

**SOCIAL AND ENVIRONMENTAL IMPACTS OF SHALE GAS DEVELOPMENT AND
PUBLIC SUPPORT FOR FRACKING IN CHINA**

by

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Abstract

The debates on the environmental impacts of shale gas development remain highly contested in recent years. The environmental uncertainty has led to growing opposition to shale gas development in numerous Western democratic countries. Understanding the social perceptions of the impacts of shale gas development is important as it affects public attitudes toward the development. There is, however, scarce data on the public perceptions of shale gas developments in non-democratic countries that are experiencing rapid shale gas development, such as China, the case study for this study. I draw on fieldwork conducted during August 2015 in Chongqing and Sichuan province, where the most active shale gas development in China is currently ongoing, to examine residents' perceptions of the impacts of the shale gas development, and to analyze how the political system affects these public perceptions. The results indicate that people in China support shale gas development in spite of the serious environmental problems they experienced for two prominent reasons: economic incentives and political pressure. Thus, this research has uncovered a gamut of positions, and a spectrum of economic and political motivations, underlying the Chinese people's support for shale gas development.

Preface

This study aims to investigate the impacts of shale gas development in China and how residents view the development. Through interviews in two villages in Sichuan province and Chongqing where large-scale shale gas development is ongoing, this study concludes that the development has affected local residents both positively and negatively. Despite the negative impacts, respondents indicated their support due to 1) low environmental awareness on fracking; 2) economic incentives; and 3) political fear.

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Chapter 1: Introduction

Having commenced shale gas development in 2009, China quickly became, by 2014, the third largest shale gas producer in the world (EIA 2014). Possessing the world's largest shale gas reserve (EIA 2015), the Chinese government has set ambitious goals to boost its shale gas production in the coming years (MLR 2015). According to Chen Weidong, a renowned energy expert and research chief at China Offshore Oil Corporation (CNOOC), China will increase its annual shale gas production from 1.3 billion cubic meters to 30 billion cubic meters by 2020 (MLR 2015). This goal is equivalent to 23 times the current yield, boosting the shale gas output from 1% of the total China's gas production to 15%.

While China is rapidly developing its shale gas industry, many Western countries such as the U.S. and Germany have encountered growing public opposition to shale gas development due to the environmental uncertainties around hydraulic fracturing (Torry 2015) – also known as fracking. Some countries, such as France and Bulgaria, have even halted their development due to environmental concerns (Weile 2014; Jolly 2013). In particular, the environmental impact on water resources caused by fracking, due to its usage of vast quantities of water and toxic chemicals to extract shale gas from the impermeable shale layers (Soeder and Kappel, 2009; Colborn et al. 2011), have engendered debate and public controversy.

Although the existing literature on the association between environmental contamination and fracking has remained inconclusive (Llewellyn et al. 2015; Drollette et al. 2015), case studies conducted in the U.S. have documented how shale gas development in fracking communities

such as the Marcellus Shale region have affected the residents there, and consequently, their attitudes toward such development (Braiser et al. 2011; Schafft et al. 2013; Anderson and Theodori 2009). These case studies revealed that many residents encountered significant water problems such as contaminated wells and flammable tap water.

There is, however, scarce information on the impact of shale gas development on communities in the rural regions of China, where the most active shale gas productions are taking place. Many of these rural regions are ecologically fragile with significant risks of groundwater contamination due to their geographical characteristics (Ting 2013). Hence, the first part of my research (Chapter 4) focuses on the social, economic and environmental impacts of shale gas development on local communities. I examine the impact of shale gas development from the residents' perspectives to understand the degree of public awareness of the potential dangers of fracking, how and why their (mis)conceptions are shared within the community, and consequently, their attitude toward the development (Auyero and Swistun 2008).

Furthermore, given that China has a one-party authoritarian regime, Chinese citizens face stricter political control and less individual freedom than the citizens of Western democratic countries. Unlike dissatisfied citizens in democratic countries who can freely take part in social movements to express their opinions, Chinese citizens do not possess the freedom of association and speech under the authoritarian regime (Huang and Yip 2012). Through censorship, the Chinese government suppresses anti-government sentiments and prohibits collective actions (King et al 2013). Collective actions such as protests have been effective in raising public awareness of fracking and subsequently leading to policy changes in many Western democratic countries

(Kaplan 2014). Hence the second half of my research (Chapter 5) focuses on the role the political regime plays in influencing people's attitudes toward shale gas development. While there is growing public opposition to shale gas development in the West, do the Chinese public share similar attitudes with their Western counterparts?

In August 2015, I travelled to two villages in Sichuan province and Chongqing municipality, southeastern part of China, where large-scale shale gas development is currently taking place. There, I interviewed 17 villagers about the community and environmental impacts of the development, how they view the impacts, and their attitudes towards the project. After interviewing them, I found that the shale gas development had significantly affected the local residents, both positively and negatively. The positive impact of the development was mostly economic, such as income creation through lease payments, and improvement in infrastructure paid for by increased government tax revenue. The development caused substantive environmental impact however, such as water contamination, water depletion and noise pollution. As they earned very minimal income as farmers, the majority of my respondents were drawn to the economic benefits, and many hoped that the shale gas development would bring prosperity to their under-developed remote villages. In addition, due to their limited education, the majority of the respondents had low awareness and understanding of the risks and dangers that shale gas development brings. The draw of economic benefits, when combined with their lack of understanding of the environmental dangers involved, has led some respondents to strongly support the shale gas development. In addition, there are other respondents who supported the development for a different reason - fear of repercussions from the government. Thus based on their attitudes toward the development, I categorized their support into two types- *active support*

¹and *resigned support*². This categorization illustrated that there were diverse attitudes towards shale gas development among the respondents, despite their overt support for it.

In **chapter two**, I present a literature review of existing debates over the shale gas development, the growing public opposition toward such development in Western countries such as the U.S. and U.K., and the rapid growth of the anti-fracking movement that has already triggered policy changes in many countries. I also review the history of shale gas development in China and describe the characteristics of China's political system that affect people's attitudes toward the government and the space for local social movements to emerge. In **chapter three**, I describe my methodology which includes my site selection, respondent sampling criteria, data analysis method. I also discuss the limitations of this study. In **chapter four**, I discuss the community and environmental impacts of the shale gas development as reported by my respondents. I also discuss their explanation of the impacts and how that affected their attitude toward the development. In **chapter five**, I discuss the two types of support articulated the respondents, and the factors that contribute to their respective attitudes. Lastly **chapter six** is the conclusion of this study.

¹ Active support is a type of support in which people are certain about their support, due to rational calculation of their interests. People who demonstrate this form of support were those who directly benefited from the shale gas development and were least affected by its negative impact.

² Resigned support refers to an involuntary type of support which highlights respondents' lack of empowerment.

Chapter 2: Literature Review

2.1 Environmental debates on shale gas development

Shale gas is natural gas that is stored deep underground in shale layers with low permeability. The lowly-permeable, non-porous shale layer makes the extraction of shale gas using conventional vertical drilling difficult. In order to extract shale gas, horizontal drilling and hydraulic fracturing are used to create fissures in the shale layers, providing pathways for shale gas to flow from the shale layers to the well. Hydraulic fracturing, also known as fracking, is the technique that pumps a large volume of water, chemicals and sand into the shale layers at high pressure to create fissures that allow the shale gas to be released and captured.

Fracking is a highly controversial practice due to its potential environmental impact on the quantity as well as quality of water resources as well as its potential of inducing earthquakes. Fracking can lead to widespread water depletion due to the massive amount of water required in each fracking operation. A well requires 2-13 million gallons of water for each frack (Vengosh et al 2014). Often, the frequency of fracking in each well depends on the geographical characteristics of the shale reserve, such as the depth of the shale layer, its thickness, and the gas composition within it (Jenkins and Boyer 2008). Each well is repeatedly fracked throughout its lifetime to ensure constant gas flow and stable productivity (Jenkins and Boyer 2008). Wells are fractured 17 times each on average, requiring a minimum average of 34 million gallons of water consumed – this is equivalent to the volume of water contained in 51 Olympic-size swimming pools. Thus fracking can deplete water resources and exacerbate water scarcity in semi-arid regions such as China (Chang et al. 2012; Xingang et al. 2013; WRI 2014).

Moreover, fracking can lead to water contamination, because of the toxic chemicals used in the fracking fluids. These chemicals can contaminate underground water and water bodies near fracking sites through the improper disposal of fracking fluids, surface spills from wastewater storage facilities, faulty well casings, or wellhead explosion due to uncontrolled gas release during fracking operation (Haworth 2011; Jackson et al. 2011). Water contamination reduces the amount of clean water that can be used as potable water or for irrigation of crops and hence can lead to more severe water scarcity problems in water-depleted regions. Consequently, fracking threatens global water security which is defined as “an acceptable level of water-related risks to humans and ecosystems, coupled with the availability of water of sufficient quantity and quality to support livelihoods, national security, human health and ecosystem services” (Bakker 2012:914)

Chemicals used in fracking fluids can pose long-term significant health impacts on human beings. Based on laboratory studies, researchers were able to identify more than 300 chemicals including formaldehyde, boric acid, methanol, hydrochloric acid, and isopropanol which act as lubricants, clay stabilizers, surfactants, solvents, and corrosives in the fracking fluids (Colborn et al. 2011; Stringfellow et al. 2014). Researchers suggested that majority of the identified chemicals can cause cancer, endocrine disruption, kidney diseases, cardiovascular problems, impacts on the skin, eyes, and other sensory organs, respiratory and gastrointestinal diseases (Colborn et al. 2011; Coffman 2009; Jackson et al. 2011). In fact, epidemiological studies show a statistical relationship between fracking well density and the aforementioned health effects. Jemielita et al. 2015 suggested that higher fracking well density is associated with higher rates of hospitalization

for cardiovascular diseases such as strokes, neurological illnesses, and skin ailments in Pennsylvania, one of the most heavily fracked states in the U.S. (Jemielita et al. 2015).

Though the health effects of fracking chemicals have been observed, no conclusive research exists to prove that fracking indeed leads to water contamination. On the one hand, some researchers suggested that they have found traces of fracking chemicals in shallow aquifers near fracking sites (Llewellyn et al. 2015). In a case study conducted in the Marcellus shale region, researchers found that the shallow aquifers near fracking wells contain a mixture of organic compounds that are identified in fracking fluids (Llewellyn et al. 2015). They also found traces of 2-n-Butoxyethanol, a compound identified in flowback, “in one of the foaming drinking water wells at nanogram-per-liter concentrations” (Llewellyn et al. 2015:6325). They concluded that fracking chemicals have migrated from the wells to aquifers and contaminated underground water.

On the other hand, the Environmental Protection Agency (EPA) suggested that fracking activities pose “no widespread, systemic” pollution. In the most recently published report in *2015 Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resource*, the EPA stated that “we did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources” (EPA 2015:6). Similarly, another study led by researchers from Yale University found that groundwater contamination is more likely caused by surface toxins infiltrating into groundwater and less likely caused by fracking chemicals (Drollette et al. 2015). The researchers concluded that “no evidence of association with deeper brines or long-range migration of these compounds to the shallow aquifers”

(Drollette et al. 2015). Their study and the EPA report suggested that there is no direct association between fracking operations and water contamination. Hence the debates on chemical contamination of water resources remain unresolved.

Despite ongoing debates on chemical contamination of water, high concentration of methane has been found in drinking wells near water sites. Unlike fracking chemicals, methane is one of the main components of natural gas, which thus is present in the shale layers: 90% of shale gas is comprised of methane (Allen et al. 2013). Since methane is naturally found in rock layers (Allen et al. 2013; Jenkins and Boyer 2008; Howarth et al. 2011), methane is released when the shale layers are fracked. The fissures created in the rock layers provide pathways for methane to migrate to aquifers.

Drinking water wells located nearer fracking wells contain higher methane concentrations than those located far away from the fracking wells (Holzman 2011; Osborn et al. 2011). In a study conducted in the Marcellus shale in the U.S., one of the largest shale plays in North America, researchers found that “in active gas-extraction areas (one or more gas wells within 1 km), average and maximum methane concentrations in drinking-water wells increase with proximity to the nearest gas well and were 19.2 and 64 mg CH₄ L⁻¹, a potential explosion hazard” (Osborn et al. 2011: 8172). A high concentration of methane in water wells can lead to explosions in wells and in households (Howarth et al. 2011). Footage of ignitable tap water in households near fracking wells was documented in the 2010 Academy Award-Nominated documentary *Gasland* (Fox 2010). Despite its explosive nature, chronic exposure to methane is considered to be non-toxic to human health (Canadian Centre for Occupational Health and Safety 2016). However, the

release of high concentration of methane can exacerbate climate change. Methane is more efficient in trapping heat than carbon dioxide with its impact on climate change 25 times greater than that of carbon dioxide (EPA 2016).

In addition to the controversial water contamination issue, fracking can also cause serious air pollution that can threaten human health. At every production and delivery stage of fracking operation, researchers have measured and found that “tons of toxic volatile compounds (VOCs), including BTEX, other hydrocarbons, and fugitive gas (methane), can escape and mix with nitrogen oxides (NO_x) from the exhaust of diesel-fueled, mobile, and stationary equipment, to produce ground-level ozone” (Colborn et al. 2011: 1042; CH2MHILL 2007; Colorado Department of Public Health and Environment 2007). Exposure to ozone at ground-level risks causing damage to tissues in lungs and lead to asthma and pulmonary disease (Islam et al 2007; Triche et al 2006). Ozone created by shale gas activity can bring unprecedented air pollution to rural areas where rapid drilling activities are taking place. In addition to the ozone, dust created by the fleets of trucks used to transport fracking fluids, wastewater, water supply and other frack-related goods can also decrease local air quality (Colborn et al. 2011).

Moreover, an increasing number of studies suggest that shale gas development can trigger earthquake that can cause potential regional damage. Researchers found that the injection of wastewater into underground wells, a common disposal practice of fracking, triggers earthquake by increasing the underground fluid pressure near the existing faults (Ellsworth 2013; Kim 2013). In 2014, fracking in northeastern B.C. caused a 4.4 magnitude earthquake, one of the largest fracking-induced earthquake ever recorded (Trumpener, 2015). Similarly, fracking in Ohio, U.S.

have triggered earthquakes in places where there were no previous record of seismic activities (Kim 2013). Other case studies conducted in Oklahoma also revealed the temporal correlation between fracking operation and the occurrence of earthquakes of magnitude ranging from 0.6 to 2.9 on the Richter scale (Holland 2013). Thus shale gas development can lead to more frequent earthquakes and cause widespread damage in local communities.

2.2 Public perceptions of shale gas development in North America

In addition to environmental debates about shale gas development, researchers have also examined laypersons' perceptions of the impact of shale gas development and their attitudes toward such development. Examining the social perception of impact is critical in exploring 1) whether people recognize the potential danger of fracking 2) how (mis)conceptions are shared within the community (Auyero and Swistun 2008; Schafft et al 2013).

Case studies in the U.S. found that residents in fracking regions were aware of both the positive and negative effects of the development (Braiser et al. 2011; Schafft et al. 2013; Anderson and Theodori 2009). Despite tremendous economic benefits in local communities, residents were critical of the negative environmental impacts of fracking and thus viewed shale gas development negatively (Anderson and Theodori 2009). Local economic growth is a significant positive impact of shale gas development (Kay, 2011). Economic impacts include job creation, increase in local business activities (e.g. hotel and restaurants), increased household income and wealth of individuals who receive lease payments on their private lands, and increased government tax revenue (Kay, 2011; Braiser et al. 2011; Anderson and Theodori 2009).

Other positive impacts include infrastructure improvements such as road construction. Many residents believed that rural areas have experienced significant improvement in roads. In a case study conducted in the Marcellus shale region, a respondent was quoted “I also think that some of the rural, smaller communities... will have some of the nicest roads... in the state” (Braiser et al. 2011:52). In addition to economic growth, infrastructural improvement is another positive impact embraced by local residents.

Residents, however, did express concern about negative impacts such as environmental problems. They had high awareness of the potential danger of fracking and worried about the impact on water quality and quantity (Braiser et al. 2011; Anderson and Theodori 2009). Anderson and Theodori 2009 stated that “the greatest environmental concern by far mentioned... dealt with freshwater supplies” as key informants in his study “listed water as a major energy-related concern” (Anderson and Theodori 2009: 122). Thus residents opposed the building of fracking facilities near their home as they worried that chemicals would seep underground and contaminate their water- “local citizens oppose the placement of disposal wells in their immediate vicinity because improper well design may allow for potential contamination of groundwater supplies” (ibid: 122). Residents were critical about the danger of fracking in which water contamination was a major concern that led to local opposition to fracking.

In addition to water concerns, air pollution and noise pollution were other negative impacts that affected the residents. Residents suggested that the around-the-clock operations of drilling activities had produced significant noise and air impacts. Such impacts had degraded their quality of life (Anderson and Theodori 2009). Apart from environmental impacts, other negative

impacts include social issues such as cultural conflicts between long-term residents and newcomers, conflicts among landowners who received different lease payments, housing shortages due to population growth, and increase in truck traffic (Ibid.; Braiser et al. 2011). Environmental concerns and social issues were costs that could outweigh the economic benefits of development. In fact, the environmental costs of fracking have led to many grassroots community-based protests against shale gas development, despite the economic benefits.

2.3 Anti-fracking movement

In spite of the promising economic benefits of shale gas development, an increasing number of people from different countries have negative attitudes toward shale gas development. According to a poll conducted by the Pew Research Center, more Americans oppose fracking (47%) than support it (41%) in 2014 (Pew Research Center 2015). Americans who supported fracking has rapidly declined from 48% in 2013 to 41% in 2014 while those who opposed fracking has increased significantly from 38% to 47% (Pew Research Center 2015). Similarly, public opposition to fracking has also increased in the U.K. According to the poll conducted by the Department of Energy and Climate Change, citizens' support for fracking has declined from 27% to 24% while the opposition to shale gas has increased from 21% to 24% from 2013 to 2014 (DECC 2014). Similarly, in Canada, citizens who support a moratorium on fracking until it is proven to be safe have increased from 62% in 2012 to 70% in 2014 (The Council of Canadians 2012; The Council of Canadians 2014). These polls reveal that public opposition to fracking has increased significantly around the world, and also that people become more critical about the environmental costs of fracking.

In fact, a recent study suggested that public awareness of fracking has increased tremendously due to the use of media since 2010. Media such as documentaries can effectively cause social and political changes as it “create[s] new topics of popular discourse, inspire political activism, and even influence policymaking” (Vasi et al. 2015: 2). For instance, the release of the award-winning fracking documentary *Gasland* has heightened public awareness of fracking with “greater online searching about fracking”, “increased social media chatter” and “heightened mass media coverage” (Ibid.: 1). *Gasland* raised public awareness of fracking through informing audiences about the environmental impacts of fracking (such as ignitable tap water), the prognosis of environmental outcomes, and the preventative actions that the public can take such as signing online petitions. Consequently, Vasi et al (2015) argue that *Gasland* changed public perceptions toward shale gas development, enhanced people’s motivation to take actions and ultimately led to policy change, which included the local moratorium on fracking in the Marcellus Shale regions (ibid.). As suggested by the response to *Gasland*, media has significantly contributed to the anti-fracking movement.

The intensifying anti-fracking movements worldwide suggest growing opposition to fracking in many countries. Researchers reported that people’s perceptions, specifically their belief about hazards, correlate with their behaviors (Tierney 1999). For instance, as shown in *Gasland*, Americans who feared that fracking would taint their wells were likely to participate in collective actions to oppose the project (ibid.; Vasi et al. 2015). Participating in collective actions, which refers to “actions undertaken by individuals or groups for a collective purpose, such as the advancement of a particular ideology or idea or the political struggle with another group” (Brunsting and Postmes 2002:527), is to seek self-protection from perceived harm (Tierney

1999). Collective actions against fracking take many forms; they can be categorized into two types- *soft* and *hard* actions based on their nature and intensity. Soft actions aim to persuade others of certain viewpoints through relatively peaceful means that involve minimal physical confrontation, such as letter writing, lobbying and petitioning (Brunsting and Postmes 2002). The online petition campaign organized by the Council of Canadians is one of the many soft actions occurring in Canada. (The Council of Canadians 2016). In contrast, hard actions are less peaceful and often involve physical confrontations with another party, such as demonstrations and blockades (Brunsting and Postmes 2002). For instance, the clash between native protesters and police in News Brunswick, Canada is an example of hard action taken by anti-fracking citizens (CBC 2013). With growing public opposition to fracking, collective anti-fracking actions, both *soft* and *hard*, are occurring more frequently worldwide.

Studies show that the growth of the anti-fracking movements in many countries such as the U.S. can be attributed to the presence of structured environmental organizations and the Internet. For example, structured environmental groups can mobilize the public by bringing grassroots communities together to oppose local fracking projects (Wood 2012; Obach 2015). For instance, FrackAction - a non-profit environmental group in New York, U.S. played an important role in professionalizing and organizing grassroots activists (Obach 2015). Organizations “provide organizational infrastructure, information, technical assistance and political savvy to the anti-fracking movement” (Wood 2012:7). For example, the anti-fracking movement in upstate New York was comprised of numerous rural community groups who were brought together by environmental groups (ibid.). Moreover, environmental groups were adept at using online platforms to organize anti-fracking actions. Activists use social media such as Blogs, Facebook

and Twitter to disseminate instant messages to mobilize grassroots activists, which significantly enhanced their organizational efficiency (Wood 2012; Obach 2015). Furthermore, activists also use online platforms to network with overseas organizations and disseminate their messages to a global audience (Wood 2012). With sufficient mobilization resources, including leadership and online communication platforms, activists have been able to enhance public opposition to fracking, effect policy changes, and ultimately bring regional or national bans on fracking in many countries.

Among many policy changes targeted at fracking, the state-wide ban in New York was one that exemplifies the results of the anti-fracking movement. Sitting atop the Marcellus shale, New York State banned fracking despite having one of the highest shale gas production potential in the country (Kaplan 2014). After years of investigation, Governor Andrew Cuomo issued a state-wide ban on fracking due to inestimable public health risks (Ibid.; New York State Department of Health 2014). The fracking ban was regarded as a significant victory for anti-fracking activists who tirelessly organized campaigns and protests to pressure the government to ban fracking (Kaplan 2014). The anti-fracking organizations played a major role in raising public awareness on fracking and facilitating social mobilization, which contributed to the eventual prohibition of fracking in the state.

Other than the U.S., Canadian provinces and territories (including Quebec, New Brunswick, Nova Scotia, and the Yukon) also imposed bans on fracking (Sherwood 2015; CBC 2014; CBC 2014). Moreover, some countries in Europe have banned fracking because of the environmental concerns. For instance, France and Bulgaria banned fracking in 2011 and 2012 respectively,

citing that fracking's potential contribution to environmental destruction (Weile 2014; Jolly 2013). Similarly, Germany has recently banned fracking due to uncertain risks of water contamination (Torry 2015). Barbara Hendricks, the Environment Minister of Germany, said "as long as risks are uncountable or currently can't be conclusively assessed, fracking will remain forbidden" (Torry 2015). With raising public opposition to shale gas exploration, the U.K is implementing tighter regulations on fracking (Carrington and GV 2015). As demonstrated by the local ban of fracking in the U.S. and Canada, national moratoriums in Germany, France and Bulgaria, and tighter regulation in the U.K., the anti-fracking movements has to a large extent led to tighter regulations against fracking.

2.4 Fracking in China

In 2009, U.S. President Barack Obama and former Chinese Presidents Hu Jintao announced an agreement to develop China's enormous shale gas resources (The White House 2009). According to the U.S. Energy Information Administration, China possesses an estimated 1,115 trillion cubic feet of technically recoverable shale gas resources, almost double the amount possessed by the U.S., the top shale gas producer in the world (EIA 2014). The agreement between the two countries was pivotal to the shale gas development in China as the U.S. could use their valuable expertise to assist the Chinese companies in the exploration of the vast resources. In 2010, as a result of the collaboration between China National Petroleum Corporation (CNPC) and Newfield Exploration Company (U.S.), the very first Chinese shale gas well (Wei 201 well) was constructed in Weiyuen, Neijiang, a city in the southeast of Sichuan province (CNPC 2015), signifying the beginning of the Chinese shale gas revolution. U.S.

expertise also helped China to expedite their development and lower their production costs (EIA 2015).

Since the breakthrough in 2010, shale gas development has rapidly intensified throughout the Sichuan Basin, where the drilling potential has been assessed to be high (Ma 2012). Shale gas production has primarily been concentrated in the Sichuan Basin and has not expanded to other regions such as the Tarim Basin due to the rough terrain and lack of water (Xingang et al. 2013). Researchers suggested that shale gas development will exacerbate existing water scarcity, as 61 percent of shale gas sources in China face high water stress (WRI 2014). Sichuan Basin, where the most intensive commercial production is located, experiences medium to high water stress. It is argued that further development of shale gas, which requires vast quantities of water and induces high risk of water contamination, is likely to intensify water scarcity in the region.

Despite water concerns, China has rapidly increased its shale gas production volume in the past few years. In 2014, there was a total of 840 shale gas wells in China. The production volume has increased from 25 million cubic meters in 2012 to 1.3 billion cubic meters in 2014, a 52-times growth (MLR 2015). In the first half of 2015, the total production volume has reached 18 billion cubic meters (MLR 2015). The government has set ambitious goal to boost shale gas development. In 2020, the production volume is expected to reach 30 bcm (MLR 2015). To encourage production, the Chinese government heavily subsidize shale gas production. The government will offer RMB\$0.3 (CAD\$0.06) per cubic meter from 2016 to 2018 and RMB\$0.2 (CAD\$0.04) per cubic meter from 2019-2020 (Ministry of Finance 2015). With vast amounts of shale gas reserves, accumulated fracking experience and governmental subsidiary policies, China

will experience rapid growth in fracking in the coming years, in spite of experts' concerns about its environmental impacts.

2.5 Chinese political uniqueness

Unlike Western democratic countries, China is a one-party authoritarian state in which the central government imposes strict political controls on its citizens. While anti-fracking movements in Western countries such as the U.S. have gained momentum in raising public awareness of fracking and effecting policy changes (Vasi et al. 2015), social movements in China are illegal and prohibited (Huang and Yip 2012). The Chinese government uses censorship to impose limitations on freedom of association and speech on its citizens (Ho and Edmonds 2008; Wallace and Weiss 2014). The state apparatus suppresses the circulation of information that threatens the supremacy of the state (Lee and Ho 2014). Researchers have suggested that people's perception of risk are shaped by political organizations (Tierney 1999). For instance, Tierney argued that "the public's judgement about risk and safety do not develop in a vacuum; rather the public is influenced by organizational strategies that seek to frame risks in ways that benefits corporate and institutional actors" (ibid:226). Thus, with censorship in China, we would expect residents to have low awareness of the dangers of shale gas development and have different perceptions of shale gas development from that of people in democratic countries.

Studies have revealed that China has by far the largest and most extensive program to limit the freedom of speech of its people in the world (Wu 2005; King et al. 2013). Researchers have proffered two theories to explain the goals of the Chinese censorship program. The *state critique* theory (Marolt 2011; King et al. 2013) suggested that the program focuses on suppressing

criticisms of the states, its policies and its leaders, such as criticisms of poor governance and corruption. It aims to silence dissent and disseminate public information more favourable to the people in power (MacKinnon 2012). Another theory that aims at explaining the goals of the censorship program is the *collective action potential* approach (Shirk 2011; King et al 2013). This theory suggests that “the target of censorship is people who join together to express themselves collectively, stimulated by someone other than the government, and seem to have the potential to generate collective action” (King et al. 2013:327). According to this theory, the government believed that “collective expression organized outside of government control equals factionalism and ultimately chaos and disorder” (King et al. 2013:327; Hu 2013:99). Consequently, these two theories suggest that the censorship program is to prevent the diffusion of information that may raise public consciousness of issues at stake, preventing the organization of collective actions that challenge the supremacy of the government.

Besides political control, the government also imposes strict media control to restrict the circulation of information. While the use of media such as documentaries was effective in raising public awareness of fracking in the U.S. (Vasi et al. 2015), the use of media to achieve the same outcome is unlikely in China’s one-party regime. For instance, *Under the Dome*, a documentary produced by a former Chinese national television broadcaster that highlights the social and health costs of the Chinese smog problem, was removed from the Internet a few days after it was released after receiving substantial public attention (BBC 2015). It appears that the documentary was removed to prevent people from raising public awareness and mobilizing criticism on the pressing pollution problems in China, thus minimizing public resentment towards the government (Browne 2015).

However, researchers have found that social movements have been possible and successful in China, despite the political control and the censorship program. For instance, mass demonstrations against the government's plan to build chemical plants to make Paraxylene (PX), a material used in polyester clothing and plastic bottles, in cities such as Xiamen, Ningbo, Shanghai and Kuming (Huang and Yip 2012) successfully forced the local governments to suspend and relocate the proposed projects. It has been proposed that these mass movements could successfully take place due to the growing number of property-owning middle class in cities "who are vigilant regarding the potential impacts of environmental hazardous construction on their property interests" (ibid:202), causing an upsurge of not-in-my-backyard activism in urban China.

In fact, researchers found that the Internet indeed played a critical role in these successful social movements that had effected policy changes in China. Mobile device and Internet have shown to be instrumental for activists to mobilize collective actions despite tight state censorship of the media and political control over the Internet (Wu 2005; Hu 2013). Successful activism could take place because activists were able to quickly shift between different websites to disseminate information and content, such as live reports of demonstrations, before the authorities were able to trace the sources and block the websites (Hu 2013). It has been found that during their campaign, the Internet acted as an information exchange hub to disseminate information, such as the hazardous effects of Paraxylene, the activities of the anti-PX campaigns, and the governments' decisions and responses to help people keep track of developments (Huang and Yip 2012; Liu 2013). Individuals actively reported the issues on their personal blogs, which has been argued to be the reason the activists managed to successfully brake the information

blockade (Tang 2010). The Internet also served as a discussion platform that enabled citizens to express their support and determination to oppose the government projects, and discuss possible strategies for actions (Huang and Yip 2012; Liu 2013). This encouraged public participation and created momentum for dissenters. The Internet acted as a tool of mobilization as it could disseminate messages quickly to a large number of potential participants and also helped activists locate external allies easily (Huang and Yip 2012). The examples above demonstrate that with sufficient resources and leadership, organized social movements are possible and had been effective in effecting policy change in China.

However, other researchers argue that activism in China is only possible in major cities and could not take root at the national level, because only major cities have the vital resources for organizing collective actions (Hu 2013). Some researchers claim that mobilization in urban cities was possible because cities had the required critical resources such as leadership from the educated middle-class, and a sympathetic media (Lee and Ho 2014). On the contrary, rural cities that are not “first-tier” (the Chinese government classifies their cities in terms of economic and social development) lacked the resources to publicize their environmental grievances (Ibid). For instance, anti-PX protests were successful in “first-tier” cities such as Xiamen, Dalian and Kunming, while a similar protest was unsuccessful in Maoming, a “third-tier” city. Scholars suggested that protests in non-“first-tier” cities failed as they could not draw media attention, which is crucial in “[affecting] the movement by validating and enlarging the scope of its frame” (Lee and Ho 2014:38; Hu 2013). In addition, it is argued that without organizational leadership by the educated middle-class, protesters could not translate their discontent into collective demand, and hence failed to win concessions from the government. Consequently, observations

suggest that lacking media support and leadership, non-“first-tier” localities are unlikely to experience activism movements that are possible in urban cities.

With the shale gas development in China currently taking place in the rural regions of Sichuan and Chongqing where resources are lacking, it is uncertain what residents, who are most directly affected by the shale gas projects, feel about the development. I, therefore, asks three questions in this study: 1) what impacts have the shale gas projects brought to the local communities?; 2) how do local residents perceive these projects?; and 3) what accounts for their perceptions?

Chapter 3: Methods

My research aims to investigate the impacts of shale gas development on the local communities and how Chinese residents perceive these developments. I selected two villages in China to conduct my case study. One village is located in Xinchang township, Neijiang city, Sichuan province, and the other village is located in Jiaoshi township, Fuling district, Chongqing, one of China's four direct-controlled municipalities located to the east of Sichuan (Table 1). The two villages are approximately 380 kilometers apart. As suggested by Oberg "it appears evident that it is easier to understand the essence of a problem if you talk to those who have a stake in the issues at hand" (Oberg 2010:52). Hence, I adopted a qualitative study because it allows me to interact with people who are most directly affected by the development to collect first-hand information to investigate the impacts of the development and the local people's attitude toward it.

The village in Xinchang is where the first fracking well in China was constructed in 2010 (figure 1) (CNPC 2015). Thus this village has the longest history of shale gas development; hence, its residents would have witnessed and experienced the changes brought about by the development through its different stages. The village in Jiaoshi is currently the one with the largest scale of shale gas production and the heaviest amount of fracking (Sinopec 2014; Davies 2015). The scales of shale gas production in these two villages are different -- Jiaoshi currently has 250 wells and produces 12 million cubic meters of shale gas daily, whereas Xinchang has 79 wells and produces 7 million cubic meters a day (Table 1) (Bai 2015; CNPC 2016). By comparing these two villages, I can investigate how the level and scale of development affects the social and environmental impacts of fracking, as well as people's attitudes toward the development. Both

villages have been designated by the national government as national shale gas demonstration areas: Changning-Weiyuan shale gas demonstration zone and Fuling shale gas demonstration zone.

	XINCHANG	JIAOSHI
CHINESE NAME	新场镇	焦石镇
JURISDICTION	Neijiang, Sichuan	Chongqing
GEOGRAPHIC LOCATION	Sichuan Basin	East of Fuling
SIZE	135.58 km ²	114 km ²
POPULATION	43,000	30,000
MONTHLY INCOME PER CAPITA	RMB \$2,850 (CAD \$611)	RMB \$3,429 (CAD \$735)
DIALECT	Neijiang dialect; Sichuanese	Fuling dialect; Sichuanese
NATIONAL SHALE GAS DEMONSTRATION AREA	Changning-Weiyuan	Fuling
NUMBER OF WELLS	79	250
PRODUCTION VOLUME	7 million cubic meters/day	12 million cubic meters/day
SHALE GAS DEVELOPMENT COMPANY	CNPC	Sinopec

Table 1 The characteristics of the two selected towns (The People’s Government of Neijiang Municipality 2015; Fuling District People’s Government of Chongqing 2015; Bai 2015; CNPC 2016).



Figure 1 Wei 201 H-1 well, the very first fracking well in China, surrounded by paddy fields and corn fields (Source: photography taken by the author).

To understand how the village residents perceive the existing and potential impact of the shale gas development and subsequently their attitudes toward the development, I used semi-structured interviews, which constitute "a particularly useful way of gathering information about people's interpretations and motivations-- why people do things, and what different experiences and social situations mean to them" (Messengill 2012). The topics that I covered in each interview included: their awareness of the drilling activities; their perceptions of the social and environmental impacts of fracking; their adaptation to the impacts; their levels of trust towards the government and industry; their attitudes toward the development (for example, their level of support for shale gas development). During these semi-structured interviews, I asked interviewees questions specific to my concerns while providing interviewees the opportunity to discuss topics that they wanted to bring to my attention. For instance, I asked respondents "how

does the development affect your livelihood?” to understand their perceptions of the positive and negative economic impact of the development (Appendix A).

Prior to the fieldwork, I had anticipated some challenges, such as the language barrier and the difficulties in recruiting interviewees. I am fluent in Mandarin but was aware that the majority of the villagers only speak the local dialect, Sichuanese, which I cannot speak. I was also aware that residents could be reluctant and unwilling to speak to a researcher from outside the village as they have lived in the village all their lives, and hence might trust local people. To minimize both the linguistic and recruitment challenges, I hired a local university student who spoke the local dialect to be my fieldwork assistant. My assistant played an instrumental role in the fieldwork as he understood the local culture and was able to establish trust between villagers and our team. Without the presence of my assistant, local people might have been hesitant to talk to me. During the interview, some respondents asked my assistant multiple times if I was a “spy”, as I do not speak the local dialect and look different from the local people. Through my assistant’s fluent Sichuanese, our team was able to establish trust with villagers, who were thereafter willing to be interviewed.

I interviewed 17 villagers in total (9 in Weiyuan and 8 in Jiaoshi) during the August of 2015 (Table 2). These villagers satisfied the following criteria: 1) they were long-term residents who have lived in the village for the past ten years or more; 2) they had no ties with the gas company, meaning that they or their family members are not working and have not worked for the gas company; 3) they were able to speak Mandarin or Sichuanese (Mandarin is the official language in mainland China; Sichuanese is the local dialect in Sichuan province). These criteria were

formulated based on the following considerations. First, residents who have lived in the village for the past ten years are likely to be aware of the conditions in the village prior to the drilling activities and hence could be aware of the changes brought by the drilling development. Second, interviewees or their relatives should not have worked for the gas company so as to avoid biases in their perceptions of the project. People who have ties to the gas company may speak positively about the project even though they may think otherwise, in order to protect their or their relative's job. Third, I had to interview only people who spoke either Mandarin or Sichuanese because the interpreter that I hired could only speak these two dialects and I could only speak Mandarin.

In Weiyuen, I interviewed a total of 9 villagers living adjacent (approximately 50-100 meters away) to Wei 201 (the first shale gas well), Wei 201- H1 (the first horizontal shale gas well) and Wei 201- H3. I selected Wei 201 and Wei 201-H1 because they were, respectively, the very first shale gas well, and the very first horizontal shale gas well in China. I also selected Wei 201-H3 because it was developed around the same time as the other two wells. These three wells are located approximately 3 kilometers apart from one another. I also interviewed a mobile phone store owner and a hotel owner in the town center, both located approximately 5 kilometers away from the wells.

In Jiaoshi town, I interviewed villagers living adjacent (approximately 50-100 meters away) to Jiaoye 1 HF (the well with the highest yield of daily gas flow), Jiaoye 5 HF, and Jiaoye 19 HF. I selected Jiaoye 1 HF because it was the largest production well in China. I selected Jiaoye 5 HF and Jiaoye 19 HF because they were located closest to the main roads. Apart from these three

wells, there are many more developing wells throughout the village. However, many of the wells were located in the mountains and were only accessible through muddy narrow roads. It was dangerous to travel to those wells with large fracking vehicles travelling the same routes. Hence, I picked the wells that were more accessible and conducted interviews with residents nearby. I also went to the town center, approximately 15 kilometers from the wells, to interview store employees, a restaurant owner and a hotel owner.

	OCCUPATION	GENDE R	AGE	MONTHLY INCOME (RMB\$)*	EDUCATION	FAMILY SIZE
XINCHANG						
1	Farmer	M	40	3000	Middle school	4
2	Business owner	M	49	2000	Middle school	5
3	Student	F	20	2000	College	4
4	Farmer	F	43	2000	Elementary	4
5	Farmer	M	53	3000	Elementary	4
6	Farmer	M	46	2000	Elementary	4
7	Farmer (village leader)	M	50	3000	Elementary	4
8	Business owner	F	45	10000	High school	4
9	Business owner	M	55	8000	Middle school	4
JIAOSHI						
10	Business owner	M	43	10000	Middle school	5
11	Store employee	F	30	3000	High school	3
12	Business owner	M	42	15000	High school	4
13	Farmer (village leader)	M	72	3000	Middle school	4
14	Employee	F	35	4000	Middle school	3
15	Farmer	M	45	3000	Elementary	4
16	Farmer	M	36	3000	Elementary	5
17	Farmer	F	72	3000	Elementary	3

*(CAD/RMB = 0.21)

Table 2 Interviewee demographics in the two case study villages.

I used purposive sampling and recruited the interviewees by approaching them on the street or knocking on their door. Because there are various potential impacts of energy development, including environmental and economic impacts, I interviewed people living close to the wells and also those living in town center. People living near the wells were mostly landowners and farmers who were likely to be aware of any environmental impacts such as noise, air, and water pollution from drilling activities. I also interviewed people in the town center (e.g. restaurant owner and hotel owner) where the majority of economic activities such as restaurants, grocery stores and hotels were located. I offered each interviewee RMB\$20 as compensation for their time.

Prior to conducting the interviews, I was aware that respondents might not truthfully answer questions concerning sensitive topics, such as their trust in the government, due to the fear of repercussions (Collins et al. 2005). For instance, respondents who held negative comments concerning the government might give me a politically correct answer: the government is good. To minimize the problem of political correctness, and to maximize the reliability of responses, my assistant and I tried to establish trust between the respondents and us by assuring them, repeatedly, of the confidentiality of the interviews at the start of the interviews. To ensure that the respondents were being honest during interviews, I asked follow-up questions based on their responses. For instance, I would ask respondents for concrete reasons as to why they trusted the government. All my respondents were able to provide detailed examples to support their views without hesitation.

Interviews ranged from 30 to 60 minutes. I recorded all interviews with the interviewees' consent. I hired a student from a Sichuan university to transcribe the interviews verbatim. I then used Nvivo 10 qualitative analysis software to analyze the 88 pages of single-spaced text by applying deductive and inductive codes at the sentence level (Suter 2012). I created deductive codes (ibid.) to document each resident's perception of community and environmental impacts using relevant categories such as *social impacts*, *environmental quality* and *economic benefits* (Brasier et al. 2011). I also created inductive codes to document residents' interpretation of impacts, their adaptation to the impacts, their reasons for supporting the development, and their attitudes toward the government and industry. For instance, to document residents' attitudes toward the development, I created the categories of *active support* and *resigned support* to classify the different types of support based on the residents' reasoning.

After initial coding, I compared the information within the categories (to ensure that the categories had distinctive definitions and are mutually exclusive from one another) and also between categories (to make possible connections) (Suter 2012; Taylor-Powell and Renner 2003). I then used the query tool in Nvivo to extract all quotes or paragraphs assigned to a specific node, which was an efficient way to compare the responses of different interviewees on a specific topic. For example, I examined how residents reveal their trust toward the government and what their responses meant implicitly or explicitly. In addition, reading through quotes or paragraphs assigned to a specific code allowed me identify any themes or patterns that I might have missed (Taylor-Powell and Renner 2003).

I hired a graduate research assistant (RA) whose native language was Mandarin as an external coder to ensure the reliability of my codes (Miles and Huberman 1994; Campbell et al. 2014). I trained the RA with my codes and randomly selected two interviews transcripts (12% of my data) for him to code. I then used “proportional agreement method” (Campbell et al 2014) to measure the dependability of the codes, which was appropriate in a qualitative research that was specifically based on interview data. This method determines the level of inter-coder reliability of each code by dividing the “number of times that all coders used it in the same text unit by the number of times that any coder used it in the transcript” (Campbell et al 2014:309). After initial coding, the majority of my codes had an agreement percentage of over 80% (Appendix III). For any unreliable code (agreement percentage below 80%), I discussed the coding discrepancies with my R.A, and we jointly amended the codes until we reached a resolution.

A limitation of study was the small sample size and hence the potential lack of representativeness of the results. However, since my research focused on the social perceptions of shale gas development, I intentionally included a range of interviewees who were affected differently by the development, such as those who lived in different proximities to the wells, and those who were of different occupations and age (Table 2). Furthermore, I only interviewed long-term residents to ensure that they were knowledgeable about the community changes brought by the development. Thus the diverse demographic characteristics of my sample mitigates the issue of representativeness and provided a delineative perspective on the social perception of shale gas development.

Another potential limitation was my sampling strategy. I used purposive sampling because the population in the villages was small and there were only a few houses scattered near fracking wells. Because of the scattered population, purposive sampling, in addition to using a list of criteria (i.e. long-term residents with no ties to the gas company) to screen my interviewees, was an appropriate strategy to minimize biases and ensure the representativeness of my sample.

Chapter 4: Community and Environmental Impacts of Shale Gas

Development in China

In this chapter, I discuss the positive and negative community and environmental impacts of shale gas development as reported by the respondents, such as water contamination and economic improvement. I then describe how respondents perceive these impacts, specifically how they understand the potential risks and adapt to these impacts (figure 2).

Residents' Perceptions of the Impacts of Shale Gas Development

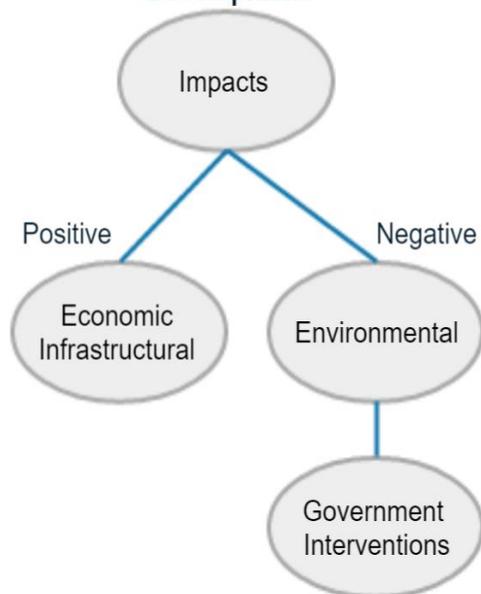


Figure 2 A thematic network depicting the perceived impacts of the shale gas development (Source: author).

4.1 Impacts of the development

Among all the impacts reported by respondents, water problems were the most frequently discussed with respondents in both villages (15 out of 17). For instance, respondents who lived

close to a fracking well (50-100 meters away) reported that the water in their wells turned black, suggesting water contamination. A respondent who lived 50 meters from a drilling well said “*I saw my neighbor pumping water from his well. We did not know what got into the water. The water was black*” (P2008, female farmer).

In addition to water contamination, respondents also reported water shortages in the town. The term “water shortage” was mentioned 42 times in total. Respondents pointed out that their wells had dried up. In Xinchang, a female respondent who was a farmer and lived in a house that overlooks the well 50 meters away said “*if we wanted to dig wells now there would not be any water... it’s unlikely there’s any water left*” (P1004, female farmer). Other respondents pointed out that the lack of water in the village had affected crop production. A male respondent in Jiaoshi who was also a farmer and lived with his wife and two children 100 meters from two wells, said: “*There was no water for the past few years. A few years ago, this flatland was full of crops. Now we have nothing.*” (P2007, male farmer).

Apart from water problems, respondents in both villages also suggested that air quality was affected. For instance, a husband and his wife who were in their 80s and lived 50 meters from a well suggested that the smell of the gas was suffocating and seriously impacted their livelihood. The husband said: “*I can’t handle it when I smell it.... It makes me feel dizzy... I wanted to throw up whenever I walked closer [to the well] ...*” (P2008, female farmer). In addition to air quality, noise pollution had led to sleep problems among residents living close to drilling wells. A respondent who opened a mini store in his house located 200 meters from a well reported that he could not sleep when the drilling was in progress: “*they drilled the wells every day and it [the*

drilling] created such loud noises that it's impossible for me to fall asleep" (P1002, male mini-store owner).

Moreover, some landowners who had leased their land to the development suggested that the returned land could not be re-cultivated. Their land was no longer fertile for farming because the top soil was removed and the soil structure had changed (figure 3). A respondent, a village leader and whose land was leased to the development for two years, stated that *"the big machines damaged the soil structure... the soil becomes too compacted... crops cannot be grown on the land anymore... the soil is damaged..."* (P2004, male land owner and village leader).



Figure 3 Top soil was removed to build roads and pipelines for drilling activities (Source: photography taken by the author).

Besides negative environmental impacts, the shale gas development also brought substantial positive impacts to local communities such as economic benefits. For landowners, their personal income was significantly increased through receiving lease payment from the production of gas on their property. During the time of the interviews, there were two types of lease agreements: the temporary lease payment and a permanent buyout. The temporary lease payment to these landowners was approximately RMB\$4000 (CAD\$817) per acre of land annually. The other type of lease agreement is the permanent buyout which involved land where the wellhead was situated. The one-time buyout payment was approximately RMB\$38,000 (CAD\$7,800) per acre of land. In addition to the monetary compensation, the government also helped affected landowners to buy life insurance at a significantly discounted rate. Landowners would receive monthly income from the insurance once they reached the age of 60.

Moreover, business owners reported that the significant increase in local population caused by the influx of outside workers had revived the local businesses. In Jiaoshi, a respondent who owned a restaurant said that the larger the development the better for businesses, because more residents meant more demand for services. He said “*I think the larger the development the bigger the economic benefits... there are seven, eight thousand workers living in our town. They have to spend money on food and rents. They helped our businesses*” (P2001, male restaurant owner). Similarly, another respondent in Jiaoshi who was a hotel owner said “*there were just one or two hotel on this street in 2012 and they were in very poor shape. This year, there are more than 10 hotels... for food services, there are 81 restaurants... in previous years there were only around ten restaurants and the businesses were bad*” (P2003, male hotel owner).

However, this increase in the demand of local business was not reported by respondents in Xinchang, where the scale of development is comparatively smaller than in Jiaoshi (79 wells in Xinchang compared to 250 wells in Jiaoshi) (Table 1). A hotel owner in Xinchang said “*the development does not help our business... I don’t see many people coming to the village... Perhaps there are more workers but they live in the dormitory provided by the gas company*” (P1008, hotel owner). Similarly, another respondent in Xinchang who owns a telephone store suggested that the businesses in town had not been affected. He said “*I don’t see any changes in our business... yes there are workers from outside who works on the well pads but there isn’t a significant increase in the population in town... it [the business] is the same*” (P1009, store owner).

As a result of increasing service demands in Jiaoshi, there were more job opportunities for local people. The restaurant owner, who often talked with his customers (many of whom were employees of the gas company), suggested that “*there are many job opportunities for everyone... they hire many local people as drivers as well... there are many many job opportunities out there because of the natural gas development*” (P2001, male restaurant owner). Similarly, another respondent who worked in a hotel said that “*certainly there are more job opportunities because there are more hotels, more restaurant, more entertainment stores and various types of businesses... there are more people so there’s more of everything... the living condition is better*” (P2002, female hotel employee).

On the contrary, job opportunities in Xinchang were not affected as the demand for local businesses remained unchanged. Respondents in Xinchang also suggested that the gas company

did not encourage local people to work for the local shale gas project. The village leader suggested that the company offered local residents minimal wages that were significantly lesser than that received by outside workers. He said “*they [the company] don’t want local people...if local people want to work for them, they offer them very low wages, much lower than that received by outside workers... local people earn less than worker from outside... we [the local people] are not happy about it*” (P1007, male village leader).

In addition to economic benefits, respondents from both villages were delighted to see improvements in infrastructure, such as roads and parks. For instance, YingBing DaDao, the main avenue in town, which used to be a muddy road that could not be travelled on during rainy days, was fixed last year through a substantial investment by Sinopec, the company driving the shale gas development. The restaurant owner said “*they [Sinopec] had invested in our town for over a billion dollar... just look at YingBing DaDao, they spent over then 10 million to fix a road*” (P2001, male restaurant owner). Furthermore, the local government built new infrastructure such as parks as they received more tax revenue from the development. The restaurant owner continued “*the government has become richer these two years... the park behind the government building was just built this year... the increase in tax has indirectly led to more infrastructures and more leisure areas*” (P2001, male restaurant owner). The shale gas development had made the government richer, which led to greater infrastructure transformation in the villages.

Respondents in Jiaoshi and Xinchang reported similar environmental impacts, including water contamination, water shortages, noise pollution and air pollution. Yet, in terms of economic impacts, respondents in Jiaoshi, which has a larger development than Xinchang, experienced

greater economic benefits than those in Xinchang. Significant economic benefits such as increase in business demand and job opportunities were reported by respondents in Jiaoshi but were not by those in Xinchang. The scale of development and the policies implemented by the gas companies (i.e. Sinopec in Jiaoshi and CNPC in Xinchang) could be the factors that caused the variations in these impacts.

4.2 Respondents' understanding of the impacts

In terms of environmental impacts, respondents said that that the water issues they encountered and witnessed were natural occurrences, as they were told by the government officials. The respondent who saw black water in the well believed that the problem was caused by the Karst topography. She said *“the local police came and sealed off the well... they said that it was due to the Karst topography in the region”* (P2008, female farmer). Similarly, another respondent whose farmland dried up believed that water scarcity in recent years was due to natural causes. Asked if the shale gas development played a role in the water problem, he said *“it's a natural disaster... what does the gas development have to do with anything? What matters is the rain from the sky! That [the shale gas development] has no impacts”* (P2007, male farmer).

Even though their wells were tainted and water became scarce, respondents did not find water problems as a major concern because the government had responded promptly and provided an alternative source of water supply for them. The respondent continued *“right now the government is installing water pipes so that water can be transported to the households from a nearby water pond located near a school”* (P2008, female farmer). Consequently, it appeared as if residents relied on the information and that government would solve the problem and hence

the problem was only a short-term temporary issue. Another respondent who were aware of the water problem said “*they [the government] make sure that we have sufficient supply of water... they didn't ignore our needs... I think the government has done well in handling the problem*” (P2001, male hotel owner).

Respondents believed that the government intervention had solved the water problems. They reported that the government built water pipelines to transport water from nearby water reservoirs, built new water storage ponds (for collecting rainwater), and also arranged water tankers to supply water to affected villagers. Consequently, they were able to adapt to the water shortages and praised the government for how they handled the problems. A male respondent who owned a hotel and experienced a short period of water shortage suggested “*everything has returned to normal now... they [government] built a water storage pond nearby to guarantee our water supply. This has not been a problem after all... I think the government handled the issue very well*” (P2006, male farmer). Respondents did not find water problems disconcerting because they had been able to adapt to the changes through government intervention.

Moreover, respondents had low awareness of the process of shale gas development (including the type of natural gas being extracted, the fracking technique, and the potential impacts of the development) because many of them were farmers and only received elementary school education (Table 1). When asked to describe the process (i.e. can you tell me how they extract the gas?), a respondent said “*I don't know. I only know farming. It's [the process] for extracting the natural gas. That's all I know. We farmers don't have much education... how will we know?*” (P1005, female farmer). Similarly, another respondent said “*you should ask the village leader.*”

We farmers only know how to farm... we don't know anything else because we don't understand it" (P1006, male farmer). Many respondents had little understanding of the projects, hence they were not critical about the water impacts of fracking.

Besides water problems, respondents were able to adapt to other environmental impacts such as the noise pollution. They reported that noise pollution was only a temporary issue as the noise subsided after the drilling was completed. A respondent who lived near a newly-constructed well suggested that *"the noise problem only occurred during drilling... we don't have that problem anymore"* (P2006, male farmer). In regard to the soil compaction issue, landowners were not concerned about the problem as they were attracted by the income they received from lease payments. The landowner who reported the issue remained supportive of the development. He said *"I hope there will be more development. I support the development. It brings us income... how can I oppose something that brings benefits to the people"* (P2004, male land owner and village leader).

Given that the majority of respondents had an average monthly income of approximately RMB\$3,500 (CAD\$750), the lease payment and the insurance benefits considerably increased their personal wealth. This wealth effect had led to much satisfaction among landowners. The respondent who owned the mini store said *"it [the insurance] is especially beneficial to older people... it's really satisfying for old people... these old people from the 50s and 60s would never have imagined that they could receive paychecks without working"* (P1002, male mini-store owner). The economic effects of land compensation were substantial for low-income farmers. Another respondent who was not a landowner put it bluntly: *"frankly speaking- this*

village was a very remote and poor village. No one ever came to develop the area... now that the government brings in development, it has tremendously improved the livelihood of the local people” (P1001, male farmer).

Respondents pointed out both the positive and negative impacts of the development. Positive impacts such as economic improvements through lease payments and infrastructure improvements through the increase in government tax revenue were important to the local community. Respondents were drawn to the positive economic benefits as many of them earned minimal incomes as farmers. They were delighted to see significant economic transformations in their villages. Apart from the positive impacts, negative impacts such as water shortages and air pollution were also reported by my respondents. However, the respondents did not find these negative impacts disconcerting. In summary, respondents did not oppose shale gas development in spite of the great environmental impacts because: 1) they were drawn by the significant economic benefits; 2) they have been able to adapt to the negative impacts through government intervention; and 3) they have low awareness of the potential danger of fracking.

Chapter 5: Support For Fracking Among Respondents in Two Villages

In this chapter, I discuss the respondents' attitude toward the shale gas development and examine why their attitude appears to be different from their Western counterparts. Specifically, I discuss the two types of support among the respondents and the factors that contribute to their respective attitude (figure 4).

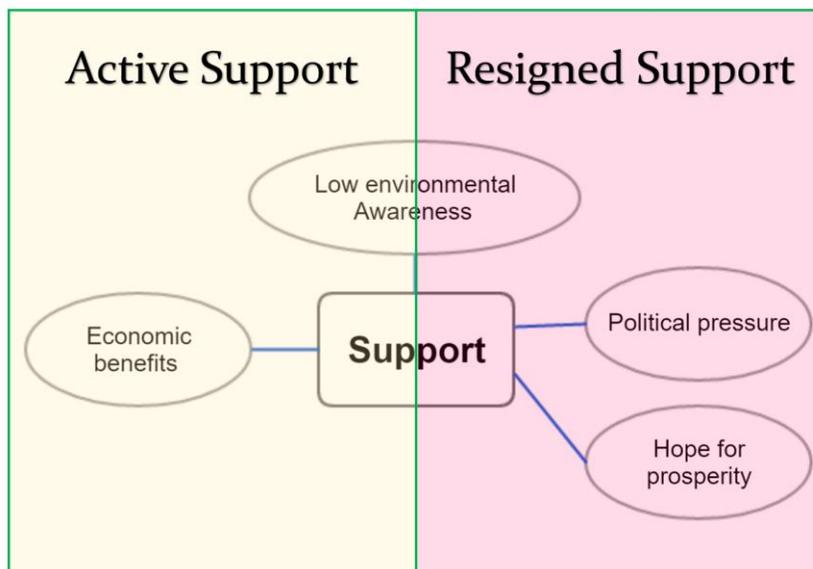


Figure 4 The two types of support among respondents (Source: author).

The respondents in my study indicated their support toward the development because they were drawn by the economic benefits, had low awareness of fracking or fear of repercussion. I distinguished their statements of support into two types: active support and resigned support. The categorizations depict respondents' various attitudes toward the development beneath their indicated support for the development. Many scholars have suggested that citizens in China were “intimidated” by the central government (Wang 2005:159; Wu and Wilkes 2016). Hence they tend to express a favorable attitude toward the government despite feeling otherwise. For

instance, researchers found that Chinese citizens' level of trust toward the central government is in fact significantly weaker than suggested by the five national surveys (Li 2016). Similarly, Wu and Wilkes (2016) found that almost half of the Chinese people in the 2006 and 2010 Asian Barometer Survey Data selected "cannot choose" when asked about the level of corruption in the local and national government. This pattern is in stark contrast with that in other Asian countries where most people were open about indicating their perceptions of corruption across all levels of government. The authors concluded that political fear affects how Chinese people respond to questions about their government (Wu and Wilkes, 2016). Hence, strict political control in China indeed causes Chinese citizens to refrain from revealing their genuine sentiments; this affect indicates different attitudes beneath their indicated responses.

Active support is a rational type of support in which people are certain about their support. On the contrary, resigned support is a non-rational, "cannot-do-anything" type of support which highlights respondents' lack of empowerment. Among all respondents, 6 of them had active support (35%) while 11 had resigned support (65%). Respondents who exhibited active support toward the shale gas development were those who directly benefited from the development. For instance, landowners and business owners whose income increased through lease payments and business expansion looked forward to more shale gas development in the community. The hotel owner said "*I firmly believe that this natural gas has brought huge development to our local economy... I certainly support the development*" (P2003, male hotel owner). Similarly, the village leader who had leased his land for two years said "*I support it [shale gas development]. Why would I oppose it when it brings benefits to villagers?*" (P2004, male landowner). Moreover, respondents who expressed active support toward the development were those who were least

affected by the environmental impacts, such as water and air pollution, as many of them lived in town, further away from the wells. Their support was based primarily on economic benefits; they did not consider environmental impact a significant issue.

Comparing the two villages, more respondents in Jiaoshi (4 out of 8) exhibited active support than those in Xinchang (2 out of 9). This is probably because the economic benefits from shale gas development were more significant in Jiaoshi than in Xinchang. The Fuling shale gas demonstration zone where Jiaoshi is located had approximately 250 wells with a daily production volume of 12 million cubic meters (Bai 2015) whereas the Changning-Weiyuan shale gas demonstration zone where Xinchang is located had approximately 79 wells with a daily production volume of 7 million cubic meters (Table 1) (CNPC 2016). Hence the larger scale of the shale gas development in Jiaoshi had led to more significant economic benefits such as increase in business demand and job opportunities than Xinchang, leading to a higher percentage of respondents voicing active support toward the development.

Furthermore, the responses suggest that the group of respondents who exhibited active support also had a high trust in the government and believed that the government was competent in serving the people. They forwarded that the community improvements in the town was made possible by the government's efforts. For example, the hotel owner in Jiaoshi said "*the government has coordinated very well with Sinopec... they have put a lot of efforts, a lot of coordinating work... they have developed Jiaoshi very well... to develop a place well, the leaders must have good thinking. Our leaders have good thinking...*" (P2003, male hotel owner). The village leader who served as the liaison between the government and the villagers, and whose

land was leased for two years, suggested that the government did a good job in providing welfare to villagers in need. He said “*the government is fair. They provide assistance to famers with needs. Just like my family, we had financial difficulties and the government provided us welfare*” (P2004, male landowner). Overall, as a result of greater economic impacts in Jiaoshi, there were more respondents who articulated active support and high trust in government in Jiaoshi than in Xinchang.

In contrast, respondents who exhibited resigned support were those who did not benefit directly from the development and supported the development due to political pressure and the hope that the development would bring them prosperity. Four reasons emerged as explanations to the resigned support expressed by these respondents. First, the rural regions where fracking was taking place were remote and poor with almost all population earning minimal income from farming. The responses suggest that villagers, who were mostly farmers, had never seen any development in their remote village before. Hence they viewed the development as a sign of hope, which could bring them economic prosperity and improve their livelihood. For example, a respondent said “*there has not been any development for so many years... this [the shale gas development] will bring us opportunities*” (P1003, female famers).

Second, we were informed that in cases where residents openly opposed or criticized the development, the local government would send “counsellors” to their home to “reconcile” with them (figure 5). Some respondents suggested that the purpose of reconciliation was “to educate the people”. The reconciliation groups put pressure on residents who held views that were against the development. In fear of repression, villagers who initially opposed the project would

become supportive toward the development. For example, a respondent who was a village leader said “*there were people who were stubborn... they had to go to the local police station to receive education... and then they became better [changed their mind]*” (P2004, male landowner).

Third, respondents in village had low awareness of the potential dangers of the development as almost all respondents only received elementary education. Recall the female farmer (P2008) who believed the black water in well was caused by the Karst topography in the region, as she was told by the government officials. Similarly, another male farmer whose farmland dried up believed that water scarcity in recent years was due to lack of precipitation. He said “*it’s a natural disaster... what does the gas development have to do with anything? What matters is the rain from the sky! That [the shale gas development] has no impact*” (P2007, male farmer).

Respondents could not relate the significant water problems directly with fracking as these impacts were unobservable on the surface and that the respondents lacked the knowledge to understand the biophysical processes of water contamination. Hence respondents did not perceive such problems were caused by the shale gas development. Moreover, they believed that the problems were temporary as the government interventions had “solved” the issues.

Lastly, respondents conceived of themselves as possessing low political efficacy, meaning that they believed their actions would not influence government affairs. For instance, a respondent said “*who can you do if you don’t support? Whatever the government wanted to do, there is nothing you can do about it*” (P1005, male farmer). Similarly, another respondent said “*the government decided to develop our village... we don’t have any say. We are farmers, what can we do?*” (P1006, male farmer). Respondents were action-less as they could not do anything to

express their opinions toward the shale gas project. It is argued that unlike those in first-tier cities, respondents in rural regions lack resources such as manpower and communication tools to organize collective actions to voice their opinions. Fracking villages had scattered populations and many houses lack Internet access. Any actions would be easily suppressed by the government and hence respondents felt action-less. They had no other options but to support the development.



Figure 5 A bulletin board that promotes the reconciliation services at the government building in Jiaoshi (Source: photography taken by the author).

Respondents who exhibited resigned support can be sub-categorized into two groups: “cannot-oppose” and “the-hopeful”. “Cannot-oppose” support referred to respondents who seemed to feel obligated to support the development. For instance, the three respondents who lived close to wells and were disturbed by air and noise pollution revealed that they felt that they had no option but to support the development because it was a government project. The female respondent who did not receive any direct benefits said: “*we support the development. It is a government*

development. What can you do if you do not support?... You cannot oppose government development... who dares oppose the government?" (P2008, female farmer). Even though they did not view the development positively, they felt that they must obey the government decision. Similarly, another respondent who previously pointed out that the cropland dried up due to water shortages said he must support the government decision because he was not allowed to oppose the government. He said *"we, farmers, have to do whatever the government tells you to do... we have to support the government... Chinese society is a one-party system... if you don't listen to them they could put you in jail for two years..."* (P2007, male farmer). Hence, respondents who exhibited a "cannot-oppose" position supported the development primarily because they feared repercussions from the government.

"The-hopeful" position refers to respondents who supported the development because they viewed the development as a sign of hope of bringing prosperity to the poor, and to the remote villages. The university student, who was aware of water contamination, and did not see any significant benefits of development on local community, said *"I think the village is too quiet. It has never been developed before... the development can perhaps bring opportunities for local people to get richer"* (P1003, female student). Similarly, a mother of two who reported water shortages in wells and who did not receive direct benefits said *"we need people to come develop our village... I hope there will be more development to make the village livelier"* (P1004, female farmer). The interviews suggest that this group of five respondents believed that the development was a sign of progress in a village that had never experienced any development before. They were hopeful that the development would bring opportunities to local people. Yet they were uncertain what forms these opportunities would take, but the development represented a sign of

hope for them. Asked how the development would bring opportunities to local people, the mother of two continued “*I don’t know what it would be... but more development will inevitably bring us benefits*” (P1004, female farmer).

In contrast with those who exhibited active support, respondents that expressed resigned support had low trust in the government because they believed that it was incompetent in serving their needs. A respondent who was a farmer and received no benefits believed that farmers were powerless and were neglected by the government. He said “*who would trust the government? If they treat farmers better then we will speak good about them... what is good about the government?...when you asked them for help, they will just ignore you. If you have personal contacts or relationships perhaps they will treat you better*” (P1006, male farmer). Similarly, the university student, who were hopeful about the development, said “*to be honest I don’t think they [the government] have been helpful to us. They have not played any role really*” (P1003, female student). Respondents agreed that people who trusted the government were those who bribed government officials to receive benefits. A respondent who lived with his family 200 meters from a well and explicitly expressed his “cannot-oppose” stance toward the development put it bluntly- “*there is no one here who trusts the government, except those who is greedy of government’s money*” (P1005, male farmer). Respondents who had not received any benefits from the government or the development believed that the government was incompetent and unhelpful to them and hence they had low trust in the government.

Regardless of their support type, all respondents shared a similarity: they had low awareness of the shale gas development. Respondents did not view the shale gas development or the existing

environmental impacts as problematic because they were ignorant about the potential danger of development and because they were able to adapt to the problems temporarily through government interventions. Even though the respondents unanimously supported the development, the nature of their support was different. Respondents who were certain about the positive impacts of development and benefited directly from the development strongly and truly supported the development. On the contrary, those who did not benefited from the development or viewed the development positively supported the development because they had no other options due to political pressures.

Respondents in this study all indicated support toward the development. Yet in reality some respondents supported it whole-heartedly while some did not. Respondents who supported it whole-heartedly voiced active support, whereas those who did not support it demonstrated resigned support. The former benefited directly from the development and were not directly affected by the negative impacts. These included, for instance, business owners, landowners and people who live far away from the wells. On the other hand, those who demonstrated resigned support did not benefit directly from the development. Majority of them live close to the wells and had been affected by the negative impacts such as water shortages and air pollution. They voiced support for the development despite feeling otherwise because they feared government repercussion. Moreover, some of them did hope for economic improvement in the village, which has not been developed before. They believed that the shale gas development could improve their villages. Thus political control and hope for prosperity were factors that led to resigned support among respondents.

Chapter 6: Conclusion

The field research has shown that, unlike in many Western countries, Chinese residents were not overtly critical of the adverse environment impact of shale gas development, such as water contamination, which had led to growing opposition to fracking in countries such as the U.S. Two related reasons could explain why they were not critical. First, the majority of the villagers had poor education, which contributed to their lack of environmental awareness. They did not realize that environmental problems such as water contamination and water shortage can be a significant long-term issue. Due to their low awareness, respondents thought that government interventions such as the deployment of water tankers to supply water had solved the problems. Second, due to their low socio-economic status, the majority of villagers had reaped tremendous economic benefits from the development, for example through the lease payments. Poor education and low socio-economic status contributed to the respondent's uncritical attitude toward the adverse impacts.

Although all my respondents indicated their support for the development, some in fact bore different attitudes toward the development in reality. Various factors had affected their attitudes toward the development, and their willingness to voice their real attitudes. One group of respondents were clearly motivated by the economic benefits of the development, and were oblivious to the negative impacts of the development. Their support toward the development was based primarily on their personal economic gains and they did not consider other impacts significant. Other respondents have yet to directly benefit from the ongoing development, but were supportive out of optimism or hope that the shale gas development would herald the

development of their villages and communities. In summary, the combination of the residents' lack of knowledge of the dangers of fracking, and the economic incentives, both reaped and envisioned, had led to the supportive attitudes of most residents.

In addition, the responses of some other interviewees suggested that the political regime and culture in China did affect people's attitudes toward the shale gas development. Fearing repercussions from the government, people who were critical of the development did not dare explicitly state their opposition. Unlike their Western counterparts who had freedom of speech and association, Chinese residents, particular those in rural areas, were not only unlikely to have any opportunities to take part in protests, their freedom to express their feelings were also suppressed by the central government's control. For example, a man who lives with his wife next to a drilling well said "*what can you do if you do not support?*" (P2008, female farmer). His comment suggested that people could not take any action even if they wanted to oppose. People were well aware of the fact that those who opposed the government would be punished. As another respondent suggested "*if you don't listen to them [the government] they could put you in jail for two years*" (P1005, male farmer). These findings suggest that Chinese people indeed had different attitudes toward the development beneath their indicated support for the development. It can be argued that activism might be along the way since some respondents had dared to openly criticize the government and the strict political control.

Also, these findings suggest that researchers should exercise caution when examining the Chinese public opinion through quantitative data such as surveys. This research has uncovered a gamut of positions, and a spectrum of economic and political motivations, beneath the villagers'

support for shale gas development, which a quantitative survey will not be able to chart or unearth. It is possible that survey data may not represent the true opinion of Chinese people as people might voice support of the government in disregard of their genuine sentiments. How representative were existing national surveys in revealing the public opinion of the Chinese people then? Hence, interviews may be a more reliable method to ascertain or gauge the public perception of the Chinese people.

Moreover, this research suggests that any effort to mobilize local opposition of shale gas development in the context of a Chinese village must take into account the economic priorities and focuses of the village residents, which dispose them towards prioritizing income gain or economic development above environmental preservation or public health and safety. In the first place, their lack of education, as well as information or other types of knowledge resources to inform them of the dangers of fracking render them ignorant of the costs and dangers of shale gas development. The interviews also prove that the restrictive political climate in China do contribute to the differences in responses by affected communities in authoritarian regimes, and in democratic regimes.

The findings of this study was based on a small sample of villagers at one single stage of shale gas development. Future research should examine the changes in people's attitudes toward the development throughout the developmental stages. The rapidly expanding shale gas development in China could lead to quick deterioration of the environment in rural areas in the near future and thus people living in fracking villages who are most vulnerable to the impacts might struggle to adapt to the changes in the community. Hence, a longitudinal study may be able to reveal shifts

and changes in the residents' perceptions of, and attitudes, towards the benefits and costs of shale gas development in their localities. Could people adapt to the environmental impacts in the long term? Would increased awareness of, and exposure to, the dangers of fracking make residents become more critical about the development like their Western counterparts. Would Chinese people in the rural areas be pushed to protest against the development in the near future despite political control? The findings of this research provided baseline information about social perceptions of the shale gas development in rural China. Future research could examine the possible changes in the social perception of the development and provide information that could inform policymakers on how to serve the needs of the affected people.

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Appendices

Appendix A: Interview questionnaire

Part I: awareness of shale gas development

1. Are you aware of the shale gas development in your village?
2. When did the shale gas project start?
3. How did you hear about shale gas development?
4. Did the government or the gas company inform you about the project prior to the construction?

Part II: perception of impacts

1. How has the development affected the community?
2. How has it affected your livelihood?
3. What are the risks of the development?
4. What are the opportunities of the development?

Part III: attitude toward the project

1. How do you view the development? Do you support or oppose the development?
2. Why do you support/oppose the development?
3. Do you trust the government? why?

Part IV: demographic information

1. Tell me about your background
2. Gender: Male/ Female
3. Age: _____
4. Occupation: _____
5. Income level: _____
6. Education: primary school/ secondary school/ high school/ university graduate
7. Marital status: Single/ Married/ Divorced/ Separated/ Widowed
8. Family size: _____

Appendix B: Code book

Code Name	Code Description	Code Example	Agreement (%)
Water quality (Envl-WQuality)	This code documents information concerning changes in water quality in recent years and residents' concern about water quality issue. Keywords of this quote include wastewater, overflow, blackish water, and oil.	"there is no changes in water quality so far... but I'm worried about the wastewater because it can overflow during heavy rain... the wastewater is probably poisonous and will affect the water we use for farming..."- (007)	86.30
Water quantity (Envl-Wquantity)	This code documents information concerning the occurrence of insufficient household water supply and drying wells, the causes of water depletion, the solution to water depletion, and the impacts of the water depletion. Keywords include water depletion, water trucks, Karst topography.	"when water supply is insufficient, Sinopec will arrange water trucks to supply water to residents... they also construct water storage ponds to collect rainwater to alleviate the problem" – (2003	83.92
Air quality (Envl-A)	This code documents information regarding the changes in air quality, presence of abnormal smell, the impacts of changes in air quality on resident's health (e.g. difficulty in breathing, nausea), resident's concern about air quality.	"that smell... I cannot stand the smell... It makes me feel dizzy... when the wind gets stronger, the smell is suffocating." – (2008)	91.2
Noise pollution (Envl-N)	This code documents information concerning noise pollution. For instance, interviewees' views on how much they are affected by the noise during the drilling process.	"I cannot fall asleep... I cannot sleep. The noise is so loud... they [the officials] should compensate us for the noise but they didn't..."- (2008)	85.30
Soil damages (Envl-S)	This code documents information concerning the negative changes to soil quality on the land that are returned to landowners after drilling construction. Farmers found that the land returned to them are no longer fertile for crop production due to soil damages. This code includes farmer's concerns about the removal of the top soil and the changes in the soil structure.	"the heavy machinery dug up the soil... the soil became harder, the crops don't grow anymore... the soil is damaged" – (2004)	82.02
Wealth creation (landowners) (E-WC)	This code includes information on how landowners' income increases due to the compensations they received from leasing	"I leased my one-acre land for two years... I received RMB\$7,000 in total..." –	80.44

out their land.

(2004); “it is very satisfying for old landowners... people who are 70, 80 years old they would have never imagine they could receive any income without working...” – (001)

Job creation for local residents (E-JC)	This code includes information about the increase in job opportunities for local residents due to fracking development. Examples of new jobs for local people include drivers of fracking vehicles, and drilling workers working on drill pads.	“many drivers are local residents... they hire local people as drivers...” – (2001)	83.88
Business activities (E-BA)	This code includes information about how the local businesses are impacted by the development. Examples of information included are the expansion of hotels, increases in the number of restaurants and entertainment stores.	“for example, there were only two hotels in the entire town and they were very bad, not up to standard... this year there are 10 hotels and they are much much better...” – (2003)	82.09
Price inflation (E-PI)	This code documents information concerning changes in the average price for goods. Example quotes include interviewees’ description of how price for vegetable has been gradually increasing due to increases in demand. The influx of outside workers have driven up the demand for goods.	“the prices have increase... the prices here are actually quite high... the prices are similar to those in the city... there are more people in town so the demand naturally goes up and so are the prices.”	87.42
Tax revenue (E-TR)	This code documents information concerning the increase in local government’s income, its impacts on local community development (e.g. the construction of roads and parks) and the significance of government investment in local communities. Keywords include <i>revenue</i> , <i>tax</i> , and <i>government investment</i> .	“the local economy has significantly improved in these two years... the government received high revenue... higher tax income...” – (2004)	82.1
Social conflicts (S-SC)	This code documents information regarding conflicts among local residents, those between local residents and newcomers, and those between local residents and government. The types of conflict include monetary and cultural. Example quotes include the types of conflicts, the frequency of conflicts, the causes of conflicts and how conflicts are resolved.	“the ridges on the farm were damaged. They [the landowners] could not tell which piece of land belongs to them and which belongs to the other landowner... There are conflicts without the ridges.”	81.98
Population (S-P)	This code documents information	“seven or eight thousand	88.26

	concerning the changes in local population due to the development. This include the approximately number of population change, the causes of change, the time of population change, residents' attitude toward population change, and the impacts of population change.	workers came to our town and reside here long-term...they have to eat, they have to spend money here... it [the increase in population] propels the local economy"- (2003)	
Roads (I-R)	This code documents information concerning the need for new roads in the village, the construction of new roads in different parts of town, the improvement in the quality of roads, the approximate amount of money invested on road construction, the damage of roads by the gas activities, plans for future road development. Quotes include information about who, when, why, where and how roads are built in recent years.	"the gas company and the government partially funded the road... the road is built with a thicker layer of concrete to accommodate heavy vehicles..." – (006)	81.33
Corruption among officials	This code documents information concerning embezzlement among local officials. Information included focuses on how local officials unlawfully take away the funding by the gas company (meant to be given to villagers as compensation).	"look at this road... the gas company has agreed to give RMB\$100,000 to repave this muddy road... we should have a new cement road by now... the corrupted officials took the money away..." – (005)	87.71
Support	This code documents information concerning residents' support for the development. Information includes residents' reasons for supporting or not supporting the development. Phrases to identify this code: <i>government decision</i> , <i>government policy</i> , and <i>government development</i> .	"this is a government development. What can you do if you do not support?... you cannot oppose government development" – (006)	80.41
Trust for the government	This code documents information concerning residents' satisfaction with the local government, their praises and criticism on the local governance, and the sensitive nature of this topic.	"if it is not because of the government, it [development] would not have been possible"- (2003); "who would trust the government?... they don't do any good to villagers..." – (006); "of course you have to trust the government... it's a one-party rule... if you don't listen to them they can put you in jail for two years..."	80.85

Trust for the gas company	This code includes information concerning residents' satisfaction with the gas company, their view on the important role of gas company in their town, and their trust in the company's ability to bring benefits to the local people.	– (2007) “if it was not because of them, we would have the money or any hope to improve the village”- (2001)	81.01
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