality was considered a mere weather phenomenon, only the voices of the press and the meteorological bureau were involved with no indication of local or foreign residents' opinions. Air quality, thus, was represented as a domestic weather condition. At a later stage where the

negative judgment of Western monitoring became predominant, government officials and Chinese experts became the main sources of opinions, while voices from the international community were still not found. With an air pollution incident attracting global media attention later on, the discussion finally became heterogeneous, which consists both domestic and international voices (Y. Chen, 2014).

The above-mentioned studies provide some insights into media coverage of the issue, yet this research either lacks an inclusive time period to track the entire trajectory, offers insufficient frames to depict the situation, or focuses on English language newspapers. To more fully examine the air pollution issue, China's social and cultural context should be taken into account, as scholars pose and frame research questions. Given that there are not many systematic studies about how the issue has been covered, this dissertation aimed to first answer the question of "what is the agenda?" by identifying media frames and attributes in the air pollution issue over the past five years. As suggested by second-level agenda-setting theory, the development of attributes is a process with contests and interaction and that involves political, economic and cultural factors. The question, therefore, will contribute to the understanding of the issue and changes in the media trajectory and illustrate unique social and political understanding.

Based on the literatures discussed above, I proposed the following research questions and hypotheses:

RQ1: What's the frequency of media coverage on air pollution from 2011 to 2015?

RQ2: What (a) frames were adopted over the five-year period and (b) how did those frames differ across the four selected media outlets?

H1: The media agenda on the air pollution issue changed over the five-year-period.

H2: Traditional media outlets would have a similar agenda over the air pollution issue.

RQ3: What are the sources (a) adopted over the five-year period and (b) by the four selected traditional media outlets?

H3: The selected media outlets adopted similar sources in their coverage of the air pollution issue.

Social Media Agenda

Agenda-setting in the age of social media. This dissertation also added to the literature by examining the agenda-setting theory in the domain of social media. Agenda-setting theory has been working well within the media-dominated public sphere where public opinion is largely formed from and manipulated by traditional media. The new media and Internet communication technologies keeps changing traditional ways of news production and consumption, altering forms of communication between the media and the public, and blurring the boundaries among audience, news professionals, and activists (Kaldor, 2003; Keane, 2003). Social networking sites, in particular, challenge traditional media outlets in their dominance of the public discourse. Social media, such as Twitter and Weibo, not only serve as a supplement to traditional news media but also challenge biased or distorted news reporting in traditional media.

Results of social media agenda setting are mixed. Some studies have found social media, such as Twitter, were more likely to follow the agenda set by traditional media (Groshek & Groshek, 2013). Some identified reciprocal relationships between social media and traditional media (Groshek & Groshek, 2010; Metzgar & Marrugi, 2009; Neuman, Guggenheim, Jang, & Bae, 2014, Vargo et al., 2014). Other studies have found social media have distinct agendas from traditional media (Neuman et al., 2014). Social media can circulate information “without having

to rely on traditional media to act as gatekeeper or fact-checker or moderator” (Metzgar & Marrugi, 2009, p. 152), which enables social media to be distinct from traditional media. As for agenda-setting effects on Weibo, studies found Weibo was able to set the agenda for traditional media in crises and specifically at the beginning stage of a crisis (Wu, et al., 2013). Later studies showed limited agenda-setting effects. For example, Jiang (2014) found some trending topics on Weibo but not others affected the agenda of China Central Television (CCTV), and Wang (2016) found businessmen, not traditional media, were agenda-setters on Weibo.

Reasons for the mixed findings are twofold. First, each study has slightly different focuses. Some targeted different social media platforms (Twitter alone or multiple social media platforms). Some compared different traditional media outlets (i.e. national newspapers, such as *The New York Times*, or local newspapers in a single state or city). Some studies considered different topics (single ordinary issue, single emergency issue, or multiple issues) or studied different time periods (from a week to a yearlong). These variations, not surprisingly, would lead to different results. For example, previous agenda-setting studies on social media mainly focused on one specific issue at a time, most of which were crisis news. Their results indicated that social media tend to set the traditional media agenda in moments of crisis, such as political scandal (Kim & Lee, 2006), elections, natural disasters (Cho & Shin, 2014), and emergencies (Bruns, Highfield, & Burgess, 2013; Kongthon et al., 2012). These issues easily captured public attention and discussions on social media. Therefore, the public was more likely to set the media agenda in those cases. However, crisis and political news usually lasts for a relatively short period of time, and public attention easily waxes and wanes. In contrast, communication scholars seldom study trending and

longer-lasting topics, such as employment, race, gender, and pollution (Twitter, 2015; Weibo, 2015).

Another theoretical problem with existing social media agenda-setting studies is that this research typically treats social media as one entity with a monolithic discourse, ignoring the dynamics of people on those platforms. In fact, various actors participate in the discussions on social media. Actors such as celebrities, business leaders, bloggers, and member of the general public have emerged as new opinion leaders, along with traditional opinion leaders like politicians, media-affiliated individual and public figures (Cho & Shin, 2014; Dubois & Gaffney, 2014; Leavitt, Burchard, Fisher, & Gilbert, 2009; Park, 2013; Parmelee, 2014). Therefore, the agenda-setting effects on social media platforms are not a linear process from traditional media or the reverse. It is more dynamic and complicated with various actors on social media platforms sharing and competing to set the news agenda. This dissertation aimed to track one non-crisis issue over a long period of time to capture more fully how agenda-setting operates on social media.

Opinion leaders and social media. The concept of opinion leaders was first defined by Katz and Lazarsfeld (1955) as “the individuals who were likely to influence other persons in their immediate environment” (p. 3). The construct of opinion leadership was rooted in voting behavior in that study (Lazarsfeld, Berelson & Gaudet (1948), where opinion dissemination followed the two-step flow theory from the mass media to opinion leaders and then to the general public. Traditionally, opinion leaders are those with higher social status and more social contacts (Katz & Lazarsfeld, 1955). The scale and density of social media networks are the catalyst to disseminate information. However, on social media, some of the characteristics of traditional opinion leadership no longer hold. For example, Chang and Kim (2011) found that 80% of the most popular

tweets in South Korea were created by ordinary individuals, rather than politicians and media professionals. Zheng & Shahin (2017) looked into tweets during the 2016 U.S. presidential debates and found tweets from celebrities, conservative activists, politicians, and traditional media outlets received the most retweets. This indicated grassroots individuals, together with traditional opinion leaders, were considered opinion leaders on social media. For Weibo, Wang (2016) examined the agenda-setting effects in both crisis events. Results showed businessmen were agenda-setters for the general public on Weibo; traditional media, however, played less of that role. Therefore, a large amount of evidences suggested more factors should be taken into account when deciding who are opinion leaders on social media.

Weibo and discussion of social issues. This dissertation focused on the social media platform Weibo. Due to the Internet censorship in China, major international social media sites, such as Facebook and Twitter, are blocked in mainland China. Weibo is the Chinese word for “microblog” and is equivalent to Twitter in terms of functions and message format. Weibo by far is one of the most popular social networking sites in China, with 222 million active users monthly by the end of 2015 (Weibo Report, 2016). Since it was launched by SINA Corporation in 2009, it has developed into a well-known sphere where Chinese netizens report, discuss, and critique current political systems, government policies, government officials’ scandals, and numerous social problems and internal contradictions.

One may question whether Weibo is free enough to allow deliberative discussion since it is completely confined within the Great Firewall of China. The truth is that it does offer a participatory platform where Chinese netizens gather and share information, build alliances, voice alternative perspectives and become empowered. The fundamentally transformative effect of

social media in China, such as Weibo, is “the emergence of a public sphere capable of eroding the ability of states to monopolize information and argument, of pushing for transparency and accountability, and of facilitating new networks across society” (Lynch, 2011, n.p.). Moreover, no one can block the Internet completely. There are various technological ways to jump the Great Firewall and be exposed to whatever information is available online. Netizens in China have managed to visit Twitter, Facebook, and many other blocked websites. They also share and spread this information on Chinese social-networking sites. Even if such information is banned for certain reasons, there will always be people who have access to the information and will spread it. In this sense, censorship in China is much less effective on the Internet than on the traditional media system. The information on Weibo can be as diverse as on other media platforms worldwide. Moreover, Weibo would play a more important role in disseminating information and influencing public opinion in China than in the West. Results of a survey of 2,503 Chinese journalists revealed that more than 90% of journalists consider news originating from social media valuable, and 50% of them regularly obtain news from Weibo (Dowell, 2010). This indicates that social media serve as a news database from which traditional media draw information (Luo, 2011; Wang, 2013). Social media also serve as a barometer of public sentiment. If a certain issue is extensively discussed on social media, then traditional media are legitimized to cover it even if the issue is sensitive (Luo, 2011). In addition, media trust has declined dramatically in recently years worldwide. Because of advanced Internet technology and the emergence of alternative information sources, such as WikiLeaks, the younger generation is exposed to more diverse information than any previous generation. As a result, they are knowledgeable about the manipulated political and media systems, and gradually turn away from consuming traditional news and instead turn to their

trusted sources for information (Bennett & Iyengar, 2008; Domingos & Richardson 2001; Hamilton, 2004).

Specifically, for the air pollution issue, existing literature from developed countries labels environmental issues as unobtrusive (Norton & Leaman, 2004; Poortinga & Pidgeon, 2003). This is because environmental issues such as climate change seldom have a direct effect on every individual's life. The air pollution issue in China, however, is obtrusive as it is closely related to everyday life, ordinary people's health, and life quality. Given the unique role of social media in China, the limited media trust and the obtrusiveness of air pollution issue, I expect the public agenda would be different from the media agenda and that criticism and cynicism arguments would be more frequent on Weibo than positive or objective statements, especially when the issues are related to government behavior. Therefore, the following research questions were asked and hypotheses posed:

RQ4: What is the (a) social media agenda over the five years and (b) what is the agenda for various actors on social media?

H4: Social media agenda on air pollution changed over time in the five-year period.

RQ5: What sources do actors on social media refer to when talking about air pollution on Weibo?

RQ6: Who are the (a) opinion leaders on social media in the discussion of air pollution and (b) what are the factors that predict social media opinion leadership?

RQ7a: What's the relationship between the traditional media and the social media agenda on air pollution issue over five years?

RQ7b: Are there intermedia agenda-setting effects among four traditional media outlets on air pollution issue over five years?

RQ7c: Are there causal relationships among different actors' social media agenda on air pollution issue over five years?

RQ7d: Are there causal relationships between traditional media and social media agendas on air pollution issue over five years?

Chapter 3 Methodology

In this dissertation, I conducted a quantitative content analysis of news stories ($N = 1,147$) and Weibo posts ($N = 4,045$) over a five-year period and coded them for a variety of frames and news sources, which will be explained in greater detail in this section. I adopted Granger's causality to test for causal agenda-setting effects between traditional and social media, which is a more rigorous statistical analysis than the more commonly used cross-lagged correlation. In this chapter, I will first explain the choice of time-period, which is the year of 2011 to 2015. Then I will move onto explaining the sampling and data collection methods for both news stories and social media posts. Next, I will introduce content analysis in detail, including how frames were defined, what sources were coded, and the calculation of inter-coder reliability. Finally, I will introduce Granger's causality in terms of what it is and how it is a more appropriate method to test agenda-setting effect, than cross-lagged correlations.

Time-Period

Both media coverage and public discussion data were collected during the five-year period between January 1, 2011, and December 31, 2015. The reasons for choosing this time period were twofold: First, it is the time period for the Twelfth Five-Year-Guideline⁷, which was debated in October 2010 at the 17th Central Committee of the Communist Party of China (CPC), and released by the National People's Congress on March 14, 2011. The 12th five-year-guideline is

⁷ Five-year-plan, or five-year-guideline, first launched in 1953, is a series of social and economic development initiatives shaped and finalized by the Communist Party of China and People's National Congress through the plenary sessions of the Central Committee and national congresses. The guidelines map strategies for economic development, set growth targets, and launch reforms. Regions will also launch their own five-year-guidelines with local characters and emphasis following the national version.

representative of China's efforts to rebalance its economy and support sustainable development. The plan also continues to advocate objectives set out in the Eleventh Five-Year Plan to enhance environmental protection. Therefore, collecting data for the complete five years gave a consistent and holistic sense of the development and changing coverage of the issue. Second, the air pollution issue first became salient among the media and the public in late 2011. As a result, the five-year-period was an appropriate time-period to examine the changing dynamics of the issue over time.

Sampling and Data Collection

To examine the news agenda on the air-pollution issue, news coverage from four newspapers was collected: *People's Daily*, *The Beijing News*, *Southern Metropolis Daily*, and *Science and Technology Daily*. Two factors decided the selection of newspapers: characteristics and locations of the newspapers. *People's Daily* is an official newspaper of the Chinese Communist Party, published nationally and worldwide with a circulation of 3 million to 4 million. Historically and also today, *People's Daily* represents the central government of China, and its coverage directly reflects government attitudes toward policy changes. Both *The Beijing News* and *Southern Metropolis Daily* are commercial daily newspapers circulating in Beijing of Northern China and the Guangdong province of Southern China, respectively. As the air pollution issue is usually more severe in the northern part of China, than in the southern part, the issue is less obtrusive in southern China. Also, north and south China have different media climates. Because the southern part of China is far away from the central government and is close to Hong Kong, the media climate in the south is more open and leans toward western-style reporting (So, 2008). As for *Science and Technology Daily*, it is the authority for science and technology issues

in China. Given the nature of the air pollution issue and its relevance to science, *Science and Technology Daily* was included in the sample.

To examine the social media agenda, Weibo (a Twitter-like social medium) was chosen as the platform. Chinese Internet users have reached 721 million (China Internet Network Information Center, 2016). Monthly active Weibo users have reached 313 million in China alone (China Internet Watch, 2016), which is almost the entire Twitter's active users worldwide (317 million) (Omnicores, 2017). Although in recent years, the rise of WeChat — a mobile-based social media application with a combination of functions, such as instant messaging, photo and video posting, and group chatting — has taken a large market share away from Weibo, Weibo is still the most popular and vibrant online discussion platform when it comes to public issues such as government policy making, government officials' scandals, and general social problems (Chao, 2010). More importantly, Weibo accommodates a variety of social groups on a single platform, including grass-roots organizations and activists, professionals in different areas, celebrities, government officials, and laypeople. Strangers can see each other's posts by searching for keywords or usernames, which largely increases the heterogeneity of discussion network. Since its launch in 2009, Weibo has been recognized as a promising public space for deliberative democracy in China (Reese & Dai, 2009). Weibo data, compared with other social media data, were more readily available. Therefore, Weibo provides an ideal example of Chinese social media platforms.

The keywords used to search for news articles in the four newspapers and on Weibo were PM2.5 and smog (*wu mai* and *mai*). Articles that contained either of the keywords were selected. PM 2.5 is the atmospheric particulate matter (PM) that has a diameter of less than 2.5 micrometers.

It is so small that it can get into the lungs and cause serious health problems; therefore, PM 2.5 has been widely used by environmental institutions in recent years as the indicator of air quality. China Core Newspapers' Full-text Database (CCND) was used to collect news coverage. In total, there are 1,048 stories about the air pollution issue in China in the past five years in the four selected newspapers, which is the whole universe. As for Weibo data, a computer-assisted method was used to assist with data collection. First, all pages with Weibo posts containing either of the keywords were retrieved on a weekly basis for all five years. Therefore, there were 260 weeks in total considered. Second, within each week, one page with keyword "PM2.5" and one page with keyword "smog" were randomly selected. Ten Weibo posts (which are equivalent to 10 tweets) were retrieved on each page. Relevant promotional content on Weibo were also included in the sample as commercial promotion is the major way commercial accounts talk about air pollution on Weibo. After irrelevant posts and bots-generated posts were eliminated, the sample resulted in a total of 4,045 Weibo posts, which are equivalent to 4,045 tweets. These Weibo posts were manually coded for the study.

Content Analysis

Defining frames. The unit of analysis in this study was the news article and the Weibo post. One of the aspects I coded for was media frames. As explained in the literature review, media outlets select some aspects of a perceived reality and make them more salient in communicating text, in such a way as to "promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" (Entman, 1993, p. 52). Frames reflect the underlying, implicit meaning in the context of a text. In this study, traditional media frames were

summarized and generated from news articles on the air pollution issue, and social media frames were identified in Weibo posts that discuss the air pollution issue.

The study applied a combination of inductive and deductive approaches to identify the frames and attributes. On the deductive side, an initial codebook was developed based on existing literature ((Beck, 1992; Gamson & Modigliani, 1989; Reese & Lewis, 2009; Zeng, Dai & Zheng, 2014). New frames were added during the coding process through an inductive process of review of 10% of the articles and posts. Accordingly, eight mutually exclusive frames were identified in both traditional news articles and social media posts. See appendix for detailed examples.

1. “War on pollution” frames

As addressed in the literature review, Premier Li Keqiang declared a “war on pollution” in 2014. Messages under this frame mainly focused on the importance or seriousness of the air pollution issue, or the confidence, responsibility, or determination to solve the problem. Weibo posts, such as “the air pollution became so serious that schools are shut down under the red alert of polluted air in Winter Beijing,” exemplified this frame because the “red alert” directive showed how serious an issue air pollution is. Coded in this frame were also news articles on government shutting down over-polluted factories and environmental departments holding conference to address the pressing air pollution issue all belonged in this frame.

2. Science frame

Inspired by the risk society theory (Beck, 1992) and existing studies on news coverage of environmental issues, a “science” frame was considered a major frame in this study. Messages under a “science” frame provide scientific and professional definitions of air pollution;

explanations about air pollution measurements; the differences between air pollution indices used in China and the U.S.; different interpretations of numbers, reasons, and solutions for air pollution problem. Under this frame, media and the public confront rumors by offering scientific explanations and proofs from environment authorities, such as scientists, researchers, or environmental professionals. News articles explaining the difference between PM2.5 and PM10, how gas consumption adds up to air pollution, why winter is more polluted than summer, and how to choose air purifier all belonged in this category.

3. Achievement

News coverage and Weibo posts under this frame usually have an emphasis on accomplishments and achievements after policies were carried out. For example, stories or posts about how the PM2.5 value has dropped in the last year, how many trees have been planted since certain policy were carried out exemplified this frame. At the same time, this frame also included stories and posts that expressed optimism that air pollution is being solved.

4. Public accountability and government trust frame

Gamson and Modigliani (1989) developed a “public accountability” frame when studying the framing of nuclear power, and I employed that frame in this study. The public accountability frame addressed confusion over the issue as officials/government/interest groups are hiding truth from the public. In the case of air pollution, as a counter frame of science frame, the “public accountability” frame emphasized the lack of trust over official data and statements. In order to solve the problem, the government should boost its credibility, providing room for public

engagement, according to this frame. News articles and Weibo posts criticizing the government not for publicizing PM2.5 data or manipulating data illustrated this frame.

5. Progress and development frame

The “progress” frame reflected the common belief that scientific advancement will lead to social progress (Nisbet, Brossard, & Kroepsch, 2003; Weaver, Lively, & Bimber, 2009). In Gamson and Modiglian’s (1989) study on framing nuclear power, the “progress” frame considers nuclear power as a technical development that can bring economic benefits to the public. In the context of air pollution, the problem is framed as a necessary and inevitable consequence of industrialization and urbanization. The air pollution issue is discussed together with society’s commitment to technological development and economic growth. This frame also highlighted achievements toward solving air pollution by comparing current data to past records or international standards. It stated that people cannot separate the pollution problem from the economic achievement and improved life quality in past decades. This frame tried to fit the air pollution issue into a bigger picture of the 12th five-year plan, relating the problem to economic growth, energy structure change and sustainable development. Stories comparing the air pollution in London with Beijing also belonged to this frame, because those stories tend to spread out the message that the pollution is inevitable and will eventually go away when the economy is well-developed.

6. Humanity/Personal interests frame

Messages under this frame focused on personal and human interests aspects. Usually, specific cases or stories were highlighted under this frame, and there was always a person involved

in the message. Examples of how a person would be involved in this frame are: a child who is diagnosed with asthma because of bad air quality; a pregnant women who miscarried because of the pollution; construction workers who must work outside under heavy pollution.

7. Public engagement frame

This frame focused on how citizens are engaged in various aspects of solving the air pollution issue, such as searching for the cause of air pollution and designing methods to measure the level of air pollution. For example, the following illustrated this frame: A college student developed his own method to monitor air quality; residents voluntarily ride bicycles instead of driving cars to work.

8. Weather forecast frame

Messages under this frame treated air pollution as an air condition. Media adopted forecast-style reporting, and posts in Weibo usually contained the PM2.5 real-time data, or expressed personal emotion under polluted weather conditions. Emotional expressions under this frame usually were phrased in the ways such as “Smog makes my mood so bad today.”

Source. A large part of the media’s power derives from its ability to amplify the views of certain sources (Reese, Grant, & Danielian, 1994). Therefore, looking at the source of the content was important to examining the essential players or range of views on the topic. Based on existing literature (Reese, Grant & Danielian, 1994; W. Chen et al., 2017; Zeng, Dai, & Zheng, 2014), the following sources were coded for the presence or absence in the context of air pollution issue:

- Government officials

- Environment experts, including experts from universities, research institutes, and professional environmental institutions.
- Environment activists
- Corporate representatives
- Media professionals
- Foreign sources, including foreign media and government
- General public.

Inter-coder reliability. To assess the reliability of the coding instrument across the three coders, an inter-coder reliability coefficient, Cohen's Kappa, was calculated based on 100 (roughly 10% of the amount of the data) non-study news articles and 200 Weibo posts (roughly 5% of the amount of the data). The non-study content were news articles and Weibo posts about air pollution in 2016, which is not in the study but is similar to the study content (Lacy, Watson, Riffe, & Lovejoy, 2015).

Two journalism majors who are fluent in both Chinese and English coded the sample. The training process lasted for a month with four rounds of testing until the coders reached consensus over how to operationalize the definition of frames. Among the variables, frames received Cohen's Kappa values, ranging from .78 to .88. Specifically, the coefficients were: .79 for "war on pollution," .80 for "science," .84 for "achievement," .87 for "public accountability," .82 for "progressive and development," .78 for "humanity," .88 for "public engagement," and .88 for "weather forecast." Cohen's Kappa coefficients ranged from .79 to 1.00 for sources. Specifically, the values were: .80 for government officials, .82 for environment experts, .79 on environment

activists, .93 for corporate representatives, .90 for media professionals, .80 for foreign sources and 1.00 on general public. Although the minimum requirement for Cohen's Kappa is generally .80, the values can be as low as .67 for exploratory coding and for coding in multi-year content analyses and still be considered reliable, according to Lacy and Riffe (1996), Lacy, Riffe, and Randle (1998), and Riff, Lacy, and Fico (2014). Given the exploratory nature of this study, the intercoder reliability with a minimum of .78 was deemed acceptable.

Opinion leadership. Opinion leadership on Weibo was operationalized as the number of forwards (retweets) a person had.

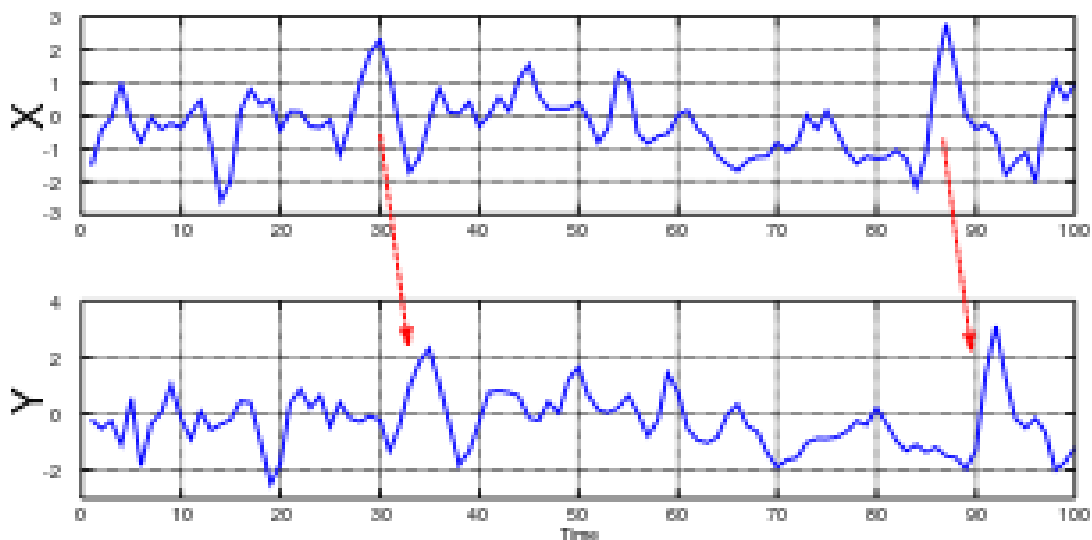
Granger's Causality Test

To test agenda-setting effects among newspapers and between newspapers and social media, Granger's causality was adopted for statistical analysis. Granger's causality is a statistical concept of causality usually adopted in time series analysis. Granger's causality was widely used in economics in the 1960s and has become a popular statistical tool in social science fields within the last few years. In the field of mass communication, a number of studies have used Granger causality tests for causal correlations in agenda-setting studies (Brosius & Kepplinger, 1990; Meraz, 2011; Peng, 2014; Neuman et al., 2014; Walgrave, Soroka, & Nuytemans, 2008). Compared to cross-lagged correlations, which researchers often use to assess relationships between time and agendas, Granger causality analysis provides more accurate results because it calculates the time span needed for a specific study. The calculation is based on Akaike information criterion (AIC) and Bayesian information criterion (BIC) values, which are the criteria commonly applied for lag selection in Granger causality tests (Beckett, 2013; Wang, 2016). In agenda-setting studies, it takes traditional media several weeks to months to set the public's agenda

(McCombs, 2004). With the influence of Internet, the agenda-setting effects can take place more quickly, normally around seven days or less (Neuman et al. , 2014). Therefore, this study used Granger causality analysis to first determine the proper time lag for this study and then to explore agenda-setting effects between the media and opinion leaders on Weibo.

Figure 3.1 shows how Granger's causality works. According to Granger's (1969), if past values of X predict Y beyond the information in past values of Y alone, then we say variable X can "Granger-cause" Y .

Figure 3.1. Illustration of Granger's causality test



For example, if the study assumes that the coverage on *People's Daily* on air pollution issue could "Granger cause" the news agenda of *The Beijing News*, it will first test to what extent will the discussion on *People's Daily* can be predicted by the discussion in previous days. Then it will test how well *The Beijing News's* agenda on the same issue can be predicted by *People's Daily's* in previous days. If the latter is more significant than the former, we can conclude that

People's Daily Granger causes *The Beijing News's* agenda on air pollution issue, which means *People's Daily* sets the agenda for *The Beijing News*.

Chapter 4 Results: Traditional Media Agenda on Air Pollution

Media Attention on Air Pollution Issue 2011-2015

Research question one asked about the amount of attention given by the media to the air pollution issue from 2011 to 2015. In total, 1,147 news articles on air pollution were analyzed in four media outlets over the five-year period. Figure 4.1 showed the frequency of news stories published in four newspapers on air pollution along the five-year-period. *Southern Metropolis Daily* published most on the air pollution issue each year and over the five years ($N = 457$), followed by *Beijing News* ($N = 286$), *Science and Technology Daily* ($N = 240$) and *People's Daily* ($N = 164$) over the five-year-period. Figure 4.2 reveals the frequency changes from 2011 to 2015. There were 94 news stories in 2011, which increased to 214 stories in 2012. Attention to the issue reached its peak in 2013 ($N = 370$) and continuously declined in 2014 ($N = 263$) and 2015 ($N = 206$).

Specifically, in 2011, 94 stories were published, with seven from *People's Daily*, 32 from *Beijing News*, 46 from *Southern Metropolis Daily*, and nine from *Science and Technology Daily*. In 2012, 214 articles were about air pollution with 36 from *People's Daily*, 41 from *Beijing News*, 104 from *Southern Metropolis Daily*, and 33 from *Science and Technology Daily*. The year 2013 produced the largest number of stories. Sixty-eight were published in *People's Daily*, 88 on *Beijing News*, 145 in *Southern Metropolis Daily* and 69 on *Science and Technology Daily*. The year 2014 had 263 stories, 34 coming from *People's Daily*, 60 from *Beijing News*, 92 from *Southern Metropolis Daily*, and 77 from *Science and Technology Daily*. The number in 2015 dropped to 206. *People's Daily* published 19 stories, *Beijing News* published 65 articles, *Southern Metropolis*

Daily published 70 and *Science and Technology Daily* had 52. While other outlets reduced the number of stories in 2014 and 2015, *Science and Technology Daily* was the exception that covered the issue most intensively in 2014.

Figure 4.1. Number of stories on air pollution in four newspapers

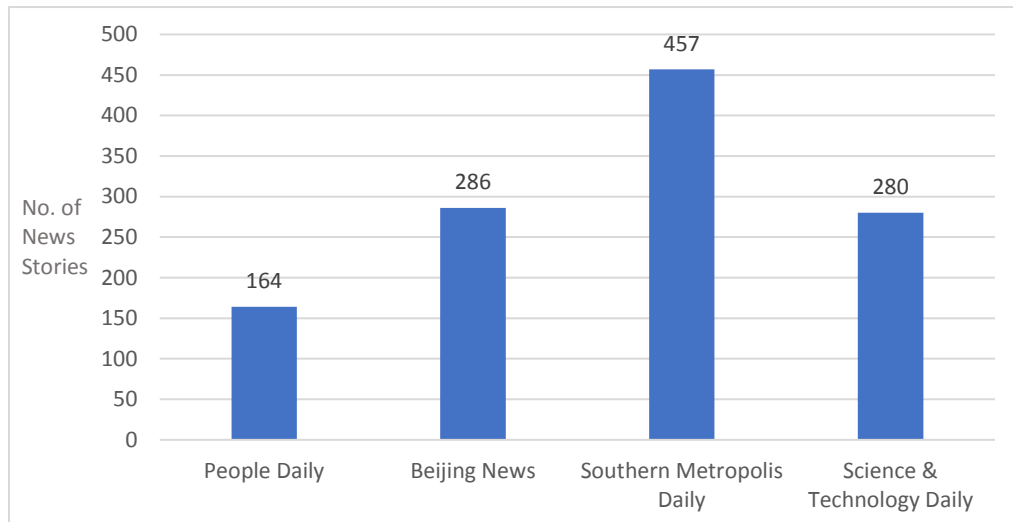
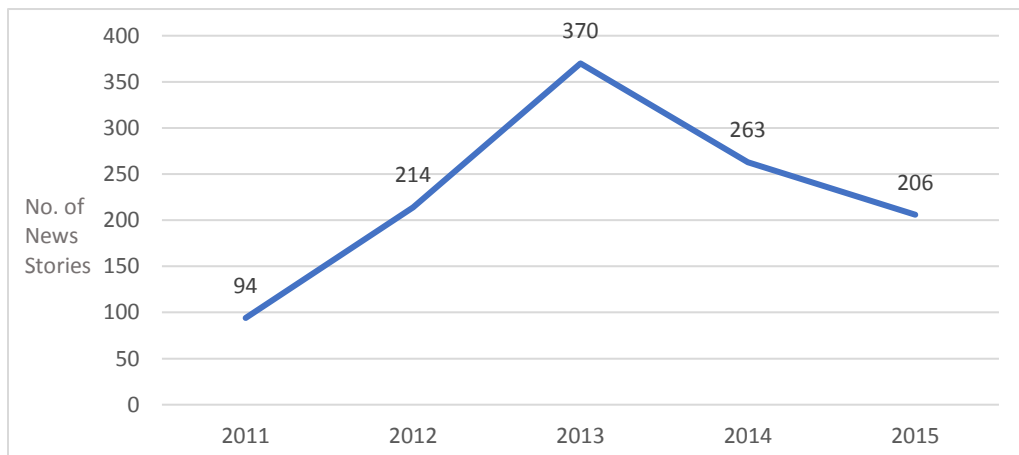
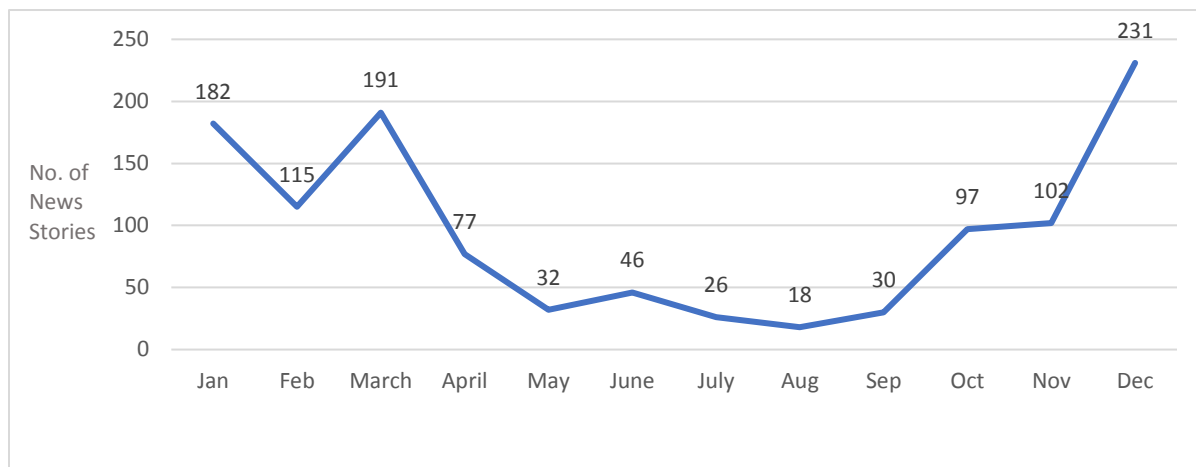


Figure 4.2. Number of stories on of air pollution, 2011-2015



Attention to the air pollution issue also varied by month. Figure 4.3 and 4.4 show the variations of media coverage frequency over the 12 months. The air pollution issue received the most coverage in winter months than in other months. Specifically, October to March received the largest amount of coverage. This is understandable, as air pollution gets serious in winter and early spring. When the temperature drops down, air circulation slows, so it becomes harder for the dust in the air to move and disappear, leading to more pollution. Also, the air pollution mostly comes as a result of coal burning. The cold winter months are when more coal is burnt, which leads to increased levels of carbon monoxide, PM10 and PM2.5.

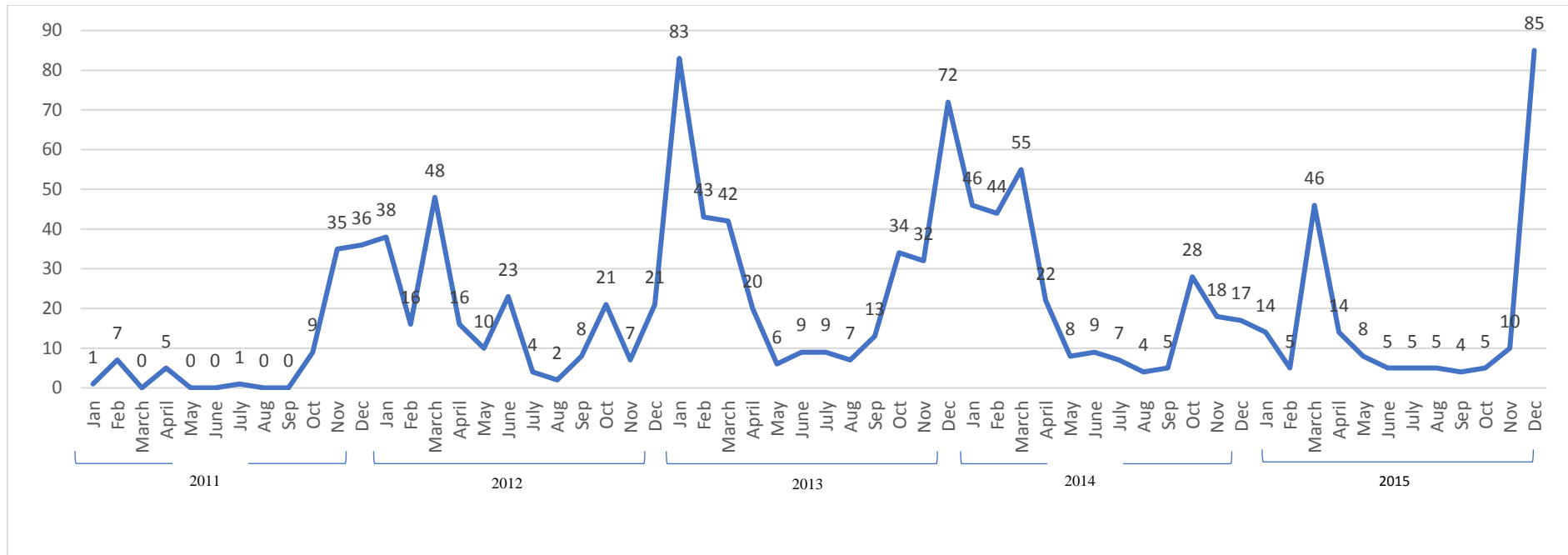
Figure 4.3 Frequency of news coverage on air pollution by months



Another interesting pattern was: The frequency of coverage increased in March every year. The possible explanation is: March is the time when the “two sessions” – National People's Congress (NPC) and National Committee of the Chinese People's Political Consultative Conference (CPPCC) – are held annually. During the “two sessions,” legislation proposals, annual government and budget reports are announced and voted upon. Environmental issues are among the most high-profile topics in recent years (Xinhua Insight, 2013; Economic Information, 2014;

Weibo, 2015) and usually hold the media and public's attention right before and after the "two sessions" (Luo, 2011). This may explain why media coverage spiked during this period.

Figure 4.4. Frequency of news coverage of air pollution by months, 2011-2015



Frames Adopted in News Stories

Research question two asked about what frames were adopted over the five-year period (RQ2a) and how that differed across the four selected media outlets (RQ2b). Overall, of the eight frames, the “war on pollution” frame was the most salient one ($n = 432$). The “science” frame ranked the second ($n = 271$), and “publicity and government trust” ranked the third ($n = 177$). The rest were “weather” ($n = 70$), “public engagement” ($n = 52$), “achievement” ($n = 40$), “humanity” ($n = 20$), and “development” frame ($n = 7$). Variations existed along the years and among different media outlets.

To answer research question 2a, Figure 4.5 and 4.6 presented frame adoptions over the years. In 2011, most news was covered under the frame of “publicity” ($n = 39$). When the U.S. Embassy in Beijing began to publish air-quality data on its official Twitter account, it started the debate on the legitimacy of a foreign country publishing data of another country and whether the Chinese government should publicize air quality data on its own.

The controversy over the U.S. Embassy publicizing China’s air-quality data reached a peak in June 2012, when the vice minister of the Chinese Ministry of Environmental Protection criticized the U.S.’s behavior – in releasing Chinese air-quality data -- as “against the Vienna Convention on Consular Relations and environmental regulations in China” (People’s Daily, 2012, n.p.). The Chinese government continued to use its own Air Pollution Index (API) that excluded the PM_{2.5} measure. The national debate on air pollution in 2012 focused on publicity and government accountability regarding the PM_{2.5} issue, as well as the seriousness of the issue and measurement details. Therefore, in 2012, the dominance of the “publicity” frame became more

salient ($n = 99$), with “war on pollution” and “science” frames increasing as well ($n = 66$, $n = 23$, respectively).

In 2013 however, the “war on pollution” frame went up dramatically and dominated that year’s news coverage ($n = 161$). The “science” frame also greatly increased and ranked second ($n = 111$). The frame of “weather” ($n = 34$) increased slightly while the publicity frame dropped dramatically ($n = 24$). With air pollution becoming a salient issue in 2013, major cities in China began to post PM2.5 air-quality data publicly to citizens. Both central and local governments had listed air pollution as a major problem of that year, and set ambitious goals for three-to-five years. Consequently, publicity became less of a discussion when central and local governments declared the “war on pollution.” At the same time, with data publicity, there was increased discussion of pollution measurement and other related scientific issues.

The years 2014 and 2015 in general followed the same pattern as 2013, with “war on pollution” and “science” frames dominating the news discourse, despite the decline in frequency. “Publicity,” “war on pollution,” “science,” and “weather” frames were more frequently adopted in news stories on the air pollution issue, and the other four frames were used less often. Over the five-year-period, the “public engagement” frame consistently increased, and the “achievement” frame began to increase since 2013. The adoption of a “humanity” frame fluctuated over the years with more adoption in 2013 ($n = 6$) and 2015 ($n = 10$). The “development” frame was seldom adopted along the five years.

Figure 4.5. Frequency of frames adopted in news stories on air pollution issue, 2011-2015 (Top four frames)

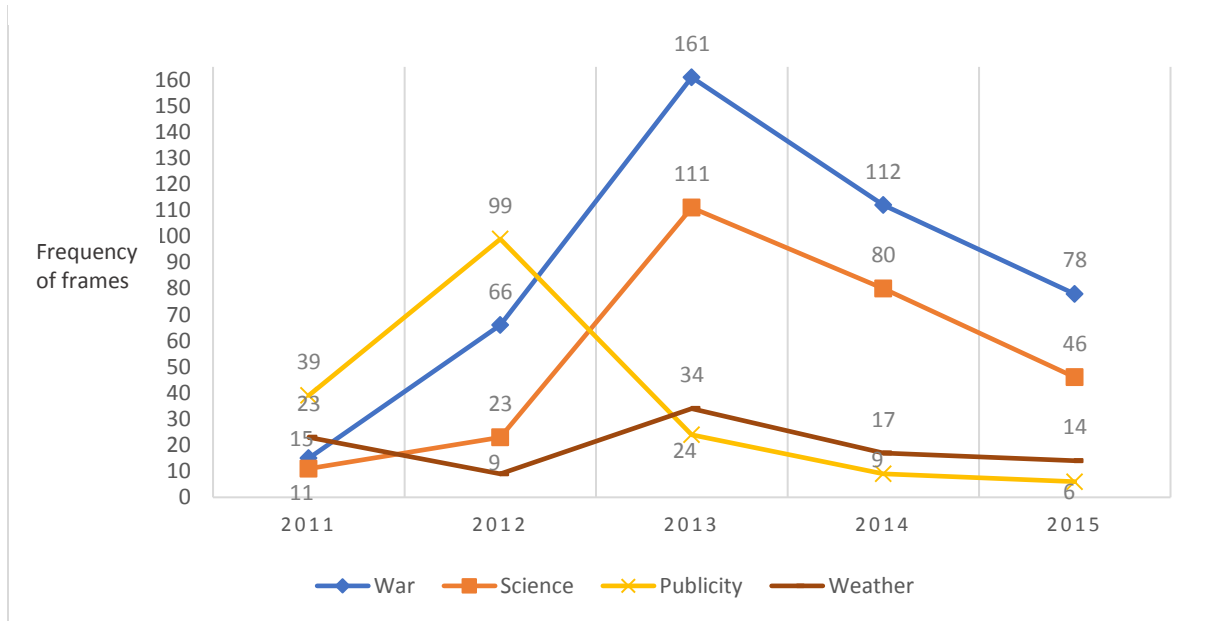
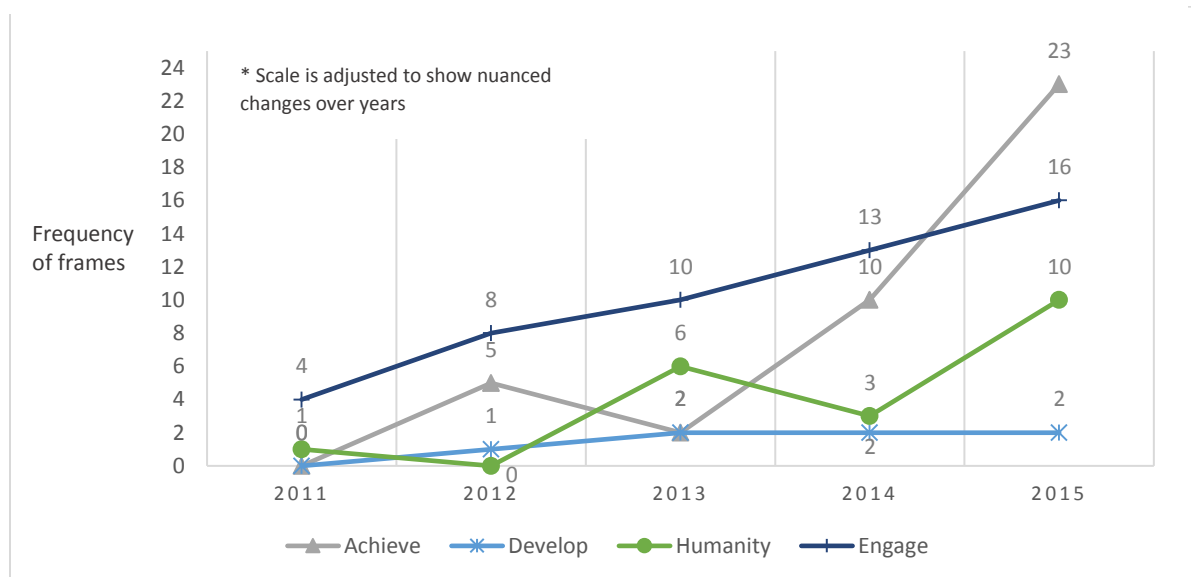


Figure 4.6. Frequency of frames adopted in news stories on air pollution issue, 2011-2015 (Rest four frames)



Hypothesis one predicted that the media agenda on the air pollution issue would change over the five-year-period. Spearman's Rho correlations showed the frame adoption from 2011 to 2015. In 2011, the traditional media agenda significantly correlated with the agenda in 2012 ($r = .84, p < .01$). From 2013 to 2015, the agendas of the three years also significantly correlated with each other (2013 and 2014, $r = .91, p < .01$; 2014 and 2015, $r = .83, p < .01$; 2013 and 2015, $r = .91, p < .01$). Therefore, H1 was supported. Results indicate that there was a shift in media's agenda on the air pollution issue in the year 2013 (see Table 4.1).

Table 4.1. Spearman's Rho correlations of frames adopted by four media outlets

	2011	2012	2013	2014	2015
2011		.84**	.25	.46	.18
2012			.39	.56	.43
2013				.91**	.91**
2014					.83**
2015					

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

In answer to RQ2b, Figure 4.7 and 4.8 presented the frequency of frames adopted by each of the four media outlets. For the frame of "war on pollution," *People's Daily* had 58 stories falling into this frame, *Beijing News* has 87, *Southern Metropolis Daily* had 182, and *Science and Technology Daily* had 105. The "science" frame had 35 stories coming from *People's Daily*, 69 from *Beijing News*, 68 from *Southern Metropolis Daily*, and 99 from *Science and Technology Daily*. For news stories under the frame of "publicity," 44% came from *Southern Metropolis Daily*; *People's Daily* and *Beijing News* also contributed 37 and 43 stories, respectively. *Science and Technology Daily* had 19 pieces framed under "publicity." The two commercial daily newspapers,

Beijing News and *Southern Metropolis Daily*, had more stories framed under “weather” and “humanity” than *People’s Daily* and *Science and Technology Daily*. As for the frame of “achievement,” *Beijing News* had 20 stories under this frame, *People’s Daily* had 13, while the other two outlets had only three and four. As for the “public engagement” frame, *Southern Metropolis Daily* had 31 stories framed under public engagement, outweighing the other three news outlets, which had four, 11, and five respectively. “Development” was the frame seldom adopted by the four outlets.

Figure 4.7. Frequency of frames adopted on air pollution issue in four media outlets (Top four frames)

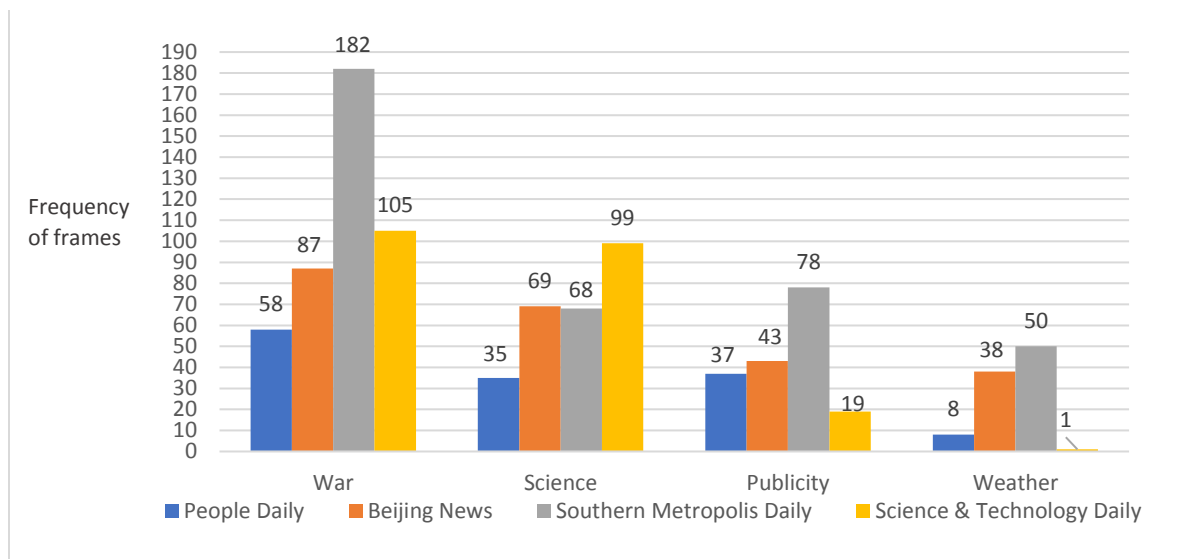
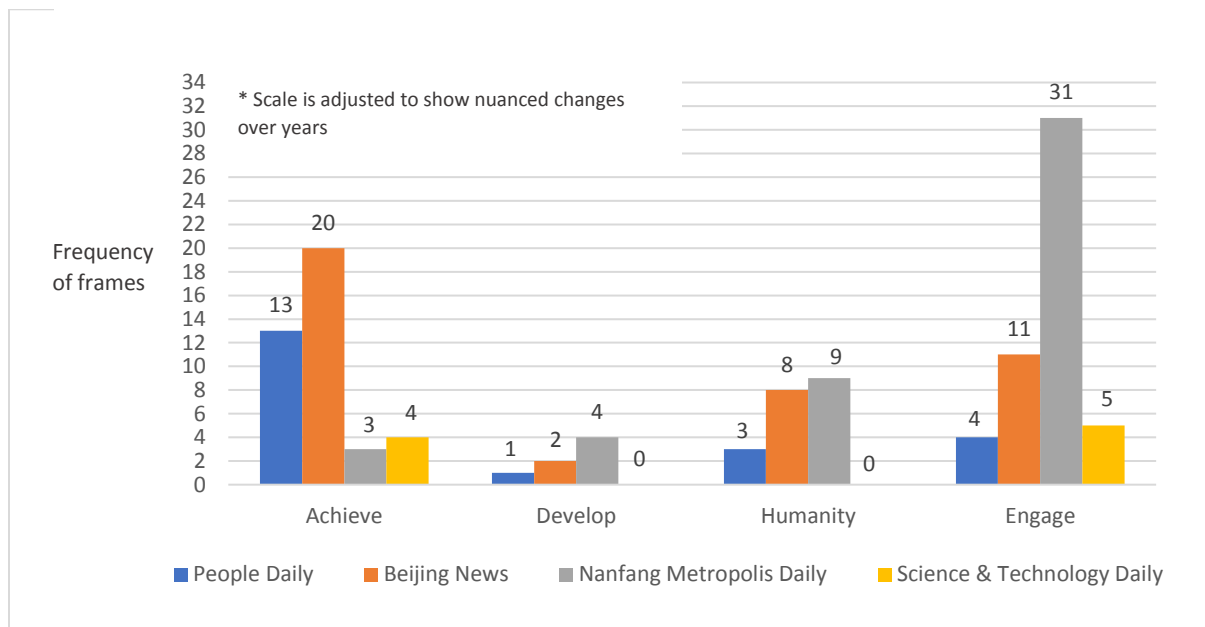


Figure 4.8. Frequency of frames adopted on air pollution issue in four media outlets



All the four media outlets adopted the “war on pollution” frame the most (Table 4.2). For *People’s Daily*, 35% of news stories adopted the “war on pollution” frame, 23% adopted “publicity,” 21% went under “science,” followed by “achievement,” “weather,” “public engagement,” “humanity,” and “development” frames. *Beijing News* has 30% of its coverage under the “war on pollution” frame. This was followed by “science” (24%), “publicity” (15%), weather (13%), achievement (7%), public engagement (4%), humanity (3%) and development (1%). News from *Southern Metropolis Daily* was dominated by “war of pollution” frame as well, followed by “publicity,” “science,” “weather,” “public engagement,” “humanity,” “development,” and “achievement” frames. *Science and Technology Daily* had most of its coverage under the frames of “war on pollution” and “science,” taking up to 85% of the total amount of coverage.

Table 4.2. Ranking of frames adoption by four news outlets on air pollution

Rank	People Daily (%)	Beijing News (%)	Southern Metropolis Daily (%)	Science & Technology Daily (%)	Total (N)
1	War of pollution (35)	War of pollution (30)	War of pollution (40)	War of pollution (44)	432
2	Publicity (23)	Science (24)	Publicity (17)	Science (41)	271
3	Science (21)	Publicity (15)	Science (15)	Publicity (8)	40
4	Achievement (8)	Weather (13)	Weather (11)	Other (3)	177
5	Weather (5)	Achievement (7)	Other (7)	Engagement (2)	7
6	Other (3)	Engage (4)	Engage (7)	Achievement (2)	20
7	Engage (2)	Humanity (3)	Humanity (2)	Weather (0)	51
8	Humanity (2)	Other (3)	Development (1)	Humanity (0)	97
9	Development (1)	Development (1)	Achievement (1)	Development (0)	52
Total	164	286	457	240	1,147

To conclude, the “war on pollution,” “science,” and “publicity” frames were the most frequent ways in which the newspapers covered air pollution. Among the four media outlets, *People’s Daily* had the most diverse frames in their coverage while *Science and Technology Daily* has the least varied adoption of frames. The two commercial newspapers stood in the middle.

H2 predicted that traditional media outlets would have a similar agenda over the air pollution issue. Spearman’s Rho correlations (Table 4.3) showed that media agendas from four newspapers significantly correlated with each other. *People’s Daily* and *Beijing News* has a stronger correlation with each other among others ($r = .94, p < .001$). The agenda in *People’s Daily* also correlated with the agenda in *Southern Metropolis Daily* and *Science and Technology Daily* ($r = .75, p < .05$; $r = .85, p < .01$, respectively). *Beijing News’* agenda had a moderate correlation with *Southern Metropolis Daily* and *Science and Technology Daily* in their agenda towards air pollution (both $r = .79, p < .05$). *Southern Metropolis Daily* also moderately correlated with

Science and Technology Daily in their air pollution coverage ($r = .80, p < .05$). Therefore, H2 was supported⁸.

Table 4.3. Spearman's Rho correlations of frames adoption by four media outlets

	People's Daily	Beijing News	Southern Metropolis Daily	Science and Technology Daily
People's Daily	-	.94***	.75*	.85**
Beijing News		-	.79*	.79*
Southern Metropolis Daily			-	.80*
Science and Technology Daily				-

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

News Source Adoption in Traditional Media

Research question three concerned sources traditional media referred to in their coverage on air pollution. In answer to RQ3a, over the five years, government sources always dominated the news story sources, followed by expert sources. Specifically, as shown in Figure 4.9 and 4.10, in 2011, 55% of sources came from the government, 25% from experts, 8% from activists, 6% from the media, 4% from the public, and 3% from corporations and businesses. In 2012, government sources reached the peak of 66%, expert source dropped to 20%, activist sources dropped to 3% and media sources dropped to 2%. Public and corporation sources increased by 1% each. In 2013, government source continued to drop to 42% while expert sources increased to 30%. Activist sources continue to drop as well, while corporation, public, and media sources slightly

⁸ Follow up with the correlations, t tests were also conducted but no significant differences were found (People's Daily, $t = 1.83, p = .09$; Beijing News, $t = 1.76, p = .08$; Southern Metropolis Daily, $t = 1.71, p = .08$; Science and Technology Daily, $t = 1.85, p = .10$).

rose. Foreign sources appeared for the first time in 2013. In 2014, the pattern of sources was similar to the pattern in 2013, except corporation sources reached a peak of 14%. In 2015, government source rose again to 52%, and expert sources dropped to 22%. Other sources slightly changed.

Figure 4.9. Percentage of sources adopted on air pollution issue, 2011-2015 (Top four sources)

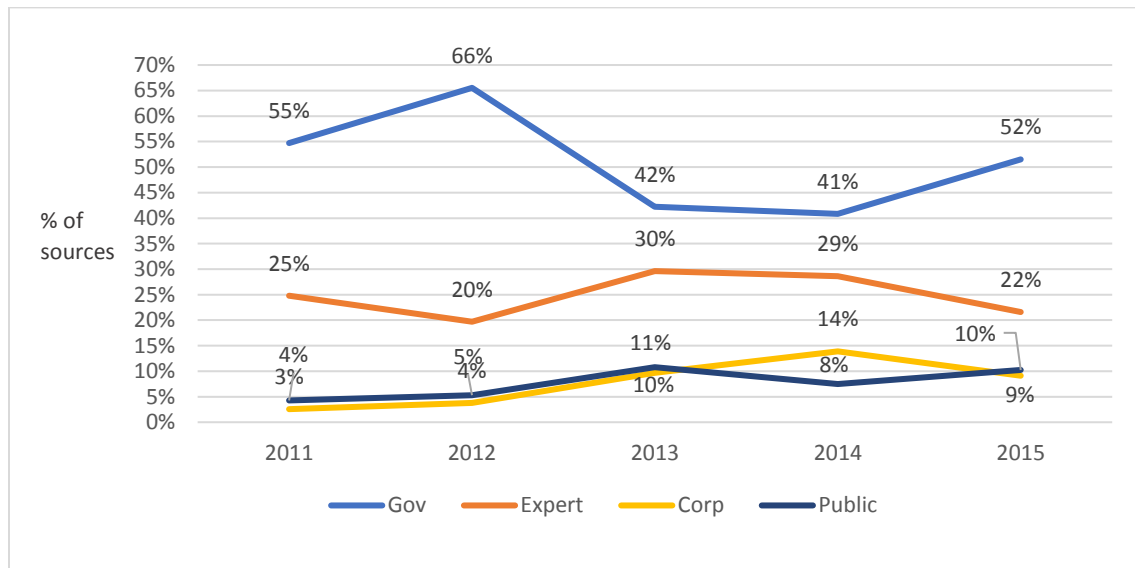
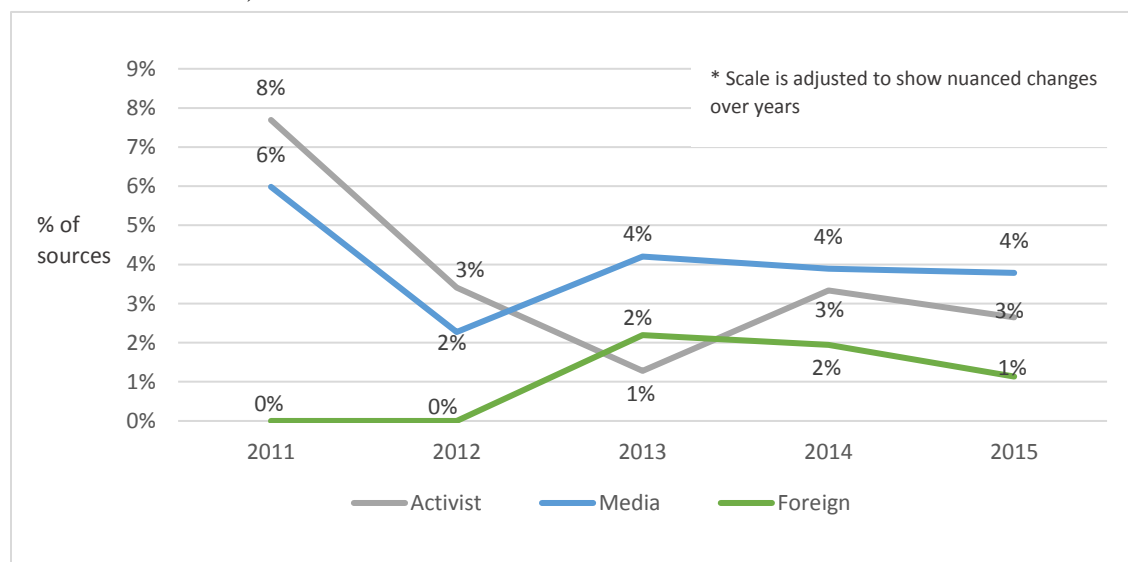


Figure 4.10. Percentage of sources adopted on air pollution issue, 2011-2015 (Rest three sources)



In answer to RQ3b, Figure 4.11 and 4.12 presented sources adopted by the four news outlets. Overall, government and expert sources were adopted the most by all four outlets. For the *People's Daily*, government sources dominated its information source, taking up to 65% of all cited sources. Another 22% were expert sources. Public sources only took 5%, and other sources were even less. In *Beijing News*, 47% of its sources came from the government, and 25% from experts. Compared with *People's Daily*, *Beijing News* had slightly more sources coming from the public (8%), media (8%), corporations (7%), activists (3%), and foreign sources (2%). *Southern Metropolis Daily* had the largest number of public sources (12%) among the four newspapers. Compared with *Beijing News*, which is also a commercial daily newspaper, *Southern Metropolis Daily* adopted more expert sources (25%) and corporation sources (10%) and slightly more activist and government sources (4% and 48%, respectively). At the same time, 3% of *Southern Metropolis Daily's* source came from media. *Science and Technology Daily* had 42% of its sources from the government, 38% from experts, and 13% from corporations. It had the largest percentage of sources from corporations among the four newspapers.

Figure 4.11. Percentage of sources adopted in four media outlets (Top three sources)

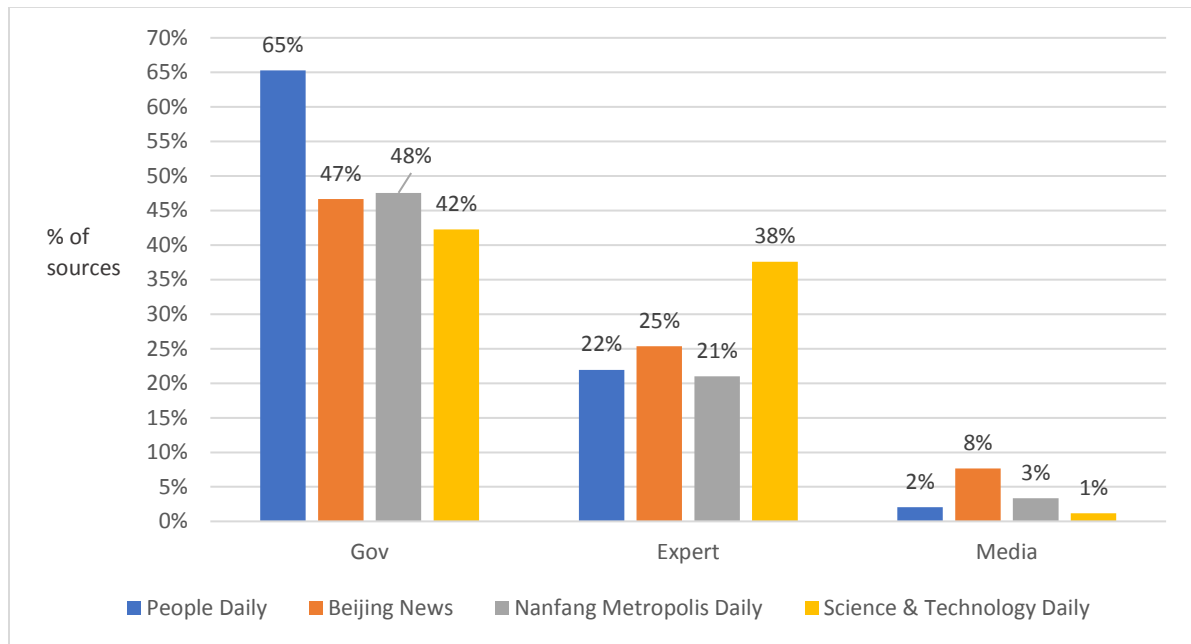
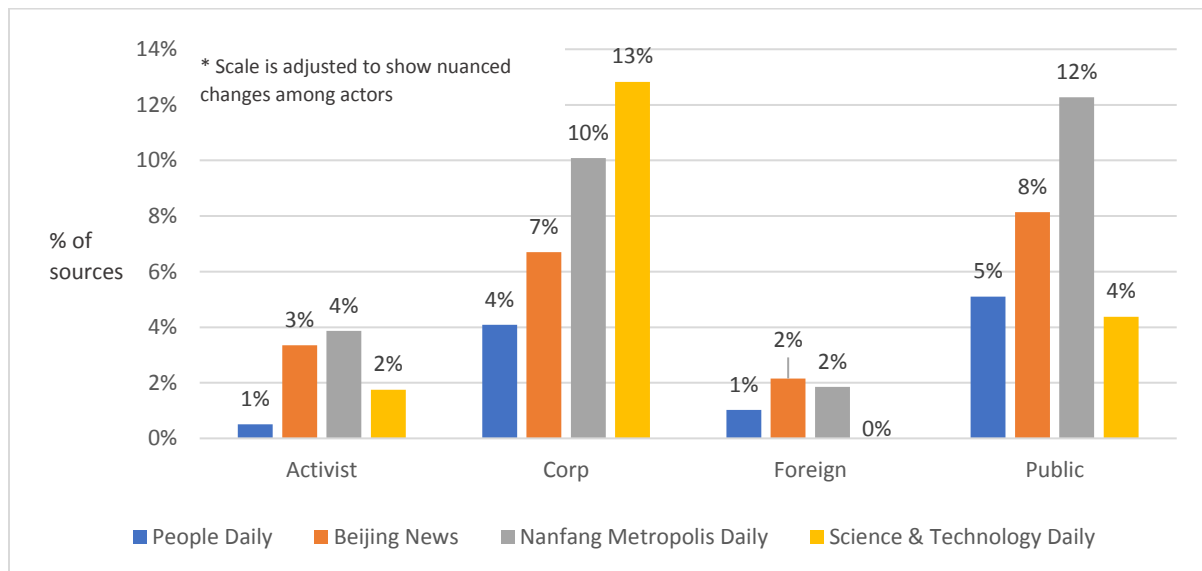


Figure 4.12. Percentage of sources adopted in four media outlets (Rest four sources)



H3

predicted that selected media outlets adopted similar sources in their coverage of the air pollution issue. Spearman's Rho correlations (Table 4.4) showed that *People's Daily* significantly correlated

with *Beijing News* ($r = .93, p < .01$), *Southern Metropolis Daily* ($r = .94, p < .01$) and *Science and Technology Daily* ($r = .90, p < .01$) in selection of sources. *Beijing News* also significantly correlated with *Southern Metropolis* and *Daily Science and Technology Daily* in source selection ($r = .85, p < .05$ and $r = .79, p < .05$, respectively). *Southern Metropolis Daily* had a strong correlation with *Science and Technology Daily* as well ($r = .96, p < .001$). Therefore, H3 was supported. These findings are very similar to the homogeneity among the newspaper issue agendas found in the seminal Chapel Hill, North Carolina, agenda-setting study, which firmly anchored agenda-setting as a prominent mass communication theory (McCombs & Shaw, 1972).

Table 4.4. Spearman's Rho correlations of source selection by four media outlets

	People's Daily	Beijing News	Southern Metropolis Daily	Science and Technology Daily
People's Daily	-	.93**	.94**	.90**
Beijing News		-	.85*	.79*
Southern Metropolis Daily			-	.96***
Science and Technology Daily				-

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

To sum up, this chapter examined news coverage about the air pollution issue from 2011 to 2015. The chapter focused on changes in media frames and source adoption over five years and across four media outlets as frames and sources show how the media represents social reality. There are five major findings from this chapter. First, the number of news stories varied across years and news outlets. The year 2013 saw the most coverage of air pollution the most, and the

commercial newspaper, *Southern Metropolis Daily*, had the largest number of news stories about the issue. Second, the coverage fluctuated over the course of my study period. Specifically, news stories increased in winter months and during the period of National People's Congress Annual Conference and decreased in summer months. This indicated that the air pollution issue became more salient in news coverage when it was obtrusive (either the air quality is worse in winter or the issue was brought up during the conferences). Third, media frames over the issue were quite consistent, but the emphasis of news coverage changed over the years. In 2011 and 2012, the media focused on "publicity" and "government trust" frames when reporting on air pollution. In 2013 to 2015, the media focus shifted to "war on pollution," and the frame of "achievement" increased in 2015. This is possibly due to the fact that more policies have been carried out at different level of governments since 2013. I found the "public engagement" frame was also on the rise during the five-year-period, but the percentages remained small, compared to other frames. Fourth, frame adoption was quite consistent across the four media outlets with "war on pollution," "science," and "publicity" frames dominating. However, there were differences across media when I examined details of the coverage. For example, *People's Daily* and *Beijing News* put more emphasis on "achievement," while *South Metropolis Daily* tended to be slightly more focused on "public engagement." Fifth, my findings are revealing about source adoption. *South Metropolis Daily* used more sources from the public, and *Science and Technology Daily* employed more sources from corporations compared with other media outlets. However, the newspapers I studied in general tended to choose government as their priority source, followed by experts, such as scientists and researchers.

Chapter 5 Results: Social Media Agenda on Air Pollution Issue

Social Media Agenda Over Five Years

Research question four asked about the social media agenda over the five years (RQ4a) and among various actors (RQ4b). Table 5.1 presents the frames used on Weibo to describe the air pollution issue over the last five years. In general, about one-third of Weibo posts on air pollution adopted the frame of “weather”. People posted the air quality data and photos on Weibo as a way to raise awareness of the issue. The frame of “war on pollution” ranked the second, taking up to almost 20% percent of the entire sample of Weibo posts. “Science” ranked third, taking up to more than 10% of the total amount of posts, and it was followed by the frames of “humanity,” “publicity and government trust,” “public engagement,” “development,” and “achievement.”

Over the five years between 2011 and 2015, the frame of “weather” was most frequently adopted while “achievement” and “development” frames were least frequently adopted on Weibo (Table 5.2). In 2011, the “war on pollution” ranked second, followed by the frames of “science,” “publicity,” “humanity,” and “public engagement.” In 2012, the frame of “war on pollution” fell to third place, and “publicity” was fourth. Following them, the frame of “science” ranked fifth out of nine frames. “Public engagement” and “humanity” ranked sixth and seventh respectively. In 2013, the frame of “war on pollution” was still the second most salient frames in online discussion of air pollution. “Humanity” ranked the fourth, “science” was fifth and followed by “public engagement.” The frame of “publicity” started to lose popularity and dropped to the seventh place out of nine. The online discussion of air pollution in 2014 and 2015 followed similar patterns.

The “war on pollution” was the frame used most besides “weather” and “other.” The “science” frame took fourth place, “humanity” fifth, “public engagement” sixth, and “publicity” seventh.

Table 5.1 Frames for air pollution on Weibo, 2011-2015

	Frequency	Percentage
Weather	1,221	30.8
Others	781	19.7
War on pollution	698	17.6
Science	423	10.7
Humanity	292	7.4
Publicity & Gov. Trust	266	6.7
Public engagement	224	5.6
Development	58	1.5
Achievement	38	1.0
Total number of Weibo	<i>N</i> = 4,032	100.0

Table 5.2 Percentages of frames for air pollution on Weibo by year, 2011-2015

Rank	2011	2012	2013	2014	2015
1	Weather (43.7)	Weather (31.4)	Weather (24.9)	Weather (28.4)	Weather (31.0)
2	War on pollution (22.2)	Other (18.1)	War on pollution (24.3)	Other (21.6)	Other (18.3)
3	Science (13.5)	War on pollution (13.8)	Other (16.4)	War on pollution (18.4)	War on pollution (11.1)
4	Publicity (11.1)	Publicity (12.1)	Humanity (10.3)	Science (12.2)	Science (9.6)
5	Other (9.8)	Science (9.2)	Science (9.4)	Humanity (8.5)	Humanity (8.7)
6	Humanity (3.7)	Public engage (8.6)	Public engage (6.4)	Public engage (6.4)	Public engage (5.3)
7	Public engage (1.6)	Humanity (5.2)	Publicity (5.7)	Publicity (2.3)	Publicity (4.1)
8	Achievement (0.4)	Development (1.2)	Development (2.3)	Development (1.4)	Achievement (2.5)
9	Development (0.3)	Achievement (0.4)	Achievement (0.3)	Achievement (0.9)	Development (1.9)

H4 argued that the social media agenda on air pollution would change over time in the five-year-period. However, Spearman's Rho correlations (in Table 5.3) further revealed the consistency of the social media agenda over five years, as all the correlations were significant. Specifically, the social media agendas from 2013 to 2015 were strongly correlated with each other ($r = .97, p < .001$; $r = .95, p < .001$, and $r = .98, p < .001$, respectively). Therefore, H4 was rejected.

Table 5.3 Spearman's Rho correlation among frame adoption across years

	2011	2012	2013	2014	2015
2011		.85**	.80**	.80**	.82**
2012			.83**	.88**	.87**
2013				.97***	.95***
2014					.98***
2015					

Actors on Social Media in Discussion of Air Pollution

As discussed in the literature review, social media platforms are not single-user platforms. Rather, various actors interact and form a dynamic discourse. RQ4b focused on agendas by different actors on social media. Table 5.4 presents the actors involved in the air pollution discussion. More than 68% of actors were laypeople, who are ordinary Weibo users, and the rest were verified accounts. Among the verified accounts, 15.3% were from verified individuals, 6.4% from media accounts, 3.5% from commercial accounts, 3.2% from government, and 2.5% from other non-government and non-profit organizations.

Table 5.4 Actors on Weibo discussing air pollution, 2011-2015

Account Type	Frequency	Percentage
Laypeople	2,716	68.4
Verified individual	607	15.3
Verified Media	254	6.4
Verified Commercial	138	3.5
Verified Government	126	3.2
Verified Organization	99	2.5
Cannot Determine	92	2.3
Total number of Weibo	<i>N</i> = 4,032	100.0

When associating actors with frames, for laypeople the frames they used very frequently were “weather” (36.7%) and “other” (20.1%). The “war on pollution” frame was in third place (15.5%). The “science” frame was fourth (7.8%), followed by “public engagement” (7.6%), “publicity” (5.9%), “humanity” (4.5%), “development” (1.3%), and “achievement” (0.5%). For verified individual accounts, “war on pollution” ranked first, followed by “other,” “weather,” “science,” “public engagement,” “publicity,” “humanity,” “development,” and “achievement.” For government accounts, the priority frame used in air pollution discussion was “weather,” followed by “war on pollution,” “science,” “publicity,” “achievement,” “public engagement,” “humanity,” and “other.” When commercial accounts discussed air pollution issue on social media, 23.2% of their content did not have a specific frame. The “weather” frame was adopted the most for commercial accounts, which took up 19.6% of their content. The “science” frame ranked the third with 18.8%, followed by “war on pollution” (12.3%), “humanity” (7%) and the “public engagement” (7%). “Publicity” “development,” and “achievement” ranked seven to ninth as frames for commercial actors. As for media actors, 31.6% of their content was framed as “war on pollution,” 24.5% as “science,” followed by publicity (9.9%), “public engagement,” “humanity,” “weather,” “other,” “achievement,” and “development.” For nongovernmental organizations (NGOs), 25.3% of their content were framed as “war on pollution,” 20.2% as “public engagement,” followed by “science” (9.9%), “publicity,” “weather,” “other,” “achievement,” “humanity,” and “development.” It is worth noticing that NGOs were the only group of actors who used “public engagement” as the frame in more than 20% of their content. (Table 5.5)

Table 5.5 Percentage of frames on air pollution by different actors on Weibo, 2011-2015

Rank	Government	Commercial	Media	NGOs	Verified person	Layperson
1	Weather (43.7)	Other (23.2)	War on pollution (31.6)	War on pollution (25.3)	War on pollution (20.6)	Weather (36.7)
2	War on pollution (22.2)	Weather (19.6)	Science (24.5)	Public engagement (20.2)	Other (19.3)	Other (20.1)
3	Science (11.9)	Science (18.8)	Publicity (9.9)	Science (19.2)	Weather (18.5)	War on pollution (15.5)
4	Publicity (7.9)	War on pollution (12.3)	Public engagement (8.7)	Publicity (11.1)	Science (14.5)	Science (7.8)
5	Achievement (4.8)	Humanity (8.0)	Humanity (6.3)	Weather (11.1)	Public engagement (8.9)	Public engagement (7.6)
6	Public engagement (4.8)	Public engagement (8.0)	Weather (5.9)	Other (7.1)	Publicity (8.4)	Publicity (5.9)
7	Humanity (2.4)	Publicity (5.8)	Others (5.5)	Achievement (3.0)	Humanity (6.9)	Humanity (4.5)
8	Other (1.6)	Development (3.6)	Achievement (4.7)	Humanity (1.0)	Development (2.1)	Development (1.3)
9	Development (0)	Achievement (0.3)	Development (2.0)	Development (1.0)	Achievement (0.3)	Achievement (0.5)

Spearman's Rho correlations revealed associations among actors in terms of how frames were adopted. The government agenda was significantly related to the NGOs' agenda ($r = .72, p < .05$). The commercial actors' agenda was significantly associated with agendas of both verified personnel ($r = .83, p < .01$) and laypeople ($r = .90, p < .01$). The media agenda was significantly related to NGOs in their agenda on air pollution ($r = .88, p < .01$), and the NGOs' agenda was

significantly correlated with the agenda of verified personnel's ($r = .67, p < .05$). Verified personnel's agenda strong correlated with laypeople's agenda ($r = .93, p < .001$). (See Table 5.6)

Table 5.6 Spearman's Rho correlation among Weibo actors in their adoption of frames

	Government	Commercial	Media	NGOs	Verified Personnel	Layperson
Government		.30	.62	.72*	.53	.57
Commercial			.30	.28	.83**	.90**
Media				.88**	.57	.40
NGOs					.67*	.53
Verified Personnel						.93***
Layperson						

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Source Selection by Actors on Social Media

RQ6 focused on what various actors refer to as sources when talking about air pollution on Weibo. Spearman's Rho correlations (in Table 5.7) showed only two significant correlations among actors in their choice of sources. Government accounts referred to sources similarly as media did ($r = .85, p < .05$), and verified personal accounts' source selection was significantly correlated with laypeople's source selection ($r = .84, p < .05$).

More specifically, Chi-squares showed the above mentioned six types of actors differed in the frequency of which they referred to government sources, expert sources, activist sources, corporation sources, media sources, and mobile application sources (in Table 5.8). Government accounts referred to government sources the most (31.7%), compared with other actors on social media. Other sources such as activists and corporations were rarely mentioned. The media also

cited government sources quite extensively (24%), but they cited media sources (29.1%) the most among others source types. Commercial actors did not refer to sources as often as the media and government actors, but when they did, corporation sources were cited the most (9.4%), followed by experts (6.5%), and mobile applications (5.1%). As for NGOs on social media, they cited media sources the most (12.1%). Activist sources were cited the second most often by NGOs (7.1%), and they cited activists the most among all actors. For both verified personal accounts and laypeople's accounts, mobile apps were the most cited sources in their tweets (8.9% and 8.4% respectively). They relied on mobile apps for news updates and more importantly, for weather forecast and air pollution data.

Table 5.7 Spearman's Rho correlations among actors in adoption of sources

	Government	Corporation	Media	NGOs	Verified Personnel	Layperson
Government		-.04	.85*	.28	.71	.54
Corporation			-.04	-.49	.11	-.08
Media				.41	.58	.38
NGOs					.27	.64
Verified Personnel						.84*
Layperson						

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Table 5.8 Cross-tabulations of sources by actors on Weibo

		GOV	Corporation	Media	NGOs	Verified Personnel	Layperson
Source	Government (Chi-square=339.81, $p < .001$)	31.7%	2.9%	24.0%	6.1%	5.9%	3.2%
	Expert (Chi-square=32.21, $p < .001$)	7.1%	6.5%	10.2%	4.0%	6.9%	3.7%
	Activist (Chi-square=17.87, $p < .01$)	0.8%	2.9%	0.8%	7.1%	2.1%	1.8%
	Corporation (Chi-square=52.71, $p < .001$)	0.8%	9.4%	3.9%	1.0%	2.1%	1.4%
	Media (Chi-square=234.81, $p < .001$)	9.5%	2.9%	29.1%	12.1%	6.8%	4.6%
	Mobile App (Chi-square=28.27, $p < .001$)	1.6%	5.1%	1.6%	5.1%	8.9%	8.4%

Opinion Leaders on Social Media

Opinion leaders come from the theory of two-step flow of communication (Katz & Lazarsfeld, 1957), and they are people who have more influence on people's opinions, actions, and behaviors. On social media like Weibo, the number of forwards (which is equivalent to “retweets”

on Twitter) is one of the most straightforward indicators of opinion leadership, as getting more forwards suggesting a more central position in the social network, attracting more attention and opinions getting more circulated and agreement (W. Chen et al., 2017).

RQ6a asked who are the opinion leaders on social media in the discussion of air pollution. Table 5.9 and 5.10 presented the most influential actors in Weibo discussions of the air pollution issue over the five-year-period. Among the 25 actors who are the top 1% of all the sampled Weibo users in terms of the number of forwards they get, 56% of them are verified personal accounts, 20% are commercial accounts, 16% are media accounts, and 8% are NGOs accounts. It is interesting to notice that neither government nor laypeople's accounts appeared in the top 1% of actors on Weibo. Among the 14 verified personal accounts, six were Internet personalities (three fashion bloggers, three professional bloggers), three were businessman, two were writers, one is a professor of economics, one was a professional game player, and one was an Olympic champion.

Table 5.9 Top 1% Opinion leaders on air pollution issue on Weibo

Actor type I	Actor type II	Number of actors
Business corporation	Commercial account	5
Media	Media account	4
Individual	Business man	3
	Fashion blogger	3
	Professional	3
	Writer	2
	Professor	1
	Game player	1
	Olympic champion	1
NGOs		2
Total		25

Table 5.10 Most forwards of Weibo posts on air pollution issue

Actor	Actor category	Weibo post	Forwards	Comments	Likes
王冉 CEO Ran Wang, CEO	Verified personnel-Businessman	今晚十点，北京PM2.5: 490。北京初雪的地面上、墙上、树上、窗上，处处写满了三个大字：有毒害，有毒害，有毒害，有毒害，有毒害，有毒害，有毒害，有毒害，有毒害，有毒害...北京，中国，该放慢脚步，好好收拾收拾自己了。就算过去穷怕了，也不能为钱不要命啊！ Tonight at 10pm, Beijing PM2.5: 490. The first snow in this city seems to tell us one thing: The air is poisonous, poisonous, poisonous, poisonous, poisonous.....Beijing and China, you should slow down your pace and self-reflect. Even if you are afraid of going back to poverty again, you should not sacrifice people's life for money!	2,846	677	
天 猫 无 限 Tmall Mobile	Commercial	#鼻尖下的中国# 空气质量差，PM2.5无处不在，天猫将于7月9日启动空净机万人团，7月13日更多惊喜！现在关注@天猫无线，转发本微博，同时@ 3名好友，赢取1980元亚都空气净化器！进入空净专场>> http://t.cn/zW5rMtM # Smell of China. Under the bad air condition and serious PM2.5 pollution, Tmall.com will launch the promotion on air purifier on July the 9th! There are more surprise on July 13th! Now follow @Tmall Mobile and forward this Weibo post, you will have the opportunity to win the air purifier worth RMB 1,980! Click in to the promotion: http://t.cn/zW5rMtM	17,566	17,692	
韩志国 Zhiguo Han	Verified personnel-Businessman	【北京印象】三里屯的疯，工体的浪，国贸的装逼不重样；CBD的富，大裤衩的装，亦庄的员工最受伤；东直门的饭，天通苑的床，上地的加班最他妈的长；西三旗的灰，回龙观的土，北六环适合测PM2.5；南三环的穷，德胜门的堵，挤地铁的孩子得练武。	2,341	240	6

Table 5.10 Most forwards of Weibo posts on air pollution issue (Con't)

		[Impression of Beijing] People hanging around Sanlitun, Gongti and National Trade Center always show off pompously and stupidly; People living in Shangdi usually work hard and overtime; The north part of Beijing is always dusty, more polluted and is the good place to monitor PM2.5; People living in South Beijing are relatively poor and suffer from heavy traffic.			
绿盾口罩 Green protection mask	Commercial	【看视频赢绿盾PM2.5口罩】100次墨粉高压冲击、水蒸气透气测试，绿盾PM2.5口罩完胜！时尚外观设计与高科技技术完美结合，实验论证活动只此一次。只要关注康纶纤维，观看视频、写下图片中问题的答案，@康纶纤维+三名好友，就有机会获得美国Nelson实验室检测验证的绿盾PM2.5口罩。 http://t.cn/zldLoB9 A combination of fashion design and high technology with hundreds of time of scientific experiments by Nelson Lab in the U.S., Green PM2.5 protection mask is the best! Watch the video, answer the question and @Kanglun fiber technology, you will have the opportunity to win Green protection mask.	2,043	1,081	2
李想 Xiang Li	Verified personnel - Businessman	推荐两款空气净化器。1、美观实用：飞利浦AC4076（3600元），CADR250，是最漂亮的空气净化机，没有之一；2、高性价比：飞利浦AC4016（2200元），CADR224。都是最高55平米，采用了新的HEPA集成滤网（4147），500多元，最糟糕的状况半年需要换一次，滤网购买方便。过滤甲醛、笨、PM2.5的效率99%以上。 Recommend two air purifiers: 1: Fashion design: Philips AC4076 (RMB 3,600), CADR250, is the most beautifully designed air purifier; 2, Economical: Philips AC4016 (RMB 2,200), CADR224. They all adopt the most updated HEPA strainer (RMB500), under the worst case, you will have to change the strainer every six months. The strainer is easy to purchase. Very efficient in purifier PM2.5, Formaldehyde and Benzene.	436	225	14

Table 5.10 Most forwards of Weibo posts on air pollution issue (Con't)

作家崔成浩 Writer Chenhao Cui	Verified personnel Writer	- 2037年7月7日，东京靖国神社，几个中国爱国志士投掷了几枚冒着黑雾的化学弹，正在参拜的多位日本内阁成员瞬间被熏倒熏死，中国志士却在烟雾中趁机逃脱。日本将此事件上报联合国禁止化学武器组织(OPCW)，联合国采样化验后随即宣布：“该化学物质不属于化武范畴，主要成分为PM2.5。” Some Chinese thought several chemical bombs at Yasukuni Shrine in Tokyo. Many Japanese senators and congressmen were poisoned to death. Japan then reported this accident to Organization for the Prohibition of Chemical Weapons (OPCW). After getting the sample of the bomb, UN official announced the lab result: The bomb isn't chemical weapon, because its major ingredient is PM2.5.	850	709	599
联合国 United Nations	NGO	[空气质量] 较小的PM10微粒能渗入到双肺深部，并能进入血液，对多个脏器系统造成损害。世卫组织2011年公布了38个国家565个城市测量的PM2.5等更小微粒年平均值。数据显示，PM2.5最少的国家为爱沙尼亚、毛里求斯、加拿大、澳大利亚、芬兰；最多的为蒙古、马达加斯加、科威特。中国没有提供PM2.5数据。 [Air quality] Particles smaller than 10 micrometers could get into the lungs and blood, causing damage to health and organs. WHO in 2011 announced the average PM2.5 index in 38 countries, 565 cities. According to the index, countries with the smallest PM2.5 value are Canada, Australia, Fenland, Estonia and Mauritius; with the highest PM2.5 value are Mongolia, Madagascar and Kuwait. China didn't provide PM2.5 data.	607	290	72
钱江晚报 Qiangjia ng	Media	【现在，杭州的空气已经是严重污染，比“重度污染”还严重！】杭州的小伙伴们，今晚没事别出门。往窗外看，又是一片白茫茫。杭州市气象台发布了霾黄色预警，PM2.5数字真是触目惊心！如果一定得出门，带个口罩吧！	414	92	12

Table 5.10 Most forwards of Weibo posts on air pollution issue (Con't)					
Evening News		[It's serious pollution right now in Hangzhou!] Dear friends in Hangzhou, don't go out tonight unless you have to. Hangzhou meteorological administration announced haze yellow alarm, PM2.5 is astonishingly high! Wear mask if you have to go out!			
环 球 时 报 Global Times	Media	<p>【室内3支烟 PM2.5超标30倍👁️】国家卫计委今天表示将推进我国控烟立法进程。@CCTV生活提示 :15平米房间内点燃1支烟，室内PM2.5从32微克/立方米瞬间增至1100多；点3支烟，PM2.5竟高达2248，超国家环境空气质量标准30倍。即使开窗也需16小时才能恢复正常值。为健康戒烟吧！转！</p> <p>If you light one cigarette indoor, PM2.5 density will rise from 32 to 1,100 mg/m² ; If you light three cigarettes indoor, PM2.5 density will be as high as 2,248, 30 times the standard density. Even if you open the window, it will take 16 hours for the PM2.5 density to get to normal range. So stop smoking! Please retweet!</p>	622	169	82
Soho 中国 Soho China	Commercial	<p>上海的地铁有没有PM2.5污染？每天乘坐上海地铁的人约700万，大家呼吸的空气是不是安全的？“我第一次坐上海地铁，感觉比纽约的好多了！”老潘昨天从2号线航站楼站一路坐到静安寺，沿途测试了十几组地铁站台和车厢内的PM2.5数据。请看视频，看老潘为何点赞上海地铁。</p> <p>Is the subway in Shanghai has air pollution problem? There are over 700 million people take subway every day, do they breathe the healthy air? Mr. Pan think the air quality in Shanghai subway is way better than that in New York City. So yesterday he monitored the PM2.5 value in over ten subway stations and in the train cars. Watch the video of how he did that.</p>	785	91	103
王占阳 Zhanyan-g Wang	Verified personnel-	<p>【再见，骆家辉大使！】骆家辉大使即将离任回国了。值此时刻，我想说：再见，骆家辉大使！您使我们知道了PM2.5，</p>	372	91	59

Table 5.10 Most forwards of Weibo posts on air pollution issue (Con't)

Economist/Professor		中美两国正在构建新型大国关系，愿您回国后仍能为此作出特殊贡献仅此一事，您就给中华民族做出了重要贡献，中国人民将永远铭记。。奇文《别了，骆氏家辉！》不是主流，请不要放在心上。 #Goodbye Ambassador Locke! Ambassador Gary Locke is going to resign and go back to the U.S. Now I want to say thank you to him, for letting Chinese people know what is PM2.5. He made such a big contribution to China that Chinese people will remember him forever. Hope he will continue to make great contribution in developing the U.S.-China relationship to a new stage.			
作家崔成浩 Writer Chenghao Cui	Verified personnel - Writer	骆家辉走了，有媒体刊文骂他是瘟神，骂得对，就是个瘟神。他没来那时，空气里只偶尔有点总悬浮颗粒物，天气好极了。可他一来，天天研究PM2.5，一年下来没几个好天气了。这样的瘟神，不赶紧赶走，还叫别人怎么活？ U.S. Ambassador Locke has gone back to the U.S. Some media criticized him and compared him with plague. I think they are right and Gary Locke is indeed a plague: Before he came to China, the air quality was good; After he came, there is haze and high PM2.5 every day. We no longer have good weather. Such a plague, please go immediately; or else, how can we live our life!	706	725	592
新闻晨报 Morning News	Media	【巴黎治霾出重磅措施：PM2.5超标！公共交通免费坐3天！】法国巴黎近日一直无风少雨，PM2.5和PM10指数连续多日严重超标。市政府决定：当地时间14日凌晨开始至16日夜间，巴黎大区的地区快线、地铁、公交车等公共交通工具将免费供民众使用，此外还通过减少公务车使用、居住区免费路边停车等治霾。 Recently, Paris suffered from high PM2.5 and PM10 air pollution. Therefore the city government made a decision: from 14th to 16th, Public Express, bus and subway in great Paris area are free to city residents.	439	168	188

Table 5.10 Most forwards of Weibo posts on air pollution issue (Con't)

		Besides, the government also has policy to reduce government use of car and provide free street parking to residents in order to solve air pollution problem.			
NASA 中文 NASA China	Verified personnel- Blogger	<p>今年3月世界卫生组织估计，在2012年有700万人由于空气污染而过早死亡，即每8个死亡的人，就有1个是由于空气污染。过去的10年里，空气质量变的越来越糟糕，呼吸不健康空气的人数上升了6.06亿，总数达到17.8亿，占全球人口的四分之一。链接为全球PM2.5的交互式地图，基于卫星数据。http://t.cn/RvKLOss</p> <p>According to WHO's estimation this March, in 2012, there are 700 million people died of air pollution: that is one out of eight people. In the past decade, air quality is getting worse and worse. There is an increase of 60.6 billion people who cannot breathe fresh air. The number adds up to 178 billion in total, taking up a quarter of the world population. The link is an interactive map of PM2.5 pollution, based on satellite data. http://t.cn/RvKLOss</p>	683	215	77
北 京 生 活 热 门 资 讯 Beijing Life Buzzfee d	Verified personnel-E- commercial Blogger	<p>#加班少一点，年轻多一点#PM2.5的污染侵害、电子产品的全天辐射，加上不间断的连续加班，再怎么补眠还是一脸疲倦？赶快呼叫Olay的年轻专车，去Olay专柜做美肌微镜锁定皮肤问题吧！即日起至9月24日，还有Olay年轻好礼可以拿哦~</p> <p>#PM2.5 pollution, electronic devices radiation pollution, plus overtime working, how should you protect your skin? Go to Olay counters and examine your skin problem! Go before September 24 to get special gift~</p>	516	99	1
smile 厮 卿 Smile Siqing	Verified personnel- Fashion Blogger	<p>清洁是护肤的基础，羽西灵芝生机焕活洁面乳泡沫细腻，使用起来温和不刺激，调理角质层，促进排污新生。还能3倍清除PM2.5附着，雾霾天也不怕~@羽西品牌官方微博</p>	1,119	788	6



Table 5.10 Most forwards of Weibo posts on air pollution issue (Con't)

		Cleanness is the foundation for skin protection. Yuesai could clean up PM2.5 attached on the skin three time as effective as other cleaning product. You don't have to worry about haze anymore! @Yuesai official account			
小米空气净化器 Xiaomi Air Purifier	Commercial	CCTV 2《消费主张》，中国家用电器研究院测试结果：#小米空气净化器2# 用20分钟，把30立方米空间的PM2.5数值，从500降到12，在四台被测试净化器中排名第一👍 视频链接： http://t.cn/R4yNoGU CCTV 2 broadcasted the research finding from China Electrical Appliance Research Institute that Xiaomi Air Purifier could reduce PM2.5 from 500 to 12 within 30 minutes. Xiaomi Air Purifier ranked the first among the four being tested. Link to the video: http://t.cn/R4yNoGU	933	656	289
大胃妖精 Cici	Verified personnel-Fashion blogger	雾霾严重的日子不能开窗通气，家中旺星人的绒毛漫天飞舞，偶尔在屋内大小便暖气一蒸腾变得无比酸爽。自救模式开启，还好把LG空气净化器接回家！小巧方便又美观，4重过滤让空气清新健康，龙卷风强力风扇30分钟快速净化空气，PM2.5甲醛烟味统统消灭掉，更是养宠人士的福音！有你保护，真的安心！ In days with serious haze, we cannot open the windows. So save yourself and buy the LG air purifier home! It's small, convenient with nice looking, four layers of purifier makes air fresh and healthy. No PM2.5 anymore! With the protection of LG, you will no longer need to worry about air pollution!	2,832	617	56
天气预报 Weather forecast	Commercial	【北京发布大雾、霾黄色预警】18日22时，北京市气象台同时发布大雾黄色预警以及霾黄色预警：预计18日后半夜到19日白天本市平原地区有雾，南部地区能见度将小于500米，请注意防范；预计19	536	223	

Table 5.10 Most forwards of Weibo posts on air pollution issue (Con't)

		<p>日白天本市大部分地区将出现能见度小于3000米的霾，空气污浊，请注意防范。看来雪前雾霾持续，静待周日降雪了</p> <p>[Beijing sending out haze alert] 18th at 10pm, Beijing meteorological administration sent out haze yellow alert: It is forecasted that after midnight on 18th to the daytime on 19th, there will be haze with visibility less than 500 meters. The haze will last till the snow comes. So let's look forward to the snow on Sunday.</p>			
江上渡 Flow on the river	Verified personnel- blogger	<p>京城的菜市口，跪着一溜即将被处决的烦人。五十三刻已到，行刑！话音未落，蒙面的刽子手上前，撤下了烦人的口罩。。。Outside the prison, there are criminals waiting for their death penalty execution. "Now it's the time!" Said the judge. Then the police went one step towards the criminals. Instead of pulling the trigger, however, the police took out the masks for all the criminals...</p>	1,116	359	
APP 游 戏大玩 家 APP Online Game	Verified personnel- online game player	<p>美国驻华大使刚刚辞职后，大使职位空置无人担当....奥巴马沮丧地说：“所以你们这些大英雄也都不敢接任驻华大使了？雾霾那么可怕？”钢铁侠、绿巨人、蝙蝠侠、蜘蛛侠等纷纷羞惭地低下了头。忽然，金刚狼提议道：“擎天柱肯定可以！他不需要呼吸！”热烈的掌声响起.擎天柱默默抬起头说：可我需要摇号！</p> <p>After the U.S. Ambassador Gary Locke resigned, Obama asks Iron Man, Hulk, Batman and Spiderman, "So... you guys, big heroes, none of you are brave enough to nominate yourself as the Ambassador in China?" They are all silent with their heads down. Suddenly, Wolverine suggests: "Optimus Prime can be the Ambassador, as he doesn't need to breath the air!" The crowd all get excited and applause. But Optimus Prime starts to talk, slowly:" But I need to get my number plate first, and it will take years to wait in line for the plate..."</p>	829	32	73

Table 5.10 Most forwards of Weibo posts on air pollution issue (Con't)

联合国 United Nations	NGO	[联合国图片] 这里是北京。。  [Photo by UN] Here is Beijing (You can hardly see anything but haze in the photo)	569	114	61
财经网	Media	多想逃离雾霾，推窗是如画的西湖，品一盏茶香、拥一方纸墨，晴耕雨读，与友人秉烛夜谈，这便是桃花源了吧。晚安  How much I wish to escape from haze! It will a paradise if outside my window is the beautiful lake, I can taste a cup of fresh tea, reading, farming and chatting with friends till midnight. Good night.	484	52	27
Tang Vision	Verified personnel-Fashion blogger	穿一件浅色的衣服、找一间白色背景的屋子、拿一束鲜花，你也可以拍出这么小清新的照片，关键不要太撞色，就可以十分小清新~~~现在全国不是雾霾就是阴雨天，这种不适合户外拍摄的天气，就让你的男朋友在室内给你拍这么一组照片吧~~~ How to take portrait photo that make you look young: Wear something light-color, find a white background and get a bunch of flower in your hand. The disadvantage is that there is haze everywhere, so not a good choice to take photo outside.	1,156	75	143
冯喆小 胖 Zhe Feng	Verified personnel-Olympic Champion	这个天气确实不讲政治！不都说好了延迟退休的吗女六十，男六十五或者更晚都行，我们有不服老的心，一直想做点什么事来证明自己没老，还有用！如果这个雾霾天这样持续在的话，我觉得北京工作的大部分人可能活不到六十五，怎么为国家继续做贡献呢？ The weather is not political-sensitive! Retirement policy has extended the retirement age to 60 for female and 65 for male. We want to work for longer time and prove we could contribute to the country. But if the air pollution continues like this, I'm afraid most people in Beijing cannot live long till they are 60 or 65, so how can we keep on making contribution to the country?	597	125	961

Predicting Social Media Opinion Leaders

RQ7b asked what are the factors that predict social media opinion leadership? When it comes to factors that determine opinion leaders online, multivariate regressions were conducted to find the answers. Sources, rhetoric (whether the post discredited the issue or included incivility), time-period (whether the tweet was posted during the “two sessions” or in winter), actor types, and frames were entered into the regression model individually to assess their impact on the dependent variable – opinion leadership. Sources, actor types and frames were chosen as independent variables because they were key factors examined in this study. Rhetoric was selected because existing studies have shown that incivility (G. Chen, 2017; G. Chen & Lu, 2016; G. Chen & Zheng, 2016) and discredited discourse (Zeng, Dai & Wang, 2014) affected how people perceived information online. Findings in chapter four showed that the amount of media coverages increased in winters and during the “two sessions” national conferences, time-period; therefore, time period was selected as the predictor for opinion leadership on Weibo. Predictors were entered in the order suggested by an existing study (W. Chen et al., 2017). Opinion leadership was operationalized as the number of forwards (retweets) a person had. Because the distribution of number of forwards is skewed, this dependent variable was log-transformed using logarithmic 10 before putting into the model. All predictors were coded as one for the presence and zero for absence. Results in Table 5.11 showed time was first entered into the model. Posting during the “two sessions” period ($\beta = .12$ $p < .001$) and posting in winter ($\beta = .13$ $p < .001$) were significant predictors of posts getting most number of forwards (retweets). Model 1 explained 2% of variance. In model 2, rhetoric factors including exaggeration and incivility were entered into the model and neither of them were significant predictors. Actors were entered into the model then. Comparing with being

a layperson, government ($\beta = .06, p < .01$), business organization ($\beta = .16, p < .001$), media ($\beta = .33, p < .001$), NGOs ($\beta = .11, p < .001$) and verified personal accounts ($\beta = .22, p < .001$) were all significant predictors. Model 3 explained 15% of variance with actors explained 13%. In Model 4, sources were entered into the model with not adopting mobile/app source ($\beta = -.08, p < .01$) as a significant predictor. It indicates Weibo posts that are not adopting mobile/app sources are more likely to predict opinion leadership. Frames were entered in model 5. Framing the tweets under “weather” and “humanity” was a negative predictor for the number of being forward ($\beta = -.14, p < .001$; $\beta = -.05, p < .05$), meaning posts not adopting the two frames predict opinion leadership on Weibo. Other frames were not significant predictors. Model 5 explained 16% of variances and frames along explained 1%. Results indicated that how the content was tailored does not matter much for becoming opinion leaders; the timing of tweets as well as identity of the author counted more toward being an opinion leader on social media for issues such as air pollution.

Table 5.11 Multivariate regressions predicting Weibo opinion leadership in terms of posts being forwarded

		Model 1	Model 2	Model 3	Model 4	Model 5
		<i>B</i>	β	<i>B</i>	β	β
Time	Two Sessions	.12***	.12***	.11***	.08**	.07**
	Winter	.13***	.13***	.12***	.09***	.08***
Rhetoric	Exaggeration		.02	.02	.03	.02
	Incivility		-.00	-.01	-.00	-.00
Actor	Government			.06**	.07**	.07**
	Business Org			.16***	.16***	.15***
	Media			.33***	.32***	.31***
	NGO			.12***	.11***	.11***
	Verified Personnel			.22***	.23***	.22***
Source	Government				-.01	-.02
	Expert				-.03	.04
	Activists				-.03	-.03
	Corp				.01	-.00
	Media				.03	.03
	Foreign				.03	.03
	Public				.01	.01
	APP/ MOBILE				-.06**	-.05*
Frame	War on pollution					-.02
	Science					-.01
	Achievement					-.02
	Publicity					-.04
	Development					-.02
	Humanity					-.05*
	Engagement					-.05
	Weather					-.14***
<i>F</i> value		19.23***	9.98***	35.31***	19.50***	14.77***
Adjusted R^2		.02	.02	.15	.15	.16
R^2 changed		.02	.00	.13	.00	.01

To conclude, the Weibo agenda on air pollution issue showed a different picture compared with the traditional media agenda. Air pollution was mostly framed as a “weather” problem on Weibo. Also, different actors had their own agendas. The media agenda on Weibo only correlated

with the agenda of NGOs and governments. How ordinary users talk about air pollution was not associated with the agenda of media, nor of the government, but it was associated with business organizations' and corporations' discourse. Results from this chapter at least implied a weak relationship between the agendas of laypeople and the media and a relatively strong relationship between agendas of laypeople and commercial organization over social issues such as air pollution. This also indicated a social trend in China right now that puts wealth and capital above everything else. This trend also reflected the identity of opinion leaders on air pollution issue. As results showed, business organizations, a businessman, and a fashion blogger who are also commercialized Internet personalities shared the space of opinion leadership with traditional elites, such as experts and the media. Some of the most reposted Weibo posts also contained commercialized content. Chapter six will further examine the causal relationship among social media actors, as well as between social media and traditional media.

Chapter 6 Results: Agenda-Setting Between Traditional and Social Media

This chapter explores the relationship between the traditional media agenda and social media agenda on the air pollution issue over the five-year period. First, it presents the correlations between each media outlet and the social media actors' agendas over five years. Second, it displays correlations between each media outlet and social media actors' use of sources over five years. Third, this chapter demonstrates causal relationships of the issue agenda between each media outlets and social media actors, adopting Granger's causality.

RQ7a explored the relationship between the traditional media and the social media agenda over the five years of the study period. Spearman's Rho correlations showed that the agenda of government accounts on Weibo was significantly correlated with the agenda of *People's Daily* ($r = .77, p < .05$), *Beijing News* ($r = .90, p < .01$), and *Southern Metropolis Daily* ($r = .67, p < .05$). Media accounts on Weibo were significantly correlated with the media agendas of all the traditional media, namely, *People's Daily* ($r = .68, p < .05$), *Beijing News* ($r = .80, p < .01$), *Southern Metropolis Daily* ($r = .83, p < .01$), and *Science and Technology Daily* ($r = .77, p < .05$). Similarly, the agenda of NGOs' accounts on Weibo also correlated with the agendas from all four media outlets. Verified personnel's agenda on air pollution correlated with the agendas of *Southern Metropolis Daily* ($r = .75, p < .05$), and *Science and Technology Daily* ($r = .70, p < .05$). Social media agendas of commercial and laypeople accounts were not associated with agendas of any traditional media outlets' (results shown in Table 6.1).

Table 6.1 Spearman's Rho correlation between social media and traditional media agenda on air pollution

	People's Daily	Beijing News	Southern Metropolis Daily	Science and Technology Daily
Government	.77*	.90**	.67*	.50
Commercial	.13	.20	.52	.31
Media	.68*	.80**	.83**	.77*
NGOs	.85**	.89**	.90**	.90**
Verified Personnel	.52	.54	.75*	.70*
Layperson	.38	.44	.65	.47

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Research question 8b explored the inter-media agenda-setting effects among four traditional media outlets over the air pollution issue. Table 6.2 contains the Granger causality results for these agendas. For the overall agenda, *People's Daily's* Granger caused the other three media outlets' agenda in a lag of one week (*Beijing News*, $F = 6.50$, $p < .05$; *Southern Metropolis Daily*, $F = 10.71$, $p < .01$; *Science and Technology Daily*, $F = 20.44$, $p < .001$). For the frame of "War on pollution," again, *People's Daily* set the agenda for both *Southern Metropolis Daily* ($F = 7.98$, $p < .01$) and *Science and Technology Daily* ($F = 6.69$, $p < .05$), and *Beijing News* set the agenda for *Science and Technology Daily* as well ($F = 25.87$, $p < .001$). For the agenda on science frame, *Science and Technology Daily's* Granger caused the agenda on *Beijing News* ($F = 4.61$, $p < .05$), *Beijing News's* Granger caused the agenda on *People's Daily* ($F = 7.31$, $p < .01$), and *People's Daily* in turn Granger caused the agenda on *Southern Metropolis Daily* ($F = 18.61$, $p < .001$). For the "achievement" frame, only *People's Daily* was found to Granger cause the agenda on *Science and Technology Daily* ($F = 19.23$, $p < .001$). The fourth frame, "publicity and government trust," results showed significant intermedia agenda-setting effects in five

relationships. For the sixth frame, named “humanity,” the agenda on *People’s Daily* Granger caused the agenda on *Beijing News* ($F = 29.09, p < .001$) with one week’s time lag, and *Beijing News*’ Granger caused the agenda on *Southern Metropolis Daily* ($F = 5.45, p < .05$) with two weeks’ time lag. Lastly, for “public engagement” frame, only *Beijing News* was found to Granger cause the agenda on *Southern Metropolis Daily* ($F = 14.70, p < .001$). In short, results suggest *People’s Daily* and *Beijing News* are in general more powerful in the intermedia agenda-setting process, except in regard to the “science” frame where *Science and Technology Daily* set the agenda for other media outlets.

Table 6.2 Granger's causality between traditional newspapers on air pollution 2011-2015

From	To	Lag (Week)	F value	p value
<i>Overall</i>				
People's Daily	Beijing News	1	6.50*	.01
People's Daily	Southern Metropolis Daily	1	10.71**	.00
People's Daily	Science and Technology Daily	1	20.44***	.00
<i>Frame one: War on pollution</i>				
People's Daily	Southern Metropolis Daily	1	7.98**	.01
People's Daily	Science and Technology Daily	1	6.69*	.01
Beijing News	Science and Technology Daily	1	25.87***	.00
<i>Frame two: Science</i>				
Science and Technology Daily	Beijing News	1	4.61*	.03
Beijing News	People's Daily	1	7.31**	.01
People's Daily	Southern Metropolis Daily	1	18.61***	.00
<i>Frame three: Achievement</i>				
People's Daily	Science and Technology Daily	1	19.23***	.00
<i>Frame four: Publicity and government trust</i>				
Beijing News	Science and Technology Daily	2	24.19***	.00
Beijing News	People's Daily	5	5.56***	.00
People's Daily	Science and Technology Daily	1	5.90*	.02
People's Daily	Southern Metropolis Daily	2	11.33***	.00
Southern Metropolis Daily	Science and Technology Daily	1	24.18***	.00
<i>Frame six: Humanity/Personal interest</i>				
People's Daily	Beijing News	1	29.09***	.00
Beijing News	Southern Metropolis Daily	2	5.45***	.01
<i>Frame seven: Public engagement</i>				
Beijing News	Southern Metropolis Daily	1	14.70***	.00

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Research question 8c asked about the causal relationship of issue agendas among different actors on Weibo. Table 6.3 showed the Granger causality results for these agendas. Only three

significant agenda-setting relationships were found between actors on Weibo. They were: government accounts on Weibo Granger caused the agenda of NGOs' accounts ($F = 13.87$, $p < .001$, time lag = 1 week), media accounts Granger caused the agenda of NGOs ($F = 7.44$, $p < .01$, time lag = 1 week), and media accounts Granger caused the agenda for VIPs' accounts ($F = 3.58$, $p < .05$, time lag = 3 weeks). Results suggested a weak causality relationships on Weibo. Besides media and NGOs, other actors seldom set the agendas of others, nor followed the agendas of others. In other words, actors on social media, when talking about the air pollution issue, have their own agendas and discourses and hardly care about how others are talking the same issue.

Table 6.3 Granger's causality between actors on Weibo on air pollution 2011-2015

From	To	Lag (Week)	F value	p value
Government	NGO	1	13.87***	.00
Media	NGO	1	7.44**	.01
Media	VIP	1	3.58*	.01

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Research question 8d explored the causal relationship between traditional media and social media agendas on air pollution over five years. Table 6.4 contains the Granger causality results for these agendas. The results showed that significant agenda-setting effects between traditional media outlets and actors on Weibo appeared in seven of 24 relationships. Specifically, the agenda of air pollution issue on *Beijing News* ($F = 12.72$, $p < .001$) and *Southern Metropolis Daily* Granger caused the agenda of media accounts on Weibo ($F = 12.60$, $p < .001$) with a week's lag. *Beijing News* ($F = 20.03$, $p < .001$), *Southern Metropolis Daily* ($F = 4.09$, $p < .05$) and *Science and Technology Daily* ($F = 6.96$, $p < .01$) Granger caused verified personnel's agenda in the discussions of air pollution with a lag of one week. *People's Daily* set the agenda for verified personals on Weibo as well, but the lag is as long as two weeks ($F = 3.81$, $p < .05$). In addition, *People's Daily*

Granger caused the agenda of government account on Weibo ($F = 4.38$, $p < .05$) with a week's time lag. According to my data, traditional newspapers did not Granger cause the agenda of commercial accounts, NGOs, or laypeople.

Table 6.4. Granger's causality between traditional newspapers and actors on Weibo on air pollution 2011-2015

From	To	Lag (Week)	F value	p value
Beijing News	Media Weibo accounts	1	12.72***	.00
Southern Metropolis Daily	Media Weibo accounts	1	12.60***	.00
Beijing News	Verified personal accounts	1	20.03***	.00
Southern Metropolis Daily	Verified personal accounts	1	4.09*	.04
Science and Technology Daily	Verified personal account	1	6.96**	.01
People's Daily	Verified personal account	2	3.81*	.02
People's Daily	Government account	1	4.38*	.04

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

To sum up, this chapter explored the agenda-setting effects among traditional media, different social media actors, and between traditional and social media on the air pollution issue during the last five years. Granger's causality was used to test these causal relationships. There are important findings from this chapter.

In the traditional media arena, first, intermedia agenda-setting reaffirmed the existing literature that the flow is from big, serious national media to local commercial media (Reese & Danielian, 1989; Gold & Simmons, 1965; Shaw & Sparrow, 1999). In the context of China, *People's Daily*, the party-owned national newspaper, is the agenda-setter for the other three media outlets on most occasions. Second, the geographical location of media outlets also influenced the intermedia agenda-setting process. At least results from this study indicated that the closer the

media outlet was to the political power center, the more likely it would be the agenda-setter for other outlets. After *People's Daily*, the mouthpiece for the party and government, *Beijing News*, which is also located near the power center of Beijing, became the other major agenda-setter. *Southern Metropolis Daily*, which is located on the very south of China and far away from the power center, on the other hand, hardly set the agendas for the other three media outlets. Third, there were variations in intermedia agenda-setting effects when I looked into specific frames adopted within an issue, and commercial media outlets also had the power to set the agendas for party-owned media. Results suggest that *People's Daily* was the major agenda-setter for the “war on pollution” and “achievement” frames, but when it comes to frames such as “publicity and government trust,” “science,” and “public engagement,” local commercial newspapers tended to set the agenda for *People's Daily*. Fourth, subject-specific media such as *Science and Technology Daily* do not have much power in setting the agendas for others, except for the field of its expertise. In the context of the air pollution issue, *Science and Technology Daily* usually followed the agendas set by others, but it became the agenda-setter under the frame of science, which is its expertise area.

For social media, only three significant agenda-setting relationships were found among government, media, NGOs, and verified personal accounts, and the effect between media and VIPs was weak. Any other actors on social media did not affect business accounts and ordinary users. This indicated a very weak agenda-setting environment on social media. Although air pollution is a salient issue on Weibo, different actors had their own different agendas when talking about the issue. Social media discourse was relatively fragmented compared with coverage of the issue by traditional media outlets.

As for traditional-social media agenda-setting, two findings are worth highlighting. First, traditional media had a very limited agenda-setting ability in terms of how one issue is discussed on social media. Results showed traditional media were only able to set the agenda for media accounts, government accounts, and verified personal accounts on Weibo. They did not affect how ordinary users talked about air pollution issue. Second, commercial media, such as *Beijing News* and *Southern Metropolis Daily*, were more likely to set the agenda for social media actors, compared with party-owned media, such as *People's Daily*.

Chapter 7 Discussion and Conclusion

Air pollution has become such a pressing issue in China in recent years that policies have been carried out by both central and local governments, during which discussion about the issue has been frequent on both traditional and social media platforms. Because the air pollution issue touches various interrelated and intervening powers in China today – including politics, economics, and international relationships – and because the power relationships change over time, studying the issue, therefore, revealed the changing power structures in contemporary China in half a decade. Under the framework of authoritarian environmentalism and agenda-setting, this dissertation examined both traditional and social media agendas about air pollution in China over a five-year period. By doing so, this dissertation not only uncovered the urgency and complexity of the air pollution issue, but also reflected the current media and social climate in China. Existing studies on air pollution are limited to a brief and specific time frame such as a few weeks (Y. Chen, 2014) or a few months (W. Chen et al., 2017). This is the first study that provided a holistic overview of China's air pollution coverage over a long period of time and tracked the changes over time. Existing studies also focus on the agenda of either traditional media or social media (e.g., Luo, 2011; Zeng, Dai & Wang, 2014; W. Chen et al., 2017), this dissertation is the first to examine traditional and social media agendas at the same time, making it possible to compare among these agendas. This dissertation also examined the intermedia agenda-setting effects among different categories of traditional media and between traditional and social media, Weibo. More importantly, this dissertation approached social media agenda differently than earlier studies did. As discussed in the literature, previous studies treated social media as a whole and compared their agenda with

the agenda of traditional media (e.g., Vargo, et al., 2014). This dissertation captured the fragmented and diverse nature of social media and examined the more nuanced agenda-setting effects among different social groups on social media platforms. Therefore, this is also a pioneer study that tested the agenda-setting effect from this approach.

In this chapter, I will summarize and explain the major findings and explicate their impact on theory as well as in practice. I will also discuss limitations of this work and highlight what avenues for future research this dissertation points to.

Major Findings and Implications

This dissertation used a quantitative content analysis and adopted both Spearman's Rho correlations and Granger's causality to test for agenda-setting effects. The first important finding is that commercial media more actively covered the issue than state-owned media do. Almost 70% of coverage came from commercial newspaper, with more than 40% of news stories from *Southern Metropolis Daily* and more than 20% from *Beijing Daily News*. Air pollution issue, as discussed in the literature review, is very close to quality of life and individual health. Therefore, commercial media such as *Southern Metropolis Daily* and *Beijing Daily News* put efforts to cover the issue in order to attract audience's attention. This finding is consistent with existing studies as commercial media, compared with state-owned and party-owned media, are more sensitive to audience's demand (Pamalee, 2014). In the context of China, existing studies found information control is a dynamic and case-specific process, in which environmental issues are generally less-censored (King & Pan, 2014; Pan, 2017). This dissertation provided additional evidence of this argument by showing that coverage on air pollution is not only less-censored, but to some extent encouraged.

As discussed in the literature, political intervention and commercial profits together drive China's media reform today. Commercial media are always seeking a niche that allows them to attract audience while avoids political sensitive zones. Air pollution is such a niche. The extensive discussion of the issue from the public legitimizes commercial media to investigate the issue. At the same time, covering a social issue like air pollution meets audience's expectations, which in turn brings media profits. As long as the coverage do not threaten the legitimacy of the Party and harmony of the society, which I will discuss in the next paragraph, commercial media enjoy the freedom of coverage.

In terms of how the issue got covered, results from this dissertation showed "war on pollution," "science," and "publicity and government trust" frames dominated the traditional media agenda with "publicity" most salient before 2013 and the other two gain salience afterwards. In terms of source adoption, government and expert sources consistently dominated the media discourse over the five years. On the other hand, the "engagement" frame, although gradually on a rise from 2011 to 2015, still appeared at a very low rate in all newspapers. *Southern Metropolis Daily* adopted the "engagement" frame the most, but still only 7% of its entire coverage used this frame. On Weibo, the "engagement" frame was adopted most frequently by NGOs (20.2%) and more frequently by all actors compared with that by traditional media, except government. Similarly, for the "humanity" frame, it was rarely used in traditional media coverage, but got relatively higher adoption rate on Weibo, especially by commercial (8%) and media (6.3%) accounts. Source adoption on Weibo was also different from traditional media and varied among actors: Government and media accounts intensively cited government officials while media and NGOs cited the media as sources the most. Compared with other actors, NGOs tended to refer to

activists the most and commercial accounts referred to corporations for information the most. Verified people and laypeople did not seem to like adopting sources in their Weibo posts. But when they did, they cited mobile application for the PM2.5 daily report more than any other sources.

These results confirmed the significance of tracking one issue over time in order to show the changing discourse. When the discussion just got heated in 2011 and 2012, “publicity and government trust” were at the center of the discussion. In 2011 and 2012, ordinary citizens started to realize the seriousness of the pollution problem. The action of the U.S. Embassy publishing PM2.5 data online, together with the dispute between U.S. and China’s officials over what should be the standard to measure air pollution, tremendously sped up and intensified the public discussion on the issue. The focus of the discussion, accordingly, is whether the Chinese government should adopt the U.S. standard of pollution measurement and publish the data, and whether the pollution data published by Chinese government is trustworthy. Therefore, “publicity and government trust” was the most adopted frame in 2011 and 2012. Starting 2013, every provinces and major cities have started to monitor and publish PM2.5 data. As Premier Li Keqiang announced “the war on pollution” in 2013, not surprisingly, “war on pollution” has dominated the media discourse since 2013. Media also framed the air pollution issue as a “scientific” issue to discuss the cause and solution of the pollution. It also helped to justify the policy oriented coverage. The changes in discourse took place fairly slowly for a non-crisis issue, such as air pollution. Studies based on media content of a few weeks or months may reveal the changes for a specific event (for example, the dispute between U.S. embassy and Chinese government), but only by

observing the issue over a long period of time can we draw a holistic picture of the media representation of one issue.

These results also reinforced the necessity to treat social media as a diverse and fragmented sphere rather than as a whole. As Reese et al. (1994) said, “social and power structures imbedded in source and attributes (frames) reveal how the whole set-up, the ‘system’ itself, is geared toward certain stories and points of views” (p. 87), the difference in frame and source adoption showed how different powers wanted to utilize the issue to best benefit their interests. NGOs tried to gain power by amplifying the “engagement” frame and activists’ voice; business leaders and corporations tried to please their consumers and protect their interests by framing the air pollution as “humanity” and adopting commercial sources. In short, social media is a stage where various actors emphasize and compete for resources by highlighting certain aspects of the issue and marginalizing the others. Only by seeing the diverse and fragmented nature of social media can we observe the dynamic framing process and test the nuanced agenda-setting effects among actors.

The overwhelming emphasis on the “war on pollution” frame, while the “engagement” and “humanity” frames were neglected, showed a different picture from the western media, where most news coverage of public issues adopted episodic frames, applying a telephoto lens and focusing on individual cases (Iyengar, 1990). Media frames can affect how people view a given problem -- whether people will see the need for individual-level solutions or seek broader social or institutional solutions to that problem. The finding provided supporting evidence for “authoritarian environmentalism” characterized by “top-down order” and “lack of bottom-up participation,” at least in the conversation about the air pollution issue: Instead of focusing on the private realm and

relating the issue of air pollution to personal experiences, traditional media consistently portrayed the issue on the institutional level, asking for policies to fix the condition that led to the problem.

The third important finding is that although commercial media are granted more freedom to reform media practice and meet public demands, state-owned media are still the major agenda-setter in China's media environment. Traditional media agenda were highly correlated, especially among *People's Daily*, *Beijing News* and *Science & Technology Daily*. Granger's causality showed agenda of *People's Daily* and *Beijing News* Granger caused the agenda on *Science & Technology Daily* and *Southern Metropolis Daily*, but there is no causality the other way around. *People's Daily* and *Beijing News* have one thing in common: They are all in Beijing where the central government locates. Linking back to authoritarian environmentalism theory (Beason, 2015; Gilley, 2012), findings from this dissertation provided supporting evidence that environmental issues still follows the "command and control" mode at national level, at least reflected in the intermedia agenda-setting results. The propaganda tool of central government, *People's Daily*, set the agenda for local news outlets. *Beijing News*, also locates in Beijing, followed *People's Daily's* agenda most quickly. *Southern Metropolis Daily*, despite its huge volume of stories on air pollution, had to be consistent with *People's Daily* and *Beijing News* in how it covered the issue. *Science & Technology Daily*, as the official newspaper for the Department of Science and Technology of China, without doubt, followed the propaganda agenda of the central government. The result confirmed that agenda-setting functioning in Western environment (McCombs, 2004) also works in the changing media environment in China. Moreover, it indicated that geographical location to a large extent decided the causal order of the agenda-setting process. Journalists who are geographically close with power centers are more likely to be affected by political leaders' agendas,

and such agendas tend to pass along to journalists who are distant from power centers (Dunn, 2009). This again provided supporting evidence for the “authoritarian environmentalism” paradigm: Central institutions have a definite say over the discourse of the issue, and local institutions follow the agenda set by their central counterpart.

The forth important finding is that social media, Weibo in this study, presented a quite different picture of the discussion on air pollution. Most of the actors discussing air pollution were laypeople, then verified people, and then media accounts. Unlike traditional media which have consistent agenda, social media agenda are quite fragmented. Commercial accounts, verified individual accounts related with laypeople’s accounts in terms of how they talk about air pollution. At the same time, government accounts, media accounts related with NGOs accounts in their adoption of frames in air pollution issue. Causal effects were only found from government to NGOs, media to NGOs and media to verified individual accounts. The results reflected that the news agenda on social media platforms is manifold with different individuals sharing what they perceive as important about air pollution. This is a positive sign for the emergence of collective intelligence in public online spaces (Kwak, Lee, Park, & Moon, 2010). It suggested that online public opinion has become a competing agenda in contemporary China. Average netizens have unprecedented opportunities to express their own opinions on public affairs and make their voices heard. Compared with traditional media, social media are closer to the realistic form of what Habermas described as “public sphere” (1962): where the general public come together to freely discuss and identify societal problems of mutual interests (Gerard, 1998). Harbermas’s public sphere centered on the idea of civic participation. Although the ideal conditions of public sphere, as Harbermas described them, is almost impossible to achieve, social media is a public space that

people regard as “a regulatory institution against the authority of the state” (Harbermas, 1989, p. 27).

Moreover, this study found no causal effects between laypeople and any other actors on social media, nor to traditional media. This finding was consistent with previous studies that public agendas on social media did not respond to media agendas (Wang, 2016), and it built on this previous research by suggesting that media cannot decide what netizens talk about and public agenda can hardly influence media and government agenda on social media. Existing studies already found the gatekeeping role of media declined as social media gained popularity (Vargo et al., 2014), but media professionals still maintained the power to set the agenda for others in issues relating to policy, politics, and international relations (Wallsten, 2007; Vonbun et al., 2016). However, for obtrusive issues like air pollution, this study provided solid evidence that agenda-setting role of traditional media has been diminished.

If people have their own agendas on social media, then the next question is: What does this mean for the role of media in people’s lives and in public discussion? Obviously, people are less dependent on media to form their own opinion. This is partly because of the public’s declined trust in media content. Thanks to the Internet technologies, people these days have so much exposure to information about the manipulated political and media systems, and they have developed profound cynicism toward these outlets (Delli Carpini & Keeter, 1997; Ryfe, 2006). Consequently, they have broken away from consuming traditional news and leaning towards their peers, friends, and trusted experts for information, which is supported by social media platforms (Bennett & Iyengar, 2008; Domingos & Richardson 2001). For obtrusive issue, because the issue is so close

to people's daily life, if media coverage is different from what they observed in reality, people easily turn away from media.

But at the same time, the lack of agenda-setting effects is also due to the fact that agendas formed on social media are fragmented with little consensus reached among actors. Agenda from ordinary citizens, in particular, was independent from all other actor's agenda. Air pollution was framed as a "weather" issue by ordinary people, and a large portion of Weibo posts did not contain any frames. As discussed before, social media show a positive sign for the emergence of public space, but another important goal of public space is to reach a common judgement about an issue and form public opinion (Harbermas, 1962; 1989, Gerard, 1998). Information on social media goes so fast that people have little patience to consume, think, and reflect on complex content such as news stories. Many times, they simply use social media to express personal feelings and emotions. Therefore, it is hard to say the discussion on Weibo really form any public opinion or common judgment, not to mention the possible influence on media content and political actions (Harbermas, 1989).

Another important finding is traditional media, especially commercial media, set the agenda for social media, not the other way around. But the agenda-setting effect only occurred from traditional media to verified individual accounts, media accounts and government accounts. In authoritarian countries such as China, the discussions about social media usually center around its degree of freedom and its impact on democracy. Some argued that social media in China have created a new public sphere characterized by deliberative criticism for democracy (Reese & Dai, 2009). Particularly, for environmental issues, researchers are generally optimistic in how social media empower NGOs and ordinary citizen in the policy-making process (e.g., Yang, 2006; Y,

Chen & Fu, 2016). According to them, NGOs and ordinary citizen can participate in online discussion of environmental policies and become the driving force that promotes the issue salience on the media and government agendas. However, results from this dissertation are less optimistic. Although progress has been made, NGOs and ordinary citizens have limited power in “authoritarian environmental” issues such as air pollution. This theoretically supported “authoritarian environmentalism” and contributed a media perspective. According to Han (2012), people in China are generally satisfied with their living standard and willing to trade political emancipation for economic development. Even with environmental pressures, the public still puts pressure on government and leaders to stand up for and make decisions for them. Findings suggested that a boundary still exists around Chinese cyberspace and it needs further observation to make the argument about democratic impact of social media on Chinese society.

Limitations and Suggestions

To map out the segmented social media agenda and the entire agenda-setting effects between traditional and social media on the issue of air pollution, this dissertation included news coverage from four traditional media outlets and Weibo posts from six types of actors on social media. Additionally, this dissertation conducted both Spearman’s Rho correlation and Granger’s causality to test agenda-setting effects among these groups from an overall perspective and for nice specific frames. However, it’s not without limitations.

The major drawback of this dissertation comes from its social media data collection. Information control leads to Weibo posts being monitored and filtered all the time. For issues such as air pollution, as discussed in the literature review, Weibo posts that potentially threatens party legitimacy and social harmony were deleted. For example, one week after the release of “Under

the Dome”, a documentary about pollution from popular former CCTV journalist Chai Jing, many related news stories and commentaries on state media sites and Weibo posts vanished (Tech in Asia, 2015) because the documentary led to unexpended stirring discussion on the controversy over energy consumption in China. “Chai Jing” “Dome” and “Under the Dome” were among the most censored terms on Weibo (Hong Kong University Weiboscope, 2015). Therefore, the Weibo data and even the traditional news story data collected in this dissertation were filtered and incomplete to some extent. However, the problem of censorship is inevitable not only for studies on China’s social media, but also for studies on social media in general. Censorship and filtering mechanisms exist in every country such as Facebook and Twitter in the U.S. (Bamman, O’Connor, & Smith, 2012; Pempel, 2015). Both Facebook and Twitter delete content that they considered improper from their platforms and are regulated by the laws of the country where they operate (Bamman, O’Connor, & Smith, 2012; Pempel, 2015). In this sense, although Weibo is censored by the government, it is another social media platform just like Facebook and Twitter. Take one step backwards, even if there were no censorship of a particular issue, it is difficult to get the whole firehose of tweets. For example, the open application program interface (API) of Twitter only gives 1% of the entire tweets and it has rate limit ceiling of how many can be collected for each 15-minute interval⁹. Therefore, one can seldom get an ideal representative social media sample in practice. However, my sampling method aimed to mitigate this limitation. For example, I used “PM2.5” and “air pollution” as the search key words, which are not sensitive most of the time in the five-

⁹ According to Twitter Development Document (<https://dev.twitter.com/rest/public/rate-limiting>), there is a rate limit every 15 minutes to use API to collect tweets. Once the ceiling is reached, the API will stop until the next 15 minute interval.

year-period, so the sampled Weibo dataset was already a relatively good representation of the entire Weibo posts on this topic.

The sampling method adopted in this study could potentially affect the finding of a lack of agenda-setting effects between traditional and social media. As things happen quickly on social media, sampling only 10 posts each week could be the reason for the lack of agenda-setting effects. Also, this dissertation studied one social medium in depth rather than social media in general. Although Weibo is the most widely used social medium in China, a limitation of this dissertation is not including other social media platforms.

In addition, Granger's causality is a powerful statistical tool to detect causal relationships, yet it has limitation as well. A Granger-causality test handles well pairs of variables in linear causal relationships, but it is potentially misleading if the true relationship involves three or more variables. Also, the results could also be inaccurate if sampling is not frequent enough or too frequent (Mariusz, 2015). In this dissertation, I selected four media outlets to present traditional media agenda. I have stated in the method session that these four media outlets can represent various media formats such as state-own media, commercial media, national media and local media from north and south China. But future studies should include more media outlets from a wider range of geographical locations to more fully capture the agenda-setting process. Related to this, for the content analysis, I attempted to maximize reliability and validity for coding the frames, but manual coding can still be subjective as frames are decided based on a small pretest sample. In addition, future studies should compare the agenda-setting process in China to other countries to provide a more robust theoretical contribution.

Future studies can explore the combination of traditional content analysis and computational content analysis, such as unsupervised topic modeling. Unsupervised topic modeling views each document (news story in this context) as an unordered “bag of words” occurring with different frequencies. Then the contents are deposited into multiple latent topics, the segregation of which is based on weighted proportion of topical word frequencies in the document (Manning, Raghavan, & Schütze, 2009). The combination of the two methods would be beneficial as they reveal hidden structure in unlabeled data while detect the nuances and complexities within the text (e.g., sarcasm) (Guo et al., 2016).

This dissertation found that traditional media have limited agenda-setting effects for social media, and laypeople almost have an independent agenda from traditional media and other social media actors. Findings in this dissertation showed some differences from previous studies, which showed traditional media and business people set the agenda for the public (Wang, 2016). Findings in this study reflected the agenda-setting effects for air pollution issue. It was not the focus of this dissertation to compare various issues, but future studies can compare different issues to generalize the agenda-setting process and communication patterns in the content of China and beyond.

Conclusion

Taken together, results from five-years’ worth of media coverage indicated that air pollution issue involves various social and political elements and the focus of the discussion shifted over time. The discussion is never restricted to air pollution, but spilled over to the political arena, such as government and political trust. Air pollution on traditional media is portrayed as a serious and pressing issue that relies on government to take action and carry out policy with advice from scientists and researchers. The public is passive with little space to engage them in the problem-

solving process. By systematically examining media agenda on air pollution issue over five years, and the agenda-setting effects between the media outlets and all kinds of actors on Chinese Weibo, this dissertation provided a holistic picture of the development of air pollution issue in China for the western world, and opens up a window to know about the ongoing changes in Chinese traditional and social media.

Appendix: Frames Examples from Newspapers and Weibo

Frames	Newspaper Examples	Weibo Examples
War on Pollution	<ul style="list-style-type: none"> • 明年深圳力争灰霾天少于 70 天 • Shenzhen aimed to reduce polluted days to fewer than 70 next year • 治理 PM2.5，北京要攻坚 • Beijing determined to kill PM2.5 	<ul style="list-style-type: none"> • NASA 从太空拍摄雾霾笼罩下的中国。近年来中国“十面霾伏”。 • NASA took photo of China from the space, stating that China has been covered by smog in recent years.
Science	<ul style="list-style-type: none"> • 对付 PM2.5，什么样的口罩才有效？ • What masks are most effective to prevent you from polluted air? • 专家辟谣：PM2.5 污染住 20 楼最悲催？ • Experts react to rumors: PM2.5 reached the highest value at the height of 20th floor? 	<ul style="list-style-type: none"> • 央视《每周质量报告》调查发现，把市场上 5 种热销空气净化器结果 3 台 PM2.5 去除率的实际检测结果都比标称效果低。此外，4 台净化器的甲醛去除率也达不到标称效能。 • CCTV “Weekly Quality Report” found three out of five popular air purifiers didn’t have the effects they claimed to; Also four out of five didn’t reach the qualification of reducing HCHO poisonous elements.
Achievement	<ul style="list-style-type: none"> • PM2.5 去年降 6.3% • PM2.5 reduced by 6.3% last year • 上月空气干净 仅 3 天未达标 • Air was clean last month, only three days are polluted 	<ul style="list-style-type: none"> • 【小伙伴们，结伴去常熟呼吸苏州好空气！】截至 14 时，苏州 AQI 为 270，重度污染。令人欣慰兴福和菱塘 2 处监测点空气质量良好！ • Good weather in Changshou! Although the nearby city Suzhou is heavily polluted with PM2.5 as high as 270, Changshu still has clean air!

Public Accountability and Trust in Government	<ul style="list-style-type: none"> • 率先公布 PM2.5 让老百姓活得明白 • Publicize PM2.5 data to be transparent towards the citizens • 监测 PM2.5 更细化才能赢得信任 • To gain trust, government needs to publicize PM2.5 monitoring process in more details. 	<ul style="list-style-type: none"> • 环保部说空气质量没毛病，美国使馆 PM2.5 爆表，看看外面这天，大家心里清楚。 • Environmental Department claimed the air quality is good; The US Embassy claimed the air is so polluted that it hit the maximum value on the pollution monitor. I think everyone can understand who tells the truth by simply looking outside the window.
Progressive and Development	<ul style="list-style-type: none"> • 伦敦大雾：一场发展和污染的博弈 • The fog in London: The dilemma between development and pollution 	<ul style="list-style-type: none"> • GDP 涨得快，环境就得遭破坏。绿色 GDP 说起来容易，执行起来，急功近利的官员太多。 • Environment was sacrificed for the increase in GDP. Green GDP, theoretically sound, but in reality, is so difficult to achieve because of the near-sighted government officials.
Humanity and Personal Interests	<ul style="list-style-type: none"> • 建筑工人雾霾中继续作业 • Construction workers continue to work in heavy smog • 雾霾来了，在中信上班的老公“不见了” • Pollution is coming, and my husband “disappeared” 	<ul style="list-style-type: none"> • 12 月 1 日上海国际马拉松赛外滩开跑，我担心一点----上海空气质量这么差，雾霾严重，PM2.5。。。选手们露天赛跑不是等于吸毒吗？ • The Shanghai International Marathon started December 1ST. Yet the air is so bad, I was worried that participants are in fact poisoning and killing themselves
Public Engagement	<ul style="list-style-type: none"> • 网友拟为 PM2.5 起中文名 • Netizens tried to give PM2.5 a Chinese name • 民间自测 PM2.5 小组：“我们不想在毒气里狂欢” • Self-organized PM2.5 monitoring: We need to do something to the air pollution 	<ul style="list-style-type: none"> • 不开大排量汽车，每天骑车上下班，保护环境，光靠说不行，要自己做才算数。 • Don't drive high-emission vehicles, and ride bike to work. Words won't help to solve air pollution, but action does.

Weather	<ul style="list-style-type: none"> • 省内大部有雾霾，或持续到周六 • The smog will last till Saturday in the province • 雨水洗礼后 PM2.5 转优 • PM2.5 dramatically reduced after the rain 	<ul style="list-style-type: none"> • 傍晚 #全国实时空气质量指数 # 前三名：鄂尔多斯 31(优)，大连 39(优)，郑州 44(优)；倒数三名：聊城 219(重度污染)，乌鲁木齐 210(重度污染)，邢台 169(中度污染)。 • Air quality top three: Ordos City (PM2.5 value: 31), Dalian (39), Zhengzhou (44); last three: Liaocheng (219), Ürümchi (210), Xingtai (169)
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