BROWNFIELD REMEDIATION AND REDEVELOPMENT IN CHINA: LEGAL AND REGULATORY FRAMEWORKS, PROCESSES AND ACTIONS

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Massive cities in China are experiencing a shift in their economic structure from traditional manufacturing to service and skill-intensive manufacturing, which leaves behind underused or abandoned industrial sites with real or perceived contamination problems in central cities and/or peripheral regions. A comprehensive and sustainable strategy for brownfield remediation and redevelopment, which embraces ecological, economic and social benefits, is a hot topic in China. However, the country is lacking a comprehensive and effective legal and regulatory framework for brownfield remediation and redevelopment, uniform national standards on site assessment, cleanup and remediation, and effective funding or financing mechanisms from the national level to local levels.

The purpose of this study is to examine policy tools that are being adopted in China to deal with brownfield remediation and redevelopment, compare them to those employed in the United States, make recommendations to improve existing frameworks, and try to coordinate cross-purpose programs in an integrated legal and regulatory framework.
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CHAPTER ONE
INTRODUCTION AND BACKGROUND

1.1 Introduction

Policy makers and planners have been giving increasing attention to brownfield remediation and redevelopment, since it combines three important components of sustainability:

- the ecological component through the prevention of additional consumption of space,
- the economic component through the encouragement of investment in inner city sites; the social component through the combination of revitalization projects with job creation and skills upgrading programs, and through fostering residents’ sense of social and historical identification (Ferber and Tomerius, 2003, p.126).

This comprehensive and sustainable strategy for development has made it important not only in Europe and the United States, but also in other developing countries that are going through industrialization and modernization.

In China, cities are experiencing a shift in their economic structure, from traditional manufacturing to service and skill-intensive manufacturing. This transition leaves behind underused or abandoned industrial sites in central cities and/or peripheral regions. Due to several decades’ of industrial activity on these sites, they normally contain hazardous materials that pose risk to human health and the environment. Moreover, rapid urbanization in China has resulted in a need to transform land uses of former industrial sites in central cities. The ecological, economic and social issues associated with brownfield remediation and redevelopment have brought the topic to the forefront.
Even though many cities in China have been and are practicing redevelopment of former industrial sites, and both the central and local governments have begun to take actions to control and remediate land contamination, a comprehensive and effective legal and regulatory framework for brownfield remediation and redevelopment has not been established. Meanwhile, uniform national standards on site assessment, clean-up and remediation and effective funding or financing mechanisms are lacking from national level to local levels. The purpose of this study is to examine policy tools that are being adopted in China to deal with brownfield remediation and redevelopment, compare them to those employed in the United States, make recommendations to improve existing frameworks, and try to coordinate cross-purpose programs in an integrated legal and regulatory framework.

1.2 Background

The brownfield issue is complicated and extensive in virtually every industrialized nation because of the gradual, but steady, migration of industries from the city to greenfield areas since the mid-1970s, leaving many large cities with innumerable underutilized or vacant industrial sites (De Sousa, 2000). However, the problem happens not only in developed countries. In China, idled or abandoned industrial sites and associated land contamination have become a serious problem in both rural and urban areas.
Brownfields in China can date back to 1950s, the beginning of highly polluting industries built during the Great Leap Forward\(^1\). Most of these industrial factories were owned by the state, and initially located on the perimeter of cities for locational advantages. Towns and cities were gradually developed around these sites along with the expansion of population, economic activities and land consumption. Due to the industrial restructuring and relocation, environmental concerns from the public, and changing economic environment, industrial companies, usually large state-owned enterprises, have either shut down or moved to suburban or rural areas leaving abandoned or under-utilized sites (Liu, 2007). It is reported in National Land Development and Consolidation Planning (2001-2003) (Ministry of Land and Resources, 2003) that as much as 4 million hectares of the land area are abandoned or idled because of previous industrial activities.

These abandoned sites are potentially valuable because they are often located in the core sections of cities, and are generally believed to have the potential to generate great profits for urban redevelopment and renewal by private developers and investors. In recent years, rapid urban development and a red-hot real estate market in China have intensified the land tension in urban areas such that there is a shortage of land supply, compared to the huge demand. It has driven local governments and private developers to bring brownfields in urban cores back to redevelopment (Liu, 2011; Xie and Li, 2012). It partly

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\(^1\) The Great Leap Forward was an economic and social campaign from 1958 to 1961 in China, which aimed to rapidly transform the country from an agrarian economy into a modern communist society through the process of rapid industrialization and collectivization. In this movement, steel manufacturing was targeted as the major industry, and goal to surpass the steel production of UK within 15 years was set. Major investments in state-owned projects were made in 1958-60. Most of the increase came through backyard steel furnaces (Lardy, Nicholas and Fairbank, 1987).
explains the fact that, even though in the absence of regulatory and financial incentives provided by governments, brownfield redevelopment is still in rudimentary in China.

On the other hand, underlying the optimistic prospective of brownfield redevelopment is the serious problem of land contamination. These idled and/or abandoned sites are suspected of being contaminated because of the activities of the previous industries and a long history of using antiquated equipment, poor management and inadequate environmental service. About 70% of the land in mining districts is polluted, and it is conservatively estimated that there are 10,000 to 20,000 highly polluted and risky industrial sites throughout the nation (Yuan and Xie, 2012). In some cases, the concentration of pollutants in the soil can be up to hundreds of times higher than regulations permit.

Little public attention was paid to land contamination in the past due to the difficulties in identifying and measuring land pollution as well as soil pollution hysteresis (the effects of pollution experienced with a lagged effect, or delay in time) (Yuan and Xie, 2012). However, a series of land contamination incidents has brought people’s attention to the grave risks to human health and environments. An example is the Sanjiang Housing Development Project in Wuhan, China. In 2006, an 18.7 hectare (280mu) parcel of land in Wuhan, which was previously used by Hanyang Pesticide Factory, was sold to Sanjiang Real Estate for residential development. Shortly after construction began, the soil was found to contain large amounts of pesticide residuals. “Several construction

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2 Overall official statistics regarding contaminated land are not available. All statistics referred here are estimates by experts from related fields (Yuan and Xie, 2012).
workers were poisoned and had to be hospitalized. The vendor, Wuhan Land Reserve Center, had to compensate 120 million RMB to Sanjiang Real Estate as it had failed to perform an adequate site assessment and information disclosure before the transaction, and the Land Reserve Center withhold the information that” (Times Weekly, 2010, http://time-weekly.com/story/2010-03-03/105985.html).

After being reported by the media, these incidents have caught the public’s attention and called for the government to identify, measure and remEDIATE contaminated sites. Since 2006, the MEP and the MLR have jointly carried out a national to establish an inventory of contaminated sites. The results of this investigation are currently unavailable to the public. Another important provision issued by State Environmental Protection Administration (SEPA, now MEP) in 2004 is Notice on Effective Pollution for Industrial Enterprise Relocations, which requires that “all local environmental protection bureaus satisfactorily carry out pollution prevention and control during the relocation process. As soon as a case of soil pollution is found, it should immediately be reported to SEPA, and pollution control countermeasures must be implemented” (Yuan and Xie, 2012, http://www.infzm.com/content/83855).

Local governments also made efforts in contaminated sites remediation. For example, Shanghai issued soil cleanup standards for the Shanghai World Expo 2010 site, which was the first attempt in China. In 2007, Beijing’s Environmental Protection Bureau (EPB) issued Guidelines on Site Environment Assessment (SEA), and Notice on SEA of

3 This investigation has complete in 2010, however, the MEP has refused to make public for the reason of State secrets.
Industrial Wasteland after Relocation. Shanxi Provincial government and Ministry of Land and Resources jointly launched Innovative Land Resource Management Initiative, which will be discussed later. Shanxi Provincial Government set up block and categorical grants for contaminated industrial site remediation.

Even though both central and local governments have taken actions to control land contamination, and remediate and reuse polluted lands for the purpose of urban development, there are regulatory and institutional obstacles and barriers in the process of brownfield redevelopment. A study of brownfield remediation and redevelopment issues in China, which was conducted by the Sustainable Development Department of the East Asia and Pacific Region of the World Bank, outlined the issues that, the nation is lacking in many areas: a comprehensive regulatory framework (including both ex-ante and ex-post liability and risks for brownfield sites); uniform national standards on site assessment, clean-up and remediation; proven technologies for investigating and remediating contaminated sites; and effective funding or financing mechanisms. China also needs to improve its information disclosure on brownfield sites and strengthen its national and local capacity and the participation of stakeholders (Xie and Li, 2010).

The institutional and regulatory issues have become barriers in the process of brownfield remediation and redevelopment.

1.3 Purpose of the study

The purpose of this study is to examine policy tools that are being adopted in China to deal with brownfield remediation and redevelopment, provide an overview of legal and regulatory frameworks for existing contaminated site management and cleanup in the
United States, compare policy tools to those employed in the United States, and make relevant recommendations to improve and coordinate existing programs into an integrative legal and regulatory framework in China.

Brownfield remediation and redevelopment is a broad topic that covers a wide range of regulatory, scientific, technological, financial and political aspects, and involves various stakeholders, such as governments, private developers and PRPs (Primary Responsible Parties). The scope of this study, however, will only cover regulatory, institutional, and financial aspects.

The study also covers a case of a brownfield redevelopment project in Yangquan, Shanxi, China, which was a multi-land use redevelopment of 146.6-acres that had been the site of a state-owned steel factory. The process involved in the redevelopment is examined to identify what policy tools were employed. Interviews with local officials were conducted to examine how the project was accommodated in the absence of a comprehensive and effective legal and regulatory framework.

1.4 Research Questions
The present study consists of three parts, (1) an overview and a comparative analysis of regulatory framework toward brownfield remediation and redevelopment in the United States, (2) policy tools that are adopted in China and associated regulatory, institutional and financial issues toward brownfield remediation and redevelopment, and (3) a case study of redevelopment project in Yangquan, Shanxi, China. The primary objective was
to provide an overview of current brownfield remediation and redevelopment situation in China, and to understand the complexity and deficiencies of existing legal and regulatory framework. The specific questions that were addressed in the study are:

- What programs and policy tools related to brownfield remediation and redevelopment are currently adopted and employed in China?

- How is the brownfield remediation and redevelopment project accommodated in the local level in the absence of a comprehensive and effective legal and regulatory framework?

- What improvements and efforts should be made by the central government based on the lessons learned from the U.S. experiences?
CHAPTER TWO
LITERATURE REVIEW

2.1 Literature Review

The literature review will first address comparative studies of policy-making activities within the US, Europe and other countries, with emphasis on policy tools and regulatory framework toward brownfield remediation and redevelopment in the US. The second section will focus on research studies about key obstacles to remediation and redevelopment, and policy-making activities to overcome those obstacles.

The review of policies tools and legal and regulatory framework of the US has generated a substantial research literature in the United States (Meyer et al. 1995, Page 1997, De Sousa 2000, Bian & Wang 2008, Gong 2010). Meyer et al. (1995) found great variability between the policy-making practices in effect in the US and those in most European countries, where they claimed that the management of contaminated sites has tended to be more “corporatist” given that member states tend to accept primary responsibility for cleanup and redevelopment. On the other hand, in the U.S. such management tends to be more “individualistic,” whereby cleanup and redevelopment is held to be the responsibility of the private sector, with governments playing a purely regulatory role by setting environmental and cleanup standards. However, De Sousa (2000) argued that the gap in the approaches being taken currently in the U.S. and Europe seems to be closing, as policy-making converges in both style and content. From the comparison of how different jurisdictions within Canada and within different nations deal with overcoming
key obstacles to remediation and redevelopment, he pointed out that although there is still some variability in policy-making style within Canada and elsewhere, the degree of variability is starting to diminish. He also argued that this convergence trend is due, in large part, to the fact that governments in the US and Europe are implementing similar policies and programs to share a greater portion of the costs and risks involved in redevelopment and remediation with the private sector.

There exists a substantial research literature on brownfields remediation and redevelopment by Chinese researchers (Liu 2007, Chang & Feng 2008, Liu & Yu 2009, Zhang & Li 2010Xie & Li 2010, Gong 2010). However, diverse in their objectives, quite a large amount has been focused on scientific/technical issues and transformation of land uses. Very few of them delved into regulatory and institutional issues, or policy-making activities towards contaminated site remediation and redevelopment. Generally, researchers have criticized China’s policy-making activities as incomprehensive, fragmented, and lagged behind.

Xie and Li (2010) pointed out that China is lacking in many areas: a comprehensive regulatory framework (including both ex-ante and ex-ante liability and risks for brownfield sites); uniform national standards on site assessment; cleanup and remediation; proven technologies for investigating and remediating contaminated sites; and effective funding or financing mechanisms. China also needs to improve its information disclosure on brownfield sites and strengthen its national and local capacity and the participation of stakeholders. They reviewed the current situation with regards to
brownfield site remediation and highlighted the fragmentation of the legal framework throughout the nation. They also highlighted some pilot programs associated with land contamination control in Beijing, Shanghai and Chongqing, which indicated that in some Chinese cities, actions have been taken to control land contamination with innovative and self-initiated programs and policy-making activities. These pilot activities proved to be effective to deal with contaminated site remediation and redevelopment. Reciprocally, local decisions and strategies to restore contaminated sites can be strengthened by national actions to reduce regulatory barriers to reuse and to expand the availability of existing resources to brownfield projects (Collaton & Bartsch 1996).

Xie and Li (2010) also reviewed the institutional arrangements and stakeholders (national and local governments, previous exploiters, local residents and potential investors) of brownfield site management in China. Existing legal provisions on the prevention and control of land pollution in China’s laws and regulations are scattered, and too general to specify legal responsibilities and obligations among stakeholders. A comprehensive legal system is desperately needed to clearly define the responsibility and liability of land contamination and remediation, and provide clear and concise guidance for all stakeholders (Liu 2007, Chang & Feng 2008). According to Greinert (2007), key stakeholders involved in brownfield redevelopment are generally categorized into five groups: (1) primary responsible party (PRP); (2) private sector; (3) federal and state government agencies; (4) local government; and (5) community. He also provided a summary of each stakeholder’s past and current behavior, and the reasons for these actions established by the brownfield literature. Understanding of each stakeholder’s
motivations, behavior, and their differing perceptions of brownfield remediation and redevelopment will help to establish each stakeholder’s responsibilities and cooperative actions in the following analysis (Greinert 2007).

As for the contaminated site problems, key obstacles associated with remediation and redevelopment have been commonly identified in the American, the European and Canadian literature (European Commission 1996, NRTEE 1998s, Collaton & Bartsch 1996, Bartsch et al. 1997, Gong 2010). De Sousa (2000) structured his comparative analysis with five components: (1) regulatory jurisdictional issues; (2) data sources; (3) cleanup criteria; (4) liability issues; and (5) funding issues, which correspond to five key obstacles: (1) variability in the character and application of regulations; (2) a lack of information on the whereabouts and conditions of contaminated sites; (3) a lack of standardized and practical cleanup criteria; (4) uncertainties regarding liability ensuing from environmental remediation; and (5) generally limited funding resources available for remediation and redevelopment.

Policy-making on brownfield remediation and redevelopment internationally has been focused on overcoming these five main obstacles. Underlying these factors, which also explains the convergence of contaminated site policies and programs, is that policy-makers realized that it is simply impossible for governments to remediate and redevelop the plethora of contaminated sites in their jurisdictions and that this massive undertaking can only be performed and financed by the private sector (De Sousa 2000). This
realization turned the policy-making to public-private cost/risk sharing strategies internationally.

De Sousa (2000) proposed a conceptual stage model capturing the policy-making evolution trend internationally: (1) Cost/Risk Encounter, (2) Cost/Risk Shuffling, (3) Cost/Risk Awareness, and (4) Cost/Risk Acceptance/Sharing. Characters of each stage are summarized in the Table 2.1. He argued that the U.S. has been in the third stage and is entering the fourth stage. The Brownfields Action Agenda⁴ (EPA, 1995) and the various state programs (e.g. Voluntary Cleanup Programs⁵), have acknowledged the broader environmental, social and economic scope of the problem and sought to develop policy tools capable of balancing public sector concerns with private sector needs and remediate contaminated sites affordably. Federal, state and local governments have started accepting responsibility and sharing costs and risks associated with contaminated sites.

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⁴ EPA initiated the Brownfields Action Agenda in 1995 in response to the widespread economic development obstacles posed by urban brownfields. The agenda encouraged states, local government, lenders, and prospective purchasers to work together to ease fears of financial liability and regulatory burdens. (http://www.epa.gov/brownfields/laws/other_bf_related_laws.htm)

⁵ From the mid-1990s, states have created voluntary cleanup programs (VCPs) to offer liability relief and other incentives for responsible parties to remediate contaminated sites. EPA remains involved in the development and operation of state VCPs, negotiating the content of VCPs with state governments, signing Memoranda of Agreement with states to accept them, and setting out basic criteria to evaluate them. (De Sousa, 2000 and http://www.epa.gov/oecaerth/cleanup/revitalization/state.html)
Table 2.1 A Stage Model of Convergence in Contaminated Lands Policy

| Stage 1: Cost/Risk Encounter | • Initial encounter with the health and environmental risks posed by contaminated sites  
|                             | • Call for scientific investigation  
|                             | • Investment standstill  
|                             | • Central government takes on primary role |

| Stage 2: Cost/Risk Shuffling | • Shifting of regulatory responsibility between different levels of government  
|                             | • Shifting of costs and risks among public and private sectors  
|                             | • Uncertainty= minimal investment |

| Stage 3: Cost/Risk Awareness | • Acknowledgement of the broader environmental, social and economic risks of inaction  
|                             | • Improved scientific understanding of risk  
|                             | • Testing of alternative policies and programs in different jurisdiction  
|                             | • Increased investment |

| Stage 4: Cost/Risk Acceptance/Sharing | • Government acceptance and sharing of financial and management risks  
|                                      | • Harmonization of effectiveness approaches and standards at all levels of government |

Source: De Sousa (2000, p.57).

In addition to the brownfield redevelopment literature, Lange and McNeil (2004a, 2004b) reported survey data from nearly 160 brownfield stakeholders and project personnel from 75 federal brownfield pilot projects on the attributes that contributed to success of brownfield redevelopments. They found that a host of characteristics related to project costs and timing, financing, community support, land use, infrastructure, willingness of lending institutions to participate in the financing, support of local politicians, availability of financial incentives, and number of jobs to be created appear important to the success of brownfields redevelopment.

Governments originally required contaminated sites to be cleaned up to pristine or natural conditions, so as to remove all public risk (De Sousa 2000). China also accords with
“polluter pays” principle. This made it extremely costly to clean sites and quite difficult to attract private investment to them. With regard to cost of environmental cleanup, Collaton and Bartsch (1996) pointed out that cleanup adds to the cost of any redevelopment project, and often it adds significantly. In most cases, adequate financing to carry out cleanup and redevelopment activities is seldom available at affordable rates, reaching to more than threefold since 1980. Moreover, cleanup delays project completion, generates extra expenses for environmental assessments and detailed appraisals, and calls for much time and staff work. These factors eat into the profitability of a project and undermine its economic viability.

Gong (2010) proposed a risk-based and site prioritization strategy drawn from the analysis of contaminated site management framework internationally that shows full remediation is often excessively costly, and that the optimal level of cleanup targets depends on the risks the site poses to its environmental and the surrounding population, which in turn largely depend on the proximity of the brownfield to population centers and its intended use. By introducing less stringent generic criteria tied to future land use, and more flexible site-specific risk assessment procedures, governments could accept some risk by allowing some contamination to be left on site and thereby reducing private sector cleanup costs (De Sousa 2000).

With regard to liability issue, Collaton and Bartsch (1996) claimed that uncertain liabilities are a key barrier that hinders private developers from obtaining financing, since the lenders concern about potential liability in the case of foreclosure, loss of collateral
value, and the project’s economic viability due to the high cleanup cost. China also needs to balance between the “polluter pays principle” and implementation efficiency, and clearly define responsibilities and liabilities, to avoid the lengthy and costly litigation (Gong, 2010). In the U.S., governments have started to share some of the costs and risks associated with liability (De Sousa 2000). First, many state governments in the U.S. are now protecting private investors from prospective liability (e.g. Covenants Not to Sue and No Further Action Letters⁶), thereby reducing the potential costs associated with re-cleaning up a site in the future. Second, governments are no longer compelling landowners to cleanup low-risk sites until their property is redeveloped or sold or until it is economically feasible, thus allowing activity to continue on site despite risks from contamination (e.g. allowing a gas station with contaminated soil to operate, allowing a contaminated site to remain vacant until a market exists for redevelopment).

With regard to funding, according to De Sousa (2000), governments in the US and Europe offer a variety of direct funding programs and financing incentives to encourage the sharing of costs and financial risks associated with remediation and redevelopment. The US approach and particularly the latest brownfield legislation passed in 2001 very much focuses on leveraging private finance, particularly through the use of specific

⁶ Covenants Not to Sue and No Further Action Letters are designed by state legislation to prevent future liability litigation if the cleanup process had to be carried out again due to changing standards (De Sousa, 2000). Covenant Not to Sue is a written promise by a state government that it will not take legal action or require additional cleanup by a party that satisfactorily cleans up a property under a state brownfield or voluntary cleanup program. No Further Action Letter is a written statement by a state government that it has no present intention to take legal action or require additional cleanup by a party that satisfactorily cleans up a property under a state brownfield or voluntary cleanup program (Glossary of Brownfields Terms, Environmental Law Institute).
economic tools such as tax and financial incentives for private investors on brownfield sites (Ferber and Tomerius, 2003). In China, there is no an effective financial mechanism associated with the contaminated sites problem at the central level (Xie & Li, 2010), all governments, especially local governments, pass on all costs and financial risks to the private sector.

However, even with these advantages, contaminated sites may simply be uncompetitive because of other, non-environmental, market-driven limitations. According to Robertson (1999), non-environmental factors such as site location and configuration and access to skilled labor typically play a far more important role than environmental liabilities in influencing location decisions. In the U.S., where brownfield sites have been redeveloped, this has often been done without public money. However, this only concerns those sites that are profitable to redevelop, where expected financial returns exceed redevelopment costs, including cleanup costs. Many others sites under current policies will never be reclaimed because they are too polluted and/or situated unfavorably. In between are the sites where public money can help and incentives matter (Ferber and Tomerius, 2003).

2.2 Summary

The literature review shows the trend of converging in policy-making style and content internationally, due to the fact that governments in the US and Europe are implementing similar policies and programs to share a great portion of the costs and risks involved in redevelopment and remediation with the private sector to solve the problem. The
remediation and redevelopment of contaminated sites is a costly and potentially risky proposition. The plethora of contaminated sites can only be remediated, redeveloped and financed by both the public and private sectors. The literature review lays the ground for a comparative analysis for China and the US, since they shared commonalities in dealing with contaminated site problems. Given the gaps in research and policy-making related to brownfield remediation and redevelopment in China, it is essential to analyze the policy framework and policy activities of the US, and learn the experiences generated from decades of practices.
CHAPTER THREE
RESEARCH DESIGN

3.1 Study Purpose and Rationale

The present analysis focuses on examining policy tools that are being adopted in China to deal with brownfield redevelopment, and comparing them to those employed in the United States. Associated policy-making activities in China were categorized into five components: (1) regulatory jurisdictional issues; (2) data sources; (3) cleanup criteria; (4) liability issues; and (5) funding issues. Policy-making activities were also classified as national, provincial and local under the above themes. The comparison between China and the US was conducted under the same framework, since parallels exist between Chinese and US forms of state (national to federal, province to state).

This qualitative research is also involved with a case study of a brownfield redevelopment project in Yangquan, Shanxi (see Figure 3.1), which was a multi-land use redevelopment of 146.6 acres that had been the site of a state-owned steel factory. The Yangquan Steel Company went bankrupt and closed the factory, laying off more than 5,000 employees. After cleanup and minor improvement of the site, the land was sold by the government to a local private real estate developer. It now houses four huge commercial complexes, one public park and more than 1.6 million square meters of new condominiums. Interviews with local officials in Yangquan, China and a site visit were conducted to answer the research question of how the brownfield remediation and
redevelopment project was accommodated at the local level in the absence of a comprehensive and effective legal and regulatory framework.

![Figure 3.1 Yangquan (Black) in Shanxi (Light Grey), China (White) (Source: Wikipedia)](image)

### 3.2 Study Description

Information and data in this research were collected primarily from transcription of relevant literature and governmental documents, observation in the way of site visit, as well as interviews with local officials in Yangquan, China.
The narrative data used for transcription, including all associated governmental policies and programs and basic documentations about the case, were collected, transcribed and categorized into five themes (regulatory jurisdictional issues, data sources, cleanup criteria, liability issues, and funding issues) related to the research questions. Except relevant literature, data was mainly collected through web-search (the official websites of government agencies) and in-person requests during interviews. Governmental documents and project proposal were obtained from Yangquan Municipal Commission of Development and Reform, Yangquan Municipal Land and Resources Bureau, Yangquan Environmental Protection Bureau, Yangquan Urban Planning Bureau, State-owned Assets Supervision and Administration Commission of Yangquan Municipal Government in person request. Old photographs of the site that show the steel factory before demolition were acquired from State-owned Assets Supervision and Administration Commission of Yangquan Municipal Government by email request as secondary data.

Face-to-face interviews were conducted in Yangquan, Shanxi, the city where the research case is located, in order to obtain relevant local policies and programs information, assess the effectiveness of national and provincial policies, and more importantly to figure out in the absence of a comprehensive legal and regulatory framework, how these brownfield redevelopment projects were accommodated in the local level. Interviewees were administrators of five redevelopment issues related bureaus in Yangquan (see Appendix for a list of interviewees), who are familiar with the relevant issues and policies of the entire jurisdiction. The questions were designed to elicit information on (See Appendix for preliminary interview questions): (1) what policies and programs were adopted
associated with brownfield redevelopment from diverse levels of government and governmental-related agencies; (2) how the government agencies in the local level define and perceive the brownfield problem, and how they define their roles; (3) the kinds of policies and programs provided by local level governmental agencies for addressing main obstacles—variability in regulatory processes, lack of data sources, lack of cleanup standards, fear of liability, limited funding resources for cleanups; (4) issues and obstacles they face in the facilitation and accommodation of brownfield redevelopment projects.

The interviews and site visit were conducted between January 8th and January 11th, 2013. The interviewees were met individually during their office hours at their offices. Researcher took notes during each interview for accuracy. Each interview lasted between 30 and 45 minutes. Communications were in Chinese, which is the first language for both the researcher and interviewees.

The site visit was conducted during the researcher’s stay at Yangquan. Photos that reflect the current conditions of the site were taken. Since the case is a multi-landuse redevelopment project, including residential, commercial and recreational buildings and open space, the visit last approximately 45 minutes to cover all kinds of physical structures.

The research was approved by Columbia University’s Institutional Review Board (IRB) on February 19th, 2013.
3.3 Limitations

The method to assess the effectiveness of China’s policies and programs does examine the actual performance of these policies on brownfield redevelopment projects, but compares policy-making activities to those other countries have done with similar constraints, thereby providing a measure of China’s progress and shortage in this area. Given the complexity of contaminated site problems and the enormous amount of regulatory activities generated by different levels of government, it is impossible to be exhaustive. The present analysis provides a general picture of China’s legal and regulatory framework in dealing with main obstacles to brownfield remediation and redevelopment.
CHAPTER FOUR
RESULTS

4.1 Introduction
The current situation in dealing with brownfield remediation and redevelopment of China was examined and compared with that of the US within the framework of how the following five obstacles were dealt with by both countries: (1) regulatory jurisdictional issues; (2) data sources; (3) cleanup criteria; (4) liability issues; and (5) funding issues. An introduction of institutional arrangement in China was provided at first to familiar readers with the policy-making actors in China. An analysis of the data yielded from the literature review and governmental documents and interviews with local officials revealed findings within the areas of the research questions:

- What programs and policy tools related to brownfield remediation and redevelopment are currently adopted and employed in China?
- How is the brownfield remediation and redevelopment project accommodated at the local level in the absence of a comprehensive and effective legal and regulatory framework?

4.2 Institutional Arrangement
In China, the management of contaminated site issues is divided among a variety of agencies in the national level: the Ministry of Land and Resources (MLR), Ministry of Environmental Protection (MEP), National Development and Reform Commission
(NDRC), and the Ministry of Housing and Urban-Rural Development (MOHURD). The following table outlines the primary responsibility of each agency involved in contaminated site remediation and redevelopment issues.

**Table 4.1 Relevant Central Governmental Agencies and Their Primary Responsibilities**

<table>
<thead>
<tr>
<th>Agencies</th>
<th>Primary Responsibilities</th>
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</table>
| Ministry of Land and Resources (MLR)          | • Implement land management law or regulations  
• Conduct land surveys and statistics  
• Issue land titles and certificates  
• Develop land use master plans  
• Manage land acquisitions and allocations  
• Review and submit land use change applications that require State Council approval  
• Conduct researches on major land management issues  
• Supervise local land bureaus  
• Coordinate with other ministries to solve land disputes |
| Ministry of Environmental Protection (MEP)    | • Supervise and manage environmental pollution prevention  
• Develop and implement guidelines for the prevention of water, air, soil and solid waste pollution |
| National Development and Reform Commission (NDRC) | • Draft national environmental protection strategy  
• Draft national urban development strategies and policies  
• Coordinate major issues in ecological development, and energy and resources savings |
| Ministry of Housing and Urban-Rural Development (MHURD) | • Endorse city planning submitted by lower level urban planning bureaus and supervise their implementation  
• Participate in land use planning review  
• Develop national urban development strategies and policies  
• Draft commercial and residential real estate guidance and policies  
• Supervise the implementation of regulatory policies in the real estate market jointly with relevant agencies |

Source: Xie and Li (2000), and edited by researcher.

In the U.S., that the Environmental Protection Agency (EPA) is the most important agency in the federal government to administer environmental policy-making; in China, the MLR and MEP share the primary responsibilities to manage contaminated sites. Since land is owned by the state, the Ministry of Land and Resources (MLR), on behalf of the

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7 For NDRC and MHURD, responsibilities that related to brownfield remediation and redevelopment are listed.
State Council, is responsible for the uniform management of land resources, including managing contaminated sites and conducting land surveys. While the Ministry of Environmental Protection (MEP) is responsible for managing environmental pollution issues, and developing and implementing regulations to prevent water, air, soil and solid waste pollution.

Other central governmental agencies, including the National Development and Reform Commission (NDRC) and the Ministry of Housing and Urban-Rural Development (MOHURD), are also involved in brownfield remediation and redevelopment in their related aspects. Although there is a clear definition of each agency’s responsibilities and duties in dealing with contaminated site problems, there is no comprehensive regulatory framework to streamline each agencies’ duties, such as to what extent each agency should be involved into the problem and how to facilitate inter- and intra-coordination and cooperation between various governmental agencies. There are the problems with overlapping responsibilities, as well as absent responsibilities, in the management of contaminated site problems, due to the lack of streamlined framework, so is the problem in local level management. Previous practices (e.g. the industrial site remediation and redevelopment for the Shanghai World Expo 2010) in brownfield remediation and redevelopment were on a case-by-case basis and a “learning by doing” manner.

The institutional arrangement at the local level is consistent with the national level. Above-mentioned national agencies have corresponding provincial and municipal bureaus that implement national policies in their related fields. These bureaus also have
policy-making powers, but they must keep them in line with national policies. In some cases, provincial and municipal agencies are taking more active and innovative roles in policy-making, since brownfield remediation and redevelopment are carried out directly at the local level. The innovative actions in policy-making taken by local governmental agencies fill the gap of policies and guidelines from the national level.

Taking Beijing as an example, redevelopment of a former industrial site needs to be approved by four municipal agencies: the Beijing Municipal Economic and Information Commission (BMEIC), Municipal Development and Reform Commission (BDRC), Municipal Urban Planning Commission (BUPC), and the Municipal City Administration and Sanitation Commission (BCASC). Before 2007, Beijing Municipal Environmental Protection Bureau (BEPB) was not involved in this approval process. In 2007, the BMPEPB issued Site Environment Assessment Guidelines and the Notice Regarding Implementation of Soil Environmental Assessment after Enterprise Relocation, which requires that soil assessments be conducted before the reuse of a former industrial site. These two documents were not mandated from the national level, but were a self-initiated policy-making activity from the local level to respond to the poisoning incident of Beijing Songjiazhuang Subway station in 2004\(^8\), which marks the beginning of the remediation and redevelopment of industrial contaminated site in Beijing (Xie and Li, 2010).

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\(^8\) The poisoning incident happened during the construction of Songjiazhuang Metro Station in Beijing in 2004. The site was occupied by a pesticide plant in the 1970s. Large quantities of residual poisonous gases remained trapped underground after the plant was replaced. Three workers were poisoned when the drilling operation reached 5 meters. The Beijing Environmental Protection Bureau later took remediation measures.
4.3 Regulatory Jurisdictional Issues

China has no legal and regulatory framework for contaminated site remediation and redevelopment. There are no special national laws and regulations for brownfield remediation and redevelopment similar to the Comprehensive Environmental Response, Compensation and Liability Act (1980) and its amendments and associated programs in the US. Provisions related to pollution and liability issues are scattered in several existing national laws or regulations, such as the Constitution, Criminal Law, Environmental Protection Law, Land Management Law, Solid Waste Pollution Prevention Law, Hazardous Chemical Waste Pollution Prevention and Control Methods, Law of Water and Soil Conservation, Land Reclamation Ordinance, and the Urban Real Estate Development and Management Regulations (Xie & Li, 2010).

The Constitution requires the rational use of land and the prevention of soil pollution; Criminal Law specifies the criminal nature of soil pollution; the Solid Waste Pollution Prevention Law regulates solid wastes; the Land Management Law prevents land desertification, soil erosion and soil pollution; and the Land Reclamation Ordinance requires that damage caused during construction work—including digging, excavating, pressing and other activities should be compensated, and the sites should be remediated. The Solid Waste Pollution Prevention Law requires entities that produce solid waste to take preventive measures, and specifies their obligation and financial liabilities.

Even though these legal requirements are clearly stated, they are too general to provide operational instructions in a systematic and consistent manner. Clear institutional
responsibilities; liabilities and responsible parties; uniform national standards and procedures on site assessment, cleanup and remediation; and effective funding or financing mechanisms, are absent. At the moment, MEP is lobbying for passing legislation on soil pollution prevention and control to fill the gap and develop a specific law for prevention and management of land contamination.

Lacking a specific law to deal with contaminated site problems, the prevention and management of these contaminated sites are guided by an ad-hoc series of regulations. Among these various regulations, three provisions are of importance: Notices on Effective Prevention and Control of Environmental Pollution for Industrial Enterprise Relocations (MEP, 2004), Recommendations on Strengthening Soil Contamination Prevention and Remediation (MEP, 2008), and Management Method of Contaminated Sites (MEP, not issued yet).

The 2004 notice from MEP is not a mandatory provision. It marks the beginning of recognition of the contaminated site management issues in the relocation of industrial enterprises. The Recommendations on Strengthening Soil Contamination Prevention and Remediation (MEP, 2008) further set out a series of working targets to be accomplished by 2015 to establish a preliminary framework for managing and controlling land contamination. It pointed out the severe problems associated with soil pollution, specified government goals, laid out a working plan to establish regulatory framework, and called for action. The proposed actions include completing the national survey of soil contamination, establishing a basic framework for a Soil Environmental Monitoring
Network, developing national and local soil pollution prevention plans, and forming a preliminary regulatory and policy framework for the prevention of soil pollution. However, the impact of this provision is limited since it lacks the legally enforcement of a national law to effectively implement and realize its goals.

Another attempt by MEP is the Management Method of Contaminated Sites to be published soon. It’s specific to contaminated site problems and is supposed to provide more detail in defining operational procedures and technical issues. It tries to set up a regulatory framework of site investigation and environmental risk assessment. According to Xie and Li (2010), it will provide guidelines under which the investigation and assessment of conditions must be carried out, what content of assessment should be included and what procedures should be followed. This document is expected to significantly contribute to establish a comprehensive regulatory framework towards brownfield remediation.

As a comparison, the Comprehensive Environmental Response and Liabilities Act (CERCLA 1980), commonly referred to as Superfund, was the most important legal framework issued in the U.S. The law made provisions for a specific remediation fund, and it gave state governments and the federal Environmental Protection Agency strong regulatory powers. Later, the Superfund Amendments and Reauthorization Act (1986) broadened the federal EPA’s mandate to include research and remediation activities. Another important federal act in dealing with contaminated sites is the Resource
Conservation and Recovery Act (1974, 1984), which governs the management of non-hazardous waste, hazardous waste and underground storage tanks.

In 1995, the EPA introduced the Brownfields Action Agenda to address the inefficiencies of Superfund and led to an increase in brownfield redevelopment in the US. This agenda further clarifies the institutional responsibilities to assign liability, provides funds for pilot programs to test redevelopment models, and limits the EPA’s activities to the management of the high-risk contaminated sites (Johnson, 1996).

Even without a comprehensive legal and regulatory framework in the national level, some provinces and municipalities with faster development pace, such as Beijing, Shanghai and Chongqing, have made efforts to formulate polices and strategic actions to deal with brownfield remediation and redevelopment. In the absence of operational guidelines from national agencies, some innovative provincial and municipal governments took innovative actions to deal with contaminated site problems. Table 2.2 outlines some actions, guidelines and regulations initiated by some local governments. These policy-making activities are consistent with national policies, and some of these pilot actions demonstrate the viability of programs.
Taking Beijing as an example, the city has established an initial regulatory framework for environmental assessment and management planning for sites vacated by relocated industries in response to the poisoning incident of Songjiazhuang Subway Station in 2004. Following the incident, a series of local regulations and administrative rules were issued. Among these, two brownfield management documents, Site Environmental Assessment Guideline (2007) and Notice on Implementing Soil Environmental Assessment for Sites Left from Industry Relocation (Municipal EPB, 2007), are of great importance. Significant progress has been made relative to other municipalities in China.

Table 2.2 Relevant Actions, Policies and Guidelines in the Local Governments

<table>
<thead>
<tr>
<th>Beijing</th>
<th>Notice on Implementing Soil Environmental Assessment for Sites Left from Industry Relocation (Municipal EPB, 2007)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Site Environment Assessment Guideline (Municipal EPB, 2007)</td>
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</table>

| Shanghai                     | Soil cleanup standards for the Shanghai World Expo 2010                                           |
|                              | Methodology on Soil Contamination Prevention and Remediation (at drafting stage, not yet issued) |
|                              | Chongqing City Environmental Protection Regulations (City People’s Congress, 2007)                  |
|                              | Notification on Strengthening the Remediation of Contaminated Former Industrial Sites (Municipal Government, 2008) |
|                              | Forwarding SEPA Notification on Implementing Pollution Control during Factory Relocation (Municipal EPB, 2004) |
|                              | Notification on Implementing Soil Contamination Control and Treatment after Factory Relocation (Municipal EPB, 2005) |
|                              | Notification on Strengthening the Management of Solid Waste Left from Closed, Shut-down, Bankrupt and Relocated Factories (Municipal EPB, 2006) |
|                              | Request for Further Regulating and Strengthening the Supervision of Contaminated Sites Left from Closed, Stopped, Bankrupted and Relocated Factories (Municipal EPB, 2008) |

<table>
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<tr>
<th>Chongqing Province</th>
<th>Management Framework on Land Contamination Prevention and Remediation (at drafting stage)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Administrative Methods for Cleanup and Remediation of Contaminated Lands in Shenyang (for trial use) (Municipal EPB, Planning Bureau, and Land and Resources Bureau)</td>
</tr>
</tbody>
</table>

Source: Xie and Li (2010), and related governmental agencies.
The Site Environmental Assessment Guidelines provides a procedure for site environmental assessment that aims to identify contaminated sites, conduct risk assessments based on current or proposed future land uses, determine remediation criteria and propose proper remediation methods. The following table provides a detailed description of this procedure (Beijing EPB, 2007).

<table>
<thead>
<tr>
<th>Table 2.3 General Procedure of Site Environmental Assessment</th>
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<tr>
<td><strong>Step 1 Contamination Identification:</strong> Identify potential contaminated sites using inventory review, field visits and interviews with landowners, operators and other related agencies.</td>
</tr>
<tr>
<td><strong>Step 2 Contamination Verification:</strong> Carry out preliminary soil and groundwater sampling and laboratorial analysis to verify the type and level of site contamination, and risks posed to human health and environment.</td>
</tr>
<tr>
<td><strong>Step 3 Risk Assessment and Remediation Plans:</strong> Conduct a risk assessment and develop soil cleanup and remediation plans. Proposed future land uses, such as residential, agricultural, industrial and commercial purposes, need to be taken into account in this risk assessment.</td>
</tr>
</tbody>
</table>

Source: Beijing Environmental Protection Bureau.

The Notice on Implementing Soil Environmental Assessment for Sites Left from Industry Relocation reinforces the Site Environmental Assessment Guidelines presented above, and is more specific to redevelopment activities. It stipulates that, prior to redevelopment, a risk assessment must be conducted, remediation plan must be prepared, and remediation must be conducted to reach the environmental targets set by the plan. It also reiterates the “polluter pays” principle that remediation costs of the contaminated sites should be paid by the responsible parties that caused the pollution. However, the framework in Beijing needs to further be enriched to identify responsible parties and develop incentives and financial mechanisms to tackle liability and financial issues (Beijing EPB, 2007).
Another municipality that has established a regulatory framework for brownfield remediation is Chongqing. To fulfill its target to relocate old and polluting industries from central urban areas for environmental concerns and urban development, Chongqing has introduced various policies and regulations, clarified institutional responsibilities, and conducted pilot projects. Different from the situation in Beijing, Chongqing has established a specialized fund for contaminated site remediation, which will be discussed later (Chongqing EPB, 2010). However, Chongqing still lacks guidelines to stipulate risk assessment procedures and cleanup criteria as Beijing’s effort.

In the U.S., within the CERCLA framework, individual state administrations are assigned responsibility for enacting and implementing their own contaminated site legislation. Besides remediation and redevelopment legislations, over 45 individual states have now implemented so-called Voluntary Cleanup Programs (VCPs) to loosen the stringent cleanup standards that federal and state Superfund-style legislation imposed. They developed remediation and redevelopment policies that offer more flexible cleanup options, give the private sector discretion to cleanup contaminated sites, and provide technical assistance, financial support, and protection from liability (De Sousa, 2000).

### 4.4 Data Sources

The lack of a systematic, nation-wide approach to collecting, storing and disseminating information on both the whereabouts of contaminated sites and on the extent of the environmental problem in China is also considered to be an important obstacle inhibiting the development of an effective remediation and redevelopment strategy. At the national
level, there is no existing inventory of contaminated sites, or related inventories. However, such information is needed to aid in the identification of brownfield sites and formulation of remediation and redevelopment policies.

In 2006, the Ministry of Environment Protection and the Ministry of Land and Resources made an attempt to jointly carry out a national survey for identifying and classifying contaminated sites, primarily on farmlands, to establish an inventory of contaminated sites (not yet finished). This investigation has been completed in 2010, and is at the stage of data processing and analyzing. This survey aimed to establish an inventory of contaminated sites, identify the type, scope, extent and spatial distribution of heavily polluted areas, analyze the causes of pollution, and propose environmental management measures. The geographical scope of this national survey covers most provinces and municipalities in China, focusing on the Yangtze River Delta, the Pearl River Delta, the Bohai Bay Economic Belt, and the old North East China industrial belt (Xie and Li, 2010, Yuan and Xie, 2012). However, the survey findings are not available to the public that it is doubtful that this effort will be practically put in use in the brownfield remediation and redevelopment activities.

According to the interviewee from Yangquan Land and Resources Bureau, they are conducting a survey on industrial contaminated sites to establish an inventory, in response to a provincial program that plans to redevelop those abandoned and/or under utilized industrial sites. This survey aims at contaminated sites that resulted from previous industrial production activities. However, the interviewee refused to reveal any
detailed information, such as location, type and extent of contamination. It is also not clear if they will share the information and cooperate with local Environmental Protection Bureau to draft remediation methods in the future.

In the US, a tiered system exists that different levels of government compile and manage different kinds of contaminated site information in a practical manner. EPA’s computerized inventory system (CERCLIS) collects contaminated sites information for those deemed to pose the greatest risk to human health and the environment. These sites that exceed a designated hazardous ranking are put on the National Priorities List, while those that do not are assigned instead to state inventories. Many state and local governments (some used funds provided by the Brownfields Action Agenda) have developed their own approaches for classifying sites based on their hazard and/or economic development potential to better target technical assistance and government funds and attract private investment (De Sousa, 2000).

4.5 Cleanup Criteria

In China, there are no uniformed standards and procedures for both environmental risk assessment and cleanup activities on soil pollution, and technical guidelines on soil remediation, officially issued on the national level. Related technical standards associated with contaminated sites are scattered into several governmental documents prepared by different ministries (Xie and Li, 2010), such as:

- Soil Environmental Monitoring Technical Specifications (HJ/T166-2004);
- Groundwater Monitoring Technical Specifications (HJ/T164-2004);
• Water Environment Monitoring Specifications (SL219-98) issued by the Ministry of Water Resources;

• Groundwater Quality Standards (GB/T14848-93);

• Soil Environmental Quality Standards (GB15618-1995);

• and Soil Environmental Quality of Industrial Enterprises (HJ/T25-1999), although the latter is very rarely used.

MEP has been working with research institutes to draft and revise a series of contaminated site management standards and guidelines, including the Soil Environmental Quality Standard (2009), Interim Measures for Soil Environmental Management of Contaminated Sites (2009), Guidelines for Contaminated Sites Environmental Monitoring (2010), Guidelines for Contaminated Site Risk Assessment (2009) and Guidelines for Contaminated Site Soil Remediation (2009). According to the interviewee from EPB, Yangquan, contaminated sites that proposed to be redeveloped are required to be cleaned up to “pristine conditions”. Based on international experience, this cleanup criteria is stringent and causes infeasible costs for responsible parties. And it provides no detailed technical guidelines to remediate. However, it is not sure if site-specific risk assessment will be introduced into these above-mentioned regulations prepared by MEP. Moreover, since at the moment there is no specific contamination site legislation in China, cleanup criteria and risk assessment/management guidelines that will be issued in the future are not in the form of legally-binding standards, that provinces and municipalities have the discretion to employ more flexible guidelines that are not legally enforceable.
Since provincial and municipal governments are directly involved in contaminated site management and remediation, they are responsible for developing both their own generic cleanup criteria and site-specific risk assessment approach. Some provinces and municipalities with faster development pace and stronger economic capacities have been working on their own regulations and technical standards, in response to the need for soil pollution management and remediation. The following are a few examples:

- Soil Environmental Quality Assessment and Remediation Standards for Exhibition Site (Provisional for Shanghai Expo)
- Site Environmental Assessment Guidelines (2007), which stipulate work procedures and technical methods for site environmental assessments in Beijing.
- Shenyang Municipal Environmental Management Measures on Contaminated Site Treatment and Remediation (trial implementation) (2007), by Shenyang Municipal Planning Bureau, and Shenyang Municipal Land Resources Bureau, stipulates the evaluation and identification of contaminated sites.

With regard to remediation techniques, even though there are various soil and groundwater remediation techniques for contaminated sites, only a few are commonly used for practical and economical reasons. According to the interviewee from Environmental Protection Bureau, Yangquan, the most commonly used remediation techniques are predominantly off-site disposal technologies, such as excavation follow by depositing contaminated soil in an off-site landfill, and co-incineration in cement kilns. Some pilot projects utilizing other technologies for soil remediation and land reuse have been also implemented jointly with foreign environmental protection companies and/or
research institutes. These pilot projects are distributed in those provinces and municipalities with self-initiative brownfield remediation and redevelopment regulatory frameworks, such as Beijing, Shanghai, and Chongqing.

Recalling international experience, two types of criteria for evaluating the extent of soil pollution and formulating cleanup goals that protect public health and safety are currently being used (De Sousa, 2000, p.31):

- “Generic numeric soil quality criteria: There are numerical indices that can be used for both assessment and cleanup activities derived from (eco) toxicological studies that identify levels according to a tolerance health risk. These indices vary according to the proposed land use for the contaminated site.

- Site-specific risk assessment/risk management: These are procedures for developing soil and groundwater criteria that consider tolerance and risk levels associated with a specific site”.

Internationally, this same generic cleanup criteria and site-specific procedures for assessing soil pollution levels and for identifying cleanup levels are used in many countries, which helps take into account each site’s characteristics, and control the effectiveness and the expense for the cleanup procedures. For example, in the US, the Risk Based Corrective Action approach developed by the American Society for Testing and Materials (ASTM), which incorporate these two types of criteria, is used as a framework for developing risk-based cleanup criteria and methods by the states.
4.6 Liability Issues

In China, the liability issues associated with contaminated sites accord with the “polluter pays” principle, which stipulates that the person responsible for polluting the site pays to have it cleaned up. This principle was of great importance in framing contaminated site remediation policy, and was encompassed by local governments in their policy-making activities. For example, Chongqing municipal government has clarified the three principles regarding liability for brownfield management (Chongqing EPB, 2010), based on national laws:

- “Polluter Pays” principle;
- “Investor Benefits” principle

However, as for imposing liability and enforcing to recover remediation costs from responsible parties, there is great variability at the local level.

According to the interviewee from EPB, Yangquan, contaminated sites that proposed to be redeveloped are required to be cleaned up to “pristine conditions” at a cost paid by responsible polluters. However, in actual cases, governmental agencies are reluctant to impose liability on responsible parties for contamination, except when the contamination at a site imposes a severe risk to human health or to the environment. They typically allow responsible parties to clean up sites voluntarily without strict risk assessment, supervision and post-evaluation, especially for those state-owned industrial enterprises that are occupying the land. In the case of transferring and redeveloping a former industrial site, when retroactive liabilities are unable to be imposed to the responsible
Parties (e.g. former enterprises that are bankrupted, closed, or restructured), the
government typically intervene in these matters to negotiate with potential developers to
recover the remediation costs from land transfers. For example, in the case of the
Hongshi Paint Plant site cleanup and redevelopment project in Beijing\(^9\), the developer
paid for the cleanup costs as part of land transfer expenditures. According to the
interviewee, the recovery of soil remediation costs from high land transfer revenue is
commonly used in the local level, and is proved to be viable and practical since it’s
unable to recover cleanup costs from unclear responsible parties.

When the contamination at a site imposes a severe risk to human health or to the
environment and arouses public awareness, local governments typical intervene to take
remediation actions and pay for the cleanup cost. For instance, the poisoning incident
happened during the construction of Songjiazhuang Metro Station in Beijing in 2004, the
polluter, pesticide plant in the 1970s, has closed years ago. The Beijing Environmental
Protection Bureau took the responsibility to remediate. Due to a lack of adequate
legislation, liability issues associated with brownfield remediation and redevelopment,
such as how the liability should be imposed/assigned, should there be protection against
liability after a site has been remediated to the standards of the day, are still not on the
table to discuss.

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\(^9\) The site of Beijing Hongshi Paint Plant once was a pesticide plant in the 1950s, which was
transformed into a paint plant in the 1980s. Site assessment results indicated that the soil is
contaminated. The bidding document of the land auction specified that the winning bidder should
implement site cleanup in accordance with the contaminated soil disposal plan formulated by
BEPB. Finally, the private developer spent tens of millions RMB of private capital on soil
remediation (Xie and Li, 2010).
In the US, the “polluter pays” principle is applied retroactively and the joint and several system is employed under Superfund legislation to charge those responsible parties for contamination. However, the stringent principle has given rise to a high amount of litigation. Under the Brownfields Action Agenda, the EPA has made a genuine effort to address the liability issue. Under the Voluntary Cleanup Programs established in the early 1990s, individual states intervene only to compel parties to clean up a site when it is deemed to be hazardous to public health and safety. Otherwise cleanup activity is largely voluntary. Moreover, the states have No-Further Action and Covenants Not to Sue certificates to prevent future liability litigation if the cleanup process has to be carried out again due to changing standards (Bartsch 1997).

4.7 Funding Issues

There is currently no formal national governmental program for funding remediation or redevelopment projects. There are various funding programs for developing effective contaminated site remediation technologies, which are generally provided to research institutes, as well as funding programs for the national survey for identifying, assessing and establishing contaminated sites inventories. However, several provinces and municipalities have designated funds for contaminated site remediation. The municipal government of Chongqing has provided a specialized subsidy fund for contaminated site environmental risk assessment, which has been significantly increased during the past years. In 2007, 200 million RMB was spent on 15 projects, while by 2009 the figures rose to 800 million RMB spent on 45 sites (Xie and Li, 2010). Moreover, Chongqing also plans to build a diverse financing mechanism for site cleanup and remediation, which will
consist of a revolving fund to finance cleanup and redevelopment activities of enterprises, and an earmarked fund to provide grants for the cleanup and remediation of contaminated land with unclear responsible parties (see Table 2.4).

<table>
<thead>
<tr>
<th>Table 2.4 Potential Financial Resources for Brownfield Remediation in Chongqing</th>
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<tbody>
<tr>
<td>Revolving fund for contaminated sites cleanup and redevelopment of enterprises</td>
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<tr>
<td>• Establish fund to finance the relocation of polluting enterprises</td>
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<tr>
<td>• Provide loans to the relocated enterprises for contaminated sites remediation</td>
</tr>
<tr>
<td>• Repay the loans with revenues from remediated land transfers</td>
</tr>
<tr>
<td>Earmarked fund to subsidize brownfield remediation</td>
</tr>
<tr>
<td>• Establish Fund with a proportion of remediated land transfer fees (coordinate with the Finance Bureau, Land and Resources Bureau)</td>
</tr>
<tr>
<td>• Prepare operational manual of the fund with the Land and Resources Bureau</td>
</tr>
<tr>
<td>• Provide subsidies for the cleanup and remediation of contaminated sites with unclear responsible parties, which are not intended for development in the short term or will be used for public purposes.</td>
</tr>
</tbody>
</table>

Source: Chongqing Environmental Protection Bureau.

There are currently no incentive mechanisms in place throughout the country for attracting private investment in brownfield remediation and redevelopment (i.e. tax incentives, tax incremented financing, etc.) An interviewee from Yangquan Urban Planning Bureau argued that, at the moment, developable land is in a short supply so that private investors are competitive and enthusiastic to acquire brownfields for commercial use, even if they are aware of that they may have to bear a large amount of cleanup costs.

In the area of funding, the situation in the US is vastly different from that in China, in that all levels of government provide a variety of funding sources and financial incentives to support remediation and redevelopment activities. In addition to Superfund, the EPA currently provides a variety of funding sources, such as: the Brownfield Assessment Demonstration Pilot Project up to $200,000 per project; the National Partnership Action
Agenda, which makes available $300 million and an additional $165 million in loan guarantees to encourage partnerships among stakeholders; the Brownfields Tax Incentives, which allows developers to deduct the costs of cleanup from their taxes; and the Brownfield Cleanup Revolving Loan Fund Pilots, which provides a $350,000 maximum loan to encourage the cleanup and reuse of brownfields. Moreover, by 1998 twenty-six states provided some form of brownfield remediation funding (grants for cleanup, revolving loan funds, etc.), and specific incentives for attracting private investment (tax credits/abatement, tax increment financing etc.) (Bartsch, 1998).

4.8 Case Study

The mixed used project in this case was 146 acres in size and located on the riverfront of Yangquan, Shanxi. Formerly, the site was occupied by Yangquan Steel Corporation from its foundation on 1917. The total project cost about 2.1 billion RMB to complete. Of that, about 0.38 billion RMB was spent for land acquisition, displacement compensation and site improvements. The project had extraordinary value due to its prime location between the central business district and newly developed urban area. Moreover, it had an excellent location with hills on the back and river at the front. Today, the site consists of 3,432,000 square feet of condominiums and apartments, 2,343,000 square feet of retail and commercial space, 971,000 square feet of hotel and office space, and ample open and green space (see Figure 4.1).
Figure 4.1 Master Plan of Jinlian Real Estate Development Project (Source: Yangquan Jinlian Real Estate Development Company)
Formerly, the site was used by Yangquan Steel Corporation, which was a state-owned steel company founded in 1917, and filed to bankruptcy in 1999. Initially, the site was on the peripheral of the city (see Figure 4.2). After decades of urban development, the site gradually became the core section of Yangquan, since it was surrounded by a newly development urban area. Intensified by the shortage of land supply and rapid urban development in Yangquan, transforming this site into a mixed-use community and revitalizing the city’s riverfront became the primary economic development goal of local government. According to the interviewee from Urban Planning Bureau, it was planned to move the steel company to a rural area and redevelop the site as the city’s sub-commercial district. After the bankruptcy of Yangquan Steel Corporation, the site was sold to Yangquan Jinlian Real Estate Development Company through an auction at a price of 0.26 billion RMB in 2004.

**Figure 4.2 Photographs of Yangquan Steel Corporation (Source: State-owned Assets Supervision and Administration Commission of Yangquan Municipal Government)**

Today, the site has been totally transformed into a gleaming district with plenty of high quality apartments, vibrant commercial and retail stores, and abundant open space, which has made the site the new and prosperous urban core of Yangquan (see Figure 4.3). This project not only improved quality of life for local residents, but also provided enormous
business opportunities for transforming the city’s industrial-based economy to service-based one. However, this project was not a strictly brownfield remediation and redevelopment project since that the interview from Environmental Protection Bureau confirmed that EPA was not involved in this project. No environmental assessment and cleanup was conducted during the land transfer and after redevelopment, which was also confirmed by interviewees from both Urban Planning Bureau and Land and Resource Bureau.

Figure 4.3 Current Site (Source: Researcher)

According to the interviewee from Urban Planning Bureau, the previously occupied land should have been cleaned up to pristine condition before the land auction. However, in this project, since the previous landowner had filed for bankruptcy. It was unable to pay off any demolition and site cleanup costs, and local government negotiated with the developer to reach out an agreement that the developer paid an upfront fee to demolish and cleanup the site. Moreover, local government recovered the displacement compensation for laid-off workers of the steel company from the high land transfer revenue. The interviewee acknowledged that local government is generally unwilling to subsidy highly profitable real estate development. Even though local governments do
subsidy certain sites that are too polluted and/or situated unfavorably, available tools are scarce at the local level, such as administrative fee exemptions.

Then what made this project work? Factors that pushed the project forward included the strong political support and the marketability of the site. Mid- and small-size cities generally have more difficulties attracting investment, redeveloping brownfield, sustaining small businesses and restructuring economy. This project received strong political support since it was linked to long-term growth plans in the city, and was deemed to be a milestone to connect the old and new developed areas and revitalize the city’s riverfront. Local government provided a series of supports, such as direct investment on public infrastructure and facilities, and convenience on approval process. Meanwhile, location and market were critical factors to attract private investment to this project, which guaranteed the success of this project and attracted developer to share the cleanup cost with local government.

However, another remediation effort made by Environmental Protection Bureau should be mentioned. Almost 80 years of production activities of Yangquan Steel Corporation had accumulated large amount of solid residues. These residues were deposited off the factory site on a suburban site (today, this site is the core section of Yangquan’s newly developed district). The landfill covered an area of 110,000 square meters, and had mounted to a height of 63 meters. In 2000, local government proposed to remediate this landfill since newly developed district had encompassed this site and it posed potential pollution to the environment. The Environmental Protection Bureau initiated remediation
plan and took the actions of solid waste solidification and earth-sheltered plantation. A civic park was built on this site. One interviewee said that a provincial funding source\(^\text{10}\) provided a 5 million RMB grant for the remediation, while local government provided the almost total 0.12 billion RMB for cleanup, remediation, site improvement and construction. According to the interviewee, the previous polluter had closed so that the government was unable to recover the remediation cost. Moreover, local government was willing to invest in this project because it was deemed a priority to remediate this contaminated site and provide public open space to local residents by politicians.

The case project was started in 2004 when the contaminated site problem had not yet attracted the attention of local government. At the moment, Shanxi has been working on a series of policies and programs to tackle the issue. Shanxi has been a prominently resource-based province and specializes in coal extraction industry. Its over-reliance on extraction and associated processing industries has resulted heavy environmental deterioration. In 2010, Shanxi was approved by the State Council to set up as a national resource-based comprehensive economy reform pilot region (National Development and Reform Commission, 2012). In the same year, Shanxi Provincial government and Ministry of Land and Resources jointly launched Innovative Land Resource Management Initiative to correspond to this pilot program.

\(^{10}\) This grant is initiated by Shanxi Provincial Government to allocate channel funds to contamination remediation and prevention. Eligible projects should either be municipals’ priority remediation and prevention projects or have attracted certain amounts of capital investments (Application for Shanxi Environmental Protection Fund, 2011-2012).
Both programs recognize the remediation and redevelopment of contaminated industrial sites as an economic development opportunity and long-term urban plans to address the shortage of land supply. The goals are to mobilize as many land resources as possible to fulfill the urban development needs and remediate the industrial contamination accumulated by decades of heavy industrial activities. These two programs set out a series of working targets to establish a preliminary framework for managing and revitalizing abandoned and/or underutilized industrial sites. Proposed actions include complete industrial site inventory, improve industrial site consolidation, relief redeveloped sites from strict annually national and provincial developable land quota, establish environmental assessment mechanism and remediation plans, and associated funding mechanism. According to the interviewee from Land and Resource Bureau, they are conducting a survey on industrial contaminated sites to establish an inventory, in response to these two programs. He acknowledged that local governments and investors are attracted to these programs because it provides a way to obtain developable land quota through conducting feasibility study and paying for required remediation. The interviewee from Yangquan Economic and Reform Committee also pointed out that at this stage, no specific funding mechanisms and tax incentives are devised to support this national resource-based comprehensive economy reform pilot program.
CHAPTER FIVE
DISCUSSION

Based on the analysis on policy-making activities in current China and comparison with those in the U.S. from Chapter 4, the findings from previous study are interpreted to answer the research questions of the study.

5.1 What programs and policy tools related to brownfield remediation and redevelopment are currently adopted and employed in China?

From the analysis of policy-making activities in Chapter 4, I confirmed that (1) the legal and regulatory framework of China to deal with brownfield remediation and redevelopment is limited, fragmented, and lags behind leading countries; and (2) there is great variability in policy-making activities within different provinces and municipalities. A handful of them with faster economic development pace have been working on establishing a regulatory framework regarding brownfield.

The Table 5.1 summarized the analysis carried out above. From this summary it can be seen clearly that, there is a far cry from the framework the U.S has established to effectively tackle the issue. At the moment, central and local governments have become aware of the environmental, economic and social risks posed by contaminated sites and have started to take actions to tackle the issues. Central governmental agencies have taken the primary responsibility by developing regulations to assess the problem, draft
cleanup criteria and procedures, establish a legal framework, and fund associated scientific research. However, the lack of legal status and strong capacity to enforce policies makes central government’s efforts faint and ineffective compared to those of some local governments.

<table>
<thead>
<tr>
<th>Table 5.1 Summary of Policy-Making Activities in both the U.S. and China</th>
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<tbody>
<tr>
<td>Actions to address obstacles</td>
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<tr>
<td>Data Sources</td>
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<tr>
<td>• Formal program for managing information</td>
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<tr>
<td>• Classification of sites according to risk</td>
</tr>
<tr>
<td>Cleanup-Criteria</td>
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<tr>
<td>• Generic</td>
</tr>
<tr>
<td>• Review cleanup</td>
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<tr>
<td>Liability</td>
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<tr>
<td>• Joint and Several of allocated</td>
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<tr>
<td>• Certificates of compliance</td>
</tr>
<tr>
<td>• Full protection from future liability</td>
</tr>
<tr>
<td>Funding</td>
</tr>
<tr>
<td>• Dedicated fund for orphan sites</td>
</tr>
<tr>
<td>• Financing programs</td>
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<td>• Incentive programs</td>
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</tbody>
</table>

At the local level, proactive and innovative actions taken by public agencies have shown an awareness of the importance of contaminated site remediation and redevelopment and attempts to find the most workable balance between public and private sectors to accommodate the interests of different stakeholders. They are one step further than central government to devise effective and affordable policies and programs to incorporate the broader ecological, economic and social components of brownfield

<sup>11</sup> “Variable” means a few of provinces and municipalities have related policies and programs.

<sup>12</sup> Since the result of national survey (2006) has not made public yet due to the reason of State secrets, it is not clear if this inventory will classify sites according to risk levels.
remediation and redevelopment. Municipalities, such as Beijing and Chongqing, are advantageous in different aspects with this problem, in a sense, they are testing alternative policies and programs to learn what works and what does not. Their experience will definitely offer important lessons for the central government to develop a comprehensive and effective national framework and for local government to establish its own approaches.

5.2 How is the brownfield remediation and redevelopment project accommodated at the local level in the absence of a comprehensive and effective legal and regulatory framework?

The second question delved into the problem at the local level, and asked how these projects are accommodated in the absence of this framework and the associated enforcement. The interviews with local officials from related bureaus provided knowledge to the researcher with regards to this question.

It was revealed that there is little public awareness of brownfield remediation and redevelopment at the local level. Most of the interviewees are not familiar with this concept, or they have comprehensive knowledge of central and provincial policies and programs in their related fields associate with brownfield remediation. Only after the researcher broke down the whole scheme of brownfield issues, gave an interpretation and asked specific questions, such as if there is any program that funds contaminated sites cleanup, then they gave feedback. Together with the literature, it is clear that there is no a regulatory framework to deal with brownfield remediation and redevelopment in most
provinces and municipalities, except those mentioned in previous chapters, such as Beijing and Chongqing.

Moreover, brownfield remediation and redevelopment projects at the local level are accommodated on a case-by-case and separated manner. Brownfield remediation and redevelopment entails ecological, economic and social perspectives, such as issues of risk assessment, cleanup and remediation, land transfer, land use planning and design. However, involved local agencies are only concerned and deal with their responsible aspects, lacking inter-agency cooperation. For example, the survey on industrial contaminated sites, which is conducted by Yangquan Land and Resources Bureau, excluded the local Environmental Protection Bureau.

There is great variability and flexibility in implementation and enforcement of associated regulations at the local level. Taking environmental protection bureau as an example, local officials are generally reluctant to face and solve contaminated site problems, as long as no incident happens that poses serious risks to human health and/or the environment, and calls public attention. Moreover, there is no stringent supervision and post-evaluation mechanism to monitor contamination and associated remediation activities. In some cases, local officials even withhold contamination information on purpose. In the case of Wuhan Sanjiang housing development project (2006), Wuhan Land Reserve Center purposeful withheld the information, that severe pollution incident happened at the site, before a land auction and after the land transfer.
At the local level, even if they are aware of the seriousness of the problem and realize their responsibilities, local authorities don’t have regulatory, technical and financial mechanisms or the capacity to tackle the issues. On the other hand, the flexibility and variability at the local level allows local officials to innovatively develop workable and affordable approaches to realize remediation and redevelopment projects. They employ available policy tools and enforcing powers within an existing legal and regulatory framework, and negotiate with private investors. For instance, local officials generally negotiate and recover soil remediation costs from high land transfer revenue in redevelopment projects. This approach is confirmed to be commonly used at the local level by the interviewee from Urban Planning Bureau.

Through the interaction with local officials in the interviews, I can state that local officials generally have less public awareness of the risks of contaminated sites than the public media and local residents. Moreover, local officials are generally reluctant to reveal information regarding their work, or encourage public participation.

5.3 Recommendations: what improvements and efforts should be made by the central government based on the lessons learned from the U.S. experiences?

Generally speaking, in the area of brownfield remediation and redevelopment, China lags far behind leading countries such as the U.S. The most important step for the central government is to establish a comprehensive and effective legal and regulatory framework specific to the brownfield issue that will incorporate specific legislation, clearly defined
institutional arrangement and responsibilities, a tiered inventory system, risk-based cleanup and remediation criteria, uniformed site assessment and post-evaluation mechanism, technical assistance, and effective financing mechanisms. Besides, China needs to improve public awareness, information disclosure and local capacity for enforcement.

First, since brownfield remediation and redevelopment contains ecological, economic and social perspectives, it calls for cooperation and coordination between different levels of governments in order to be carried out successfully. Central government should incorporate the institutional arrangement and responsibility issue in its effort to establish the regulatory framework. Roles and responsibilities of each agency and each level of government should be streamlined and clearly defined in the framework to avoid overlapping or absent responsibilities and improve effectiveness and efficiency. Local capacity and authority to tackle brownfield issue should be supported, encouraged and clearly defined in this central governmental framework.

Second, just as in the U.S., the management of the environment is a shared responsibility of the federal and state governments, government at federal and central levels should focus on general policy-making activities and technical assistance, while local governments should develop their own approaches consistent with federal and central governmental policies. Local governments in China generally tend to focus on economic development and are reluctant to tackle contaminated site remediation issues, as well as lack regulatory, technical and financial capacities. However, local governments are
advantageous in local knowledge (e.g. unique land development needs, specific economic and ecological goals) that facilitates brownfield remediation and redevelopment in a more workable and affordable way. There is a great variability within different regions of China in terms of economic development, technical and knowledge support and contamination degrees. Central government should encourage and support local governments to build their own capacities and develop specific approaches (e.g. data collection, cleanup criteria, risk assessment standards, and financing mechanisms).

Third, with regard to cleanup criteria, most countries used stringent criteria to remediate sites to pristine conditions, which has proven to be extremely costly and quite difficult to attract private investment to them. International experience has shown that risk-based approaches in contaminated site management are better. They introduce less stringent generic criteria tied to future land use, a prioritized system to identify remediation urgency and more flexible site-specific assessment procedures. Governments accept some risk by allowing an acceptable level of contamination and thereby reduce cleanup costs. There are large number of contaminated sites and limited availability of remediation funds. Moreover, given that, in China, land is owned by the government and most industrial sites are owned by state-owned-enterprises, responsibility will ultimately fall on the State. It may not be easy to share costs and risks with the private sector as other countries have done. Central government should support the employment of this risk-based strategy to tackle the issues effectively and affordably.
Fourth, to effectively practice risk-based strategies in contaminated site management, an inventory to collect information on site, type, conditions, and risk levels of contaminated sites. Local governments should also establish their own inventories consistent with central government with information on the sites’ physical and economic potential to facilitate site-specific strategies. Specific approaches by local governments to assign legal responsibilities, manage orphan sites, and recover associated funding for site remediation should be strengthened based on more flexible and workable local practices.

Fifth, financing mechanism is another important factor. Drawn from the U.S. experience, all levels of government provide a variety of funding sources and financial incentives to support remediation and redevelopment activities. Considering the fact the there are no financial mechanisms for brownfield issue at the central level, central government is urgent to develop financing mechanism to provide available financial and incentive tools (e.g. grants for cleanup, revolving loan funds, taxes deduction, etc.) to both central and local governmental agencies to tackle brownfield issues, encourage private investment (such as recover cleanup costs from land transfer revenues), reduce cleanup costs and fund orphan contaminated sites.

Sixth, at the central level, information disclosure should be strengthened in order to improve public awareness and facilitate public participation. While at the local level, public awareness of risks of contaminated sites, and ecological, economic and social benefits to remediate and redevelop these sites needs to be strengthened among private sector, local residents, and especially local officials.
In summary, to cope with the challenge from increasing pressure on brownfield remediation and redevelopment, the central government in China should tap into the experiences accumulated by other countries, establish its legal, regulatory and institutional framework, improve and coordinate existing fragmented policies and programs, and figure out most workable balance between public and private sectors to accommodate the issues.
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Appendix A: Interview Questions for Local Government Officials (English Version)

Yangquan Municipal Commission of Development and Reform, Shanxi, China
- Are there any programs, initiatives and policies associate with brownfield redevelopment from central, provincial and local levels?
- What role the commission of development and reform is playing, and what is the responsibility associated with brownfield redevelopment?
- What are the drivers for the government to redevelop underused and abandoned industrial sites?
- What specific aims do the governments expect to achieve?
- Is there any financial tool to facilitate brownfield redevelopment?
- What issues associated with brownfield redevelopment are you concerning?

Yangquan Municipal Land and Resources Bureau, Shanxi, China
- Are there any programs, initiatives and policies associate with brownfield redevelopment from central, provincial and local levels?
- Is there any specific program with underused and abandoned industrial land investigation, consolidation and revitalization?
- What incentives the land and resources bureau can provide to facilitate brownfield redevelopment?
- What role the land and resources bureau is playing, and what is the responsibility associated with brownfield redevelopment?
- What issues associated with brownfield redevelopment are you concerning?
- What work the land and resources bureau are doing associated with underused and abandoned industrial land, and what are the short term and long term working plans?
- What obstacles the underused and abandoned industrial site reuse are facing?
- What legal procedures and steps are required for the land transfer?

Yangquan Environmental Protection Bureau, Shanxi, China
- Are there any programs, initiatives and policies associate with brownfield redevelopment from central, provincial and local levels?
- What role the environmental protection bureau is playing, and what is the responsibility associated with brownfield redevelopment?
- What issues associated with brownfield redevelopment are you concerning?
- Are there any standards for the contamination assessment?
- Are there any legal procedures and steps to remediate industrial sites?
• What standards are utilized associated with soil and underwater contaminant remediation?
• Are there any funds associated with contaminant remediation from central, provincial and local levels?
• Who are responsible for the industrial site contamination, and who are responsible to pay for the remediation?
• For the redevelopment of Yanggang site (the case studies in the research), what assessment, procedures, and remediation standards were utilized?

Yangquan Urban Planning Bureau, Shanxi, China
• Are there any programs, initiatives and policies associate with brownfield redevelopment from central, provincial and local levels?
• What role the urban planning bureau is playing, and what is the responsibility associated with brownfield redevelopment?
• What issues associated with brownfield redevelopment are you concerning?
• What are you able to do to facilitate brownfield redevelopment project under the existing legal and regulatory framework?
• What was the land use planning for redevelopment of the Yanggang site (the case studied in the research)?
• What incentives urban planning can provide to attract redevelopment?
• What objectives urban planning bureau were expected to achieve, and whose interest were expected to protect?

State-owned Assets Supervision and Administration Commission of Yangquan Municipal Government, Shanxi, China
• Are there any programs, initiatives and policies associate with brownfield redevelopment from central, provincial and local levels?
• What role the state-owned assets supervision and administration commission is playing, and what is the responsibility associated with brownfield redevelopment?
• What issues associated with brownfield redevelopment are you concerning?
• How does the commission negotiate with associated governmental departments and private developers to protect the interest of both enterprises and laid-off workers?
• What strategies the commission was using to solve the interest conflict between state-owned enterprises and private developers?
• What policies the commission was utilizing to protect and resettle laid-off workers in the state-owned enterprise restructuring, closure or bankruptcy?
Appendix B: Interview Questions for Local Government Officials (Chinese Version)

初步采访稿（中文版）

山西省阳泉市发展和改革委员会

• 中央政府、省政府和地方政府是否有针对工业废弃地再开发项目的相关法律、政策和针对性项目吗？
• 针对工业废弃地再开发项目，发展和改革委员会的具体职责是什么？在该类项目开发过程中，起到什么作用？
• 对于地方政府来说，是什么因素来吸引政府将工业废弃地重新进行开发？
• 对于工业废弃地的再开发，地方政府希望能通过该类项目，取得哪些成果？
• 中央政府、省政府和地方政府是否有相关的经济优惠措施来吸引该类项目的开发？
• 从发展和改革委员会的角度来说，对于该类项目的开发，哪些因素是最关注的？

山西省阳泉市国土资源局

• 中央政府、省政府和地方政府是否有针对工业废弃地再开发项目的相关法律、政策和针对性项目吗？
• 各级政府有对于工业废弃地更新改造再利用的具体政策和措施吗？
• 国土资源局能提供哪些优惠条件，来吸引针对工业废弃地再开发的项目？
• 针对工业废弃地再开发项目，国土资源局的具体职责是什么？在该类项目开发过程中，起到什么作用？
• 从国土资源局的角度来说，对于该类项目的开发，哪些因素是最关注的？
• 针对工业废弃地，国土资源局正在做哪些工作？有什么短期和长期的工作计划和目标？
• 从国土资源局的角度来说，哪些因素限制了工业废弃地的再开发利用？
• 对于该类土地的买卖，有哪些具体程序？
山西省阳泉市环境保护局
- 中央政府、省政府和地方政府是否有针对工业废弃地再开发项目的相关法律
  政策和针对性项目吗？
- 针对工业废弃地再开发项目，环境保护局的具体职责是什么？在该类项目开发过程中，起到什么作用？
- 从环境保护局的角度来说，对于该类项目的开发，哪些因素是最关注的？
- 目前有哪些污染物评估的具体标准？
- 目前有哪些治理污染物的程序？
- 针对地下水污染和土壤污染，目前有哪些治污标准？
- 各级政府目前有哪些治理污染物的专项基金？
- 根据目前的法律框架，谁对于污染物有法律责任，谁对于治理污染物有经济责任？
- 对于阳钢再开发项目，在具体操作过程中，有哪些污染物评估方法和治理标准？

山西省阳泉市规划局
- 中央政府、省政府和地方政府是否有针对工业废弃地再开发项目的相关法律
  政策和针对性项目吗？
- 针对工业废弃地再开发项目，城市规划局的具体职责是什么？在该类项目开发过程中，起到什么作用？
- 从规划局的角度来说，对于该类项目的开发，哪些因素是最关注的？
- 各级政府有对于工业废弃地更新改造再利用的具体促进政策和措施吗？
- 对于阳钢再开发项目，城市总体规划中对于该地块的土地属性是如何规划的？
- 从规划局的角度，对于工业废弃地更新改造再利用能提供哪些具体吸引条件？
- 对于工业废弃地的再开发，规划局希望能通过该类项目，取得哪些成果？对于哪些群体目标的哪些利益希望能到维护？
山西省阳泉市政府国有资产监督管理委员会

- 中央政府、省政府和地方政府是否有针对工业废弃地再开发项目的相关法律、政策和针对性项目吗？
- 针对工业废弃地再开发项目，国资委的具体职责是什么？在该类项目开发过程中，起到什么作用？
- 从国资委的角度来说，对于该类项目的开发，哪些因素是最关注的？
- 在该类项目的开发中，国资委如何权衡破产改制企业、下岗职工和开发商的利益纠葛？
- 国资委利用哪些具体措施和手段来平衡国资委如何权衡破产改制企业、下岗职工和开发商的利益分配问题？
- 国资委利用哪些具体政策来保护下岗职工的利益？
Appendix C: Interviewee List

To acquire the viewpoints on the legal and regulatory framework associated with local brownfield redevelopment, the researcher plans to interview a number of governmental officials for the research. A list of those potential interviewees follows.

Yangquan Municipal Commission of Development and Reform, Shanxi, China
Resource Based Economic Restructuring Office
山西省阳泉市发展和改革委员会

Yangquan Municipal Land and Resources Bureau, Shanxi, China
Land Consolidation and Rehabilitation Office
山西省阳泉市国土资源局土地开发整理中心

Yangquan Environmental Protection Bureau, Shanxi, China
山西省阳泉市环境保护局

Yangquan Urban Planning Bureau, Shanxi, China
山西省阳泉市规划局

State-owned Assets Supervision and Administration Commission of Yangquan Municipal Government, Shanxi, China
山西省阳泉市政府国有资产监督管理委员会

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13 To protect the interviewees’ right to confidentiality, all names and identifying information, except information on the bureaus they are working for, from the interviews were removed and coded. Each interviewee will be assigned a number: I1, I2, I3, I4 and I5. A master list that matches the coding number with the identification of each interviewee were created after the interviews, so that the researcher, supervisor, and chairperson have access to trace the individual data if necessary. The list was stored in researcher’s personal computer, which is password protected. Only researcher, supervisor, and chairperson have access to this list. Interviewees’ identification information will not be revealed to public and other interviewees participating in the study before, during and after the study.