

CASE STUDY

A Review of Industrial Restructuring in the Ruhr Valley and Relevant Points for China

Robert P. Taylor, Senior Advisor,
Institute for Industrial Productivity

July 2015



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1. ABOUT THIS REPORT

Over five decades, the economy of the Ruhr Valley in Germany has undergone a dramatic restructuring, away from its original coal and steel-based economy to a more diversified service economy. The process was difficult, but the restructuring has been more successful than in some other regions around the world that are facing similar challenges. Although the industrial restructuring that China is now facing is, in some ways, different, there also are similarities in the aspirations to develop the service economy as heavy industrial growth slows—to soften social hardships and job loss, and to proceed with industrial restructuring in such a way as to help stem the tide of the country’s worsening environmental pollution.

This report provides an overview of the Ruhr’s experience, as seen from an outsider. It seeks to put the story of economic restructuring in the Ruhr in a context that makes sense for Chinese readers.

Following the overview section, the report provides a summary of the restructuring policy phases in the Ruhr’s recent history. It then provides recommendations on a number of specific topics of the Ruhr’s experience that may be most relevant for concerned Chinese to explore in detail, through recommended future Chinese-German exchanges. The report thus provides only a first step in an effort to help enable lessons from the Ruhr Valley’s rich experience to be understood and brought to bear in the truly massive industrial restructuring that China will see over the next decade and beyond.

2. OVERVIEW

Introduction to the Ruhr Valley

The Ruhr Valley of northwestern Germany has been a center for European coal and steel production since the middle 1800s. The Rhine River forms the western border of this region, which includes three rivers running east to west into the Rhine (the Lippe, the Emscher and the Ruhr). With underground reserves of coking, semi-anthracite, steam and gas coals, and excellent logistics to the Rhine and ocean, the Ruhr quickly developed into a major industrial, largely-urbanized region. Its population grew from just 400,000 people in 1850 to 3.8 million people in 1925. The Ruhr was a center for military industry during the Second World War. After the war, coal and steel production rebounded through the 1950s.

Today, the Ruhr is home to 5.2 million people. It spans an area of over 4400 square kilometers, including a series of municipalities, such as Essen, Duisburg, Dortmund, Bottrop, Bochum, Hamm and others. These municipalities grew around coal mines and heavy industry plants.

The Ruhr is a geographic region with certain economic, demographic and historical continuity. It is not an administrative region. The Ruhr is part of the State of North Rhine-Westphalia (NRW), the largest of Germany’s 16 states with a population of almost 18 million people. Within the Ruhr region there are 11 district-level municipalities and 4 rural districts, comprising the next level of government administration. In Germany’s federal system, both the states and the municipalities enjoy considerable independence and autonomy.

The Ruhr region has gone through a dramatic and difficult economic transition over the last 50-60 years.



Facing pressure from lower-cost producers, the coal and steel-based economy went through a sharp decline, causing massive job losses in those traditional sectors. At the same time, environmental conditions had become intolerable by the middle of the last century, requiring attention and investment to improve air, water and soil conditions. The last five decades have brought many difficulties and much change.

Today the Ruhr region is primarily a service economy. There were no universities in the Ruhr in the 1950s. Now there are over 220,000 students enrolled in the region's new universities and technical schools. Air pollution problems have largely been solved. Major investments have been made (and continue) to return key rivers back to more natural, unpolluted states. Many environmentally-degraded, old industrial sites have been successfully cleaned up and redeveloped, and more brownfield development projects are planned. Certainly challenges remain, and people in the Ruhr feel that the transition is not yet complete. Efforts to continue to develop new economic opportunities and jobs remain a top priority. But the region has seen much progress compared to some other regions in the world that faced similar pressures for economic restructuring. And certainly, there is much to learn from the various policies adopted and experiences gained in this historic region.

The dilemmas faced in the 1960s and 1970s

Beginning in the late 1950s, the Ruhr's underground coal mines, with an average depth of 650 meters, had increasing difficulties competing with less-expensive coal from other areas. Moreover, demand for coal began to fall overall due to the rise of oil as a fuel. Coal mines began to close under the economic pressure and the number of coal mining jobs fell sharply. Then, in the mid-1970s, demand for the Ruhr's steel production also began to fall quickly, due the increasing availability of less-expensive steel on the global market.

In 1956, the coal mines of the Ruhr produced 124 million tons of coal, employing almost 500,000 people (Hospers 2004). In the 1930s, the steel plants of the Ruhr produced one-sixth of the world's steel (Schepelmann 2010) and, in 1958, the Ruhr's steel plants employed about 220,000 people (Rehfeld 2014). In the 1950s, the coal, steel and related industries together employed 70% of the labor force in the Ruhr (Schepelmann 2010). As these core industries began to contract sharply in the 1960s and 1970s, the entire Ruhr region faced a dire economic crisis. By the 1990s, about two-thirds of the coal, steel and related industry jobs were gone.

At the same time, environmental conditions had deteriorated to reach levels that would be considered totally unacceptable today. Industry and urban infrastructure was founded on early and middle 20th century technology, with little regard to environmental issues. The worldwide environmental protection movement had not yet really begun. Air pollution from heavy industry was poorly controlled. Water pollution was severe, and was exacerbated by a naturally high water table, falling ground levels due to mining, and difficulties in evacuating standing water. Toxic waste from heavy industry polluted urban soil.

Campaigning for national election in 1961, Willy Brandt, who would become one of West Germany's most famous Chancellors, declared that "the sky above the Ruhr must turn blue again." At the time, this goal seemed to many to be a dream that looked very difficult if not impossible to achieve. But given the drain of existing pollution on the quality of life, the idea captured local and national hopes.

Pressures therefore began to build to force change and economic restructuring. Faced with such



pressure, however, the Ruhr area also suffered from several specific challenges that made the prospects for successful restructuring particularly daunting, including:

- The Ruhr basically had a monolithic economic structure, concentrated on coal and coal-using heavy industry. There was little diversity in the economy and no history of developing more diverse undertakings.
- The economy of the Ruhr was dominated by a few very large firms. Small and medium-sized enterprises were few and underdeveloped.
- The local education system was weak, with no higher-level technical schools or universities operating until 1961.

Successful navigation through radical economic shifts

Economic restructuring in the Ruhr involved hardship for the local people, it was difficult, and ultimately required a wide variety of programs and projects involving many institutions and people. Public financial costs also were high—for social protection spending, infrastructure, and new projects. However, large-scale outward migration and long-term economic decline were avoided.

The gross domestic product (GDP) generated by the Ruhr region doubled in constant US dollar terms from 1957 to 2009, and has continued to grow modestly since then (RVR online databank). Considering this period is over five decades, the average economic growth rate over the period was low (1.3% p.a.), and substantially lower than in Germany overall. However the growth rate was positive, which was not an easy achievement given the collapse of the region’s original core production economy.

Table 1: Total Population in the Ruhr, 1961-2013 (millions)

1950	1961	1970	1987	1990	2000	2010	2013
4.59	5.67	5.66	5.26	5.40	5.36	5.15	5.05

Source: RVR Databank, at www.metropoleruhr.de

The economic boom of the 1950s brought large-scale migration into the Ruhr, resulting in a population increase of some 24% from 1950 to 1961. Since then, the economic difficulties have brought a modest decrease in population, but only by a total of 11% from 1961-2013, which is remarkable compared to some other regions in the world that have witnessed such a radical downturn in the original core production economy. Still, as the population decline has continued in recent years (amounting to 6% from 2000 to 2013), development of jobs for in-situ workers remains a key priority.

Real GDP per capita has thus more than doubled during the 1957-2013 period. GDP per worker in the Ruhr stood at about E 65,000 in 2012. While GDP per worker was 4% below the national average in 2000, stronger growth per worker in the Ruhr caused the GDP per worker to actually slightly exceed the national average in 2012 (RVR Databank).

Behind the long-term averages of positive growth, however, lies a different picture—a picture of radical economic shifts. Economic output and jobs in the core production sectors fell precipitously. Economic



growth and jobs were maintained only by strong growth in the service sector, including many fields that were new, even if they had roots in the old economy.

The radical fall in the core coal and steel sectors can especially be seen in their employment figures. By the 1990s, over half a million of the coal and steel jobs had been lost. But the fall continued further. By 2005, coal production stood at just 18 million tons, only 15% of the 1957 level, employing only 31,000 workers (RVR Databank). In 2005, the number of steel workers in the Ruhr had fallen to 30,000 (RVR Databank). Together these two industries employed just a little over 60,000 people in 2005, compared to some 720,000 in 1957.

Table 2 below shows the dramatic changes in gainful employment in the Ruhr from 1961 to 2011. In 1961 the entire secondary sector (production industry), including coal and steel but some other industries as well, employed 1,426,000 workers, accounting for almost 62% of total employment in the Ruhr. By 2011, the secondary sector employed just 496,000 workers. Almost one million production industry jobs had been lost, representing about 40% of the job total in the Ruhr.

Service sector job growth, however, was robust. Almost one million new service industry jobs were added over the same period. As a result, the total number of jobs in 2011 was about the same as in 1961. While production industry jobs fell from 62% of the total to 21%, service industry jobs rose from 38% to 78%.

Table 2: Gainful Employment in the Ruhr, 1961-2011

	1961	1970	1987	1991*	2001*	2011
	Thousands of workers					
Agriculture & forestry	6	7	11	22	10	9
Production industry	1426	1216	828	852	587	496
Service industry	876	941	1227	1378	1677	1824
TOTAL	2308	2164	2066	2252	2274	2329
	Percentage					
Agriculture & forestry	0.3	0.3	0.5	1.0	0.4	0.4
Production industry	61.8	56.2	40.1	37.8	25.8	21.3
Service industry	38.0	43.5	59.4	61.2	73.7	78.3

**Statistical series revision*

Source: RVR Statistical Databank, at www.metropoleruhr.de



Public investment to modernize infrastructure and develop a strong university and technical education system were basic foundations that helped make service industry growth possible. In addition, many of the success cases of service industry development were built upon strengths stemming from the old economy or new opportunities arising from the economic transition. One services growth area, for example, was in modern logistics, where knowledge from years of heavy industrial commodity cross-shipment by road, rail and water helped lay a foundation for a modern packaging and transport logistics planning, design, monitoring and control service industry. Other growth areas were in environmental diagnostic analysis, remediation project design, emission and pollutant monitoring, environmental management and project implementation. Much practical experience was gained through the development and implementation of many of the new environmental clean-up and protection projects that were required to alleviate the region's serious environmental pollution problems, with the result that the Ruhr is now home to one of the strongest environmental management and service industries in central Europe.

Many challenges remain. Unemployment levels in the Ruhr remain persistently high. Probably the most difficult period of unemployment was in 1987 and 1988, when the unemployment rate reached 15.1% from the effects of coal mine and steel plant layoffs (Hospers 2004). Nevertheless, unemployment in 2013 was at 12.1% in the Ruhr, still substantially higher than in the State of NRW (9.1%) or Germany as a whole (7.4%) (RVR Databank).

Government policies and programs have played a key role in the transition of the Ruhr's economy. The federal government of Germany backstopped key social protection and broad policies, but the policies and programs of the NRW state government, increasingly working with local Ruhr institutions, played a critical role.

3. SUMMARY OF THE RESTRUCTURING POLICY PHASES IN THE RUHR

Government policy and program support to reduce hardship and assist in the economic restructuring in the Ruhr include support from municipal administrations, the state of NRW, the federal German government, and, increasingly, the European Union.

Very broadly, German government policy has consistently sought to mitigate economic hardship among its citizens, to promote a good measure of economic equality, and to support in-situ development in regions undergoing hardship rather than outward migration. The last broad trend differs from approaches in some other countries (such as the U.S.) where labor mobility may be actively encouraged as one way to accommodate regional economic downturns (Noll 2014 interview).

One national policy that has impacted the Ruhr has been the national subsidization of German hard coal (mined underground), which began in 1958. The subsidy involves a series of complex policies, which have developed and changed over time. Arguments in favor of the subsidy typically focus on ensuring a measure of national energy security, as coal is Germany's only large-scale fossil fuel resource, and on desires to forestall the large-scale employment impact of mine production cuts and closures.

Essentially, the main thrust of the policy has been to make additional payments to German coal consumers, increasingly focused on German electric power generators and iron and steel companies, to ensure that the effective prices they pay for German hard coal are on par with the prices they might pay for imported coal. During the 1960s, when the prices for domestic and imported coal were fairly close, the subsidy was small. As the costs of coal mining in Germany steadily rose, however, the cost of the



subsidy rose during the 1970s, 1980s and 1990s. Total costs of the subsidy from 1958 to 2002 amounted to a very high E 158 billion (in constant E 2000, Storchmann 2005). The subsidy will come to an end in 2018 with the planned closure of Germany's last underground hard coal mine (see page 12 below). While the subsidy policy may have slowed the fall of German coal production somewhat, it could not avert the eventual complete closure of Germany's comparatively high-cost hard coal mines.

National and NRW policies have included a variety of social protection programs to reduce hardship among workers losing their jobs. The main programs have included government "redundancy payments" when workers' jobs are eliminated, hardship compensation programs, re-adaption payments to assist with re-training and other costs associated with employment shifts, funding for early retirement initiatives, and contributions to miner pensions. Among these, the two largest programs for coal miners have been public funding for early retirement programs and pension funds (Storchmann 2005).

The 1960s to mid-1980s: The pressure to change

While important new infrastructure and education development initiatives were undertaken, and deeper social protection policies introduced, policies in the 1960s and 1970s also exhibited a degree of denial of change in the region and continued hope that the "good days would return." As one longstanding local expert observed, "There is a time lag between the beginning of economic decline and regional strategies to face structural change in an active way." (Rehfield, 2014).

The downturn in the coal industry in the 1960s was to some extent compensated by a boom period in steel production at that time. The two oil crises of the 1970s brought dreams of a comeback for coal as a national energy alternative. But the beginnings of a sharp downturn in the steel industry and further cost increases in coal production in the 1970s brought real trouble in the 1980s, when these trends continued further.

By the mid-1980s, the large steel companies in the Ruhr—Hoesch, Mannesmann, Thyssen, Kloeckner and Krupp—were in financial crisis. Some verged on bankruptcy. The company response was to close a number of key steel mills, invest in steel production elsewhere, and diversify into other business opportunities also outside of the Ruhr (see pages 17-18 below). While rational from the corporate perspective, the increasing withdrawal of these core companies from the region's traditional core industry left the Ruhr in increasingly dire straits.

The mono-structure of the Ruhr's economy, which had been successful in past decades and centered on coal and steel production by large companies, was now at the core of the Ruhr's problem. The economy needed to diversify. However, the region had little experience or foundation for the development of new small and medium-sized enterprises (SMEs) to help fill the void left by the declining core industries. While some SMEs existed, many were suppliers of highly-specialized materials, machines and services ordered by the core coal and steel companies. Focused on filling precisely prescribed orders from the large companies, these SMEs had little history of innovation themselves. In some ways the large companies, although retreating from the region, also presented obstacles, such as resistance to the sale of their vacated land for other uses, except at exceptionally-high prices (RVR website).

Government policies and programs during this period were largely centralized—led by the national government with program specifics and implementation support from NRW State. Programs were designed and implemented through public institutions at the State level. All measures were based on



the direct allocation of resources to activities and fields previously defined at the State level with little influence from regional and local players (Maggi 2000, p. 13). Three approaches were particularly noteworthy and would have an important bearing on the future:

- Investments in infrastructure, especially intraregional and interregional public transportation systems and roads;
- Investment in new institutions of higher learning, creating new universities and technical institutes in the Ruhr where none had existed before; and
- Promotion of investment in environmental protection, although these were primarily “end-of-pipe” technical pollution treatment solutions at this point.

Increasingly, in the 1980s, policymakers recognized the need to develop new, more diversified business sectors in the region and new SMEs. The investments noted above helped to create some more conducive conditions. However, the centralized approach relying on institutions at the State level to direct pre-defined investment and projects was not producing new business results on the ground.

Some experts on the early period of economic restructuring of the Ruhr write about the “mental burdens” that placed an obstacle to success (RVR website). The long dominance of coal and steel had created a specific social texture, established privileges and the region’s identity. Workers were accustomed to relying on the big companies. There was little innovation outside of the big companies. As the companies began to retreat and the coal and steel industry fell into decline, anger, pessimism and passivity would naturally prevail. Progress towards new, more diversified and flexible economic ventures would require different kinds of social and economic exchange relations (Bross, 2000 p. 23). These relationships would need to include strong links with the education and technical institutions that were just beginning to establish roots, international networking, familiarity with operation in a fast-moving, interconnected and flexible business or production service environment, and greater regional cooperation and coordination. For people grounded in an older, more traditional economic culture, this type of transition was difficult. New approaches were needed.

The mid-1980s-1990s: “Let’s do things differently”

The late 1980s and 1990s witnessed the beginning of new bottom-up development approaches, guided by regional planning and key NRW State institutions, but designed and implemented by local groups. A now famous development program along the Emscher River heralded in the new approach. It focused on umbrella programs that provided an overall framework for local initiatives, a bundling of resources from a variety of public and private sources, and new planning and business networks. New technology and innovation centers were launched, beginning with the establishment of the Dortmund Technology Park at the Technical University of Dortmund (founded in 1965). Gradually, some new business clusters began to take root, most notably in the environmental management field.

The Emscher River International Building Exhibition (IBA) initiative was much broader than its name suggests—the initiative was a broad development program for the Emscher River region running from east to west through the central part of the Ruhr. From the early 1900s, the Emscher River had become a wastewater open sewer for local industry and households. Considered Germany’s most polluted river, the Emscher was a depressing, unhealthy embarrassment for local inhabitants. Adding to the pollution, the Emscher landscape in the 1980s was characterized by vacant factories, closed mines and abandoned docks, sinking ground from mining, large heaps of mining residues and dams (Schepelmann 2013). The



Emscher River IBA program set forth five themes: the renovation of the Emscher landscape into parkland, the ecological improvement of the Emscher River, development of new uses for abandoned industrial buildings, development of new work locations, and development of new housing forms and municipal districts. The initiative's official subtitle was "Workshop for the Future of Old Industrial Regions."

The approach of the Emscher IBA initiative was innovative and new. In 1988, the NRW State government established a small, new Emscher Park planning company, Emscher Park GmbH. The state provided initial funding to the company of about E 18 million but the company was given autonomy over its operations. The company called upon the towns, companies, architects, citizens and interest groups along the Emscher River to make single project proposals supporting the program's five themes. The company and its board provided planning coordination and quality control, while projects came from ideas developed competitively by many participating groups. The company packaged and organized funding for the projects from a variety of other government programs and private sponsors. The program was thus a local participation framework with quality control, rather than a predefined set of projects. One of the slogans was "revitalization from within" (Hospers 2004, RVR website, Scheleppmann 2013, Maggi 2000).

It was agreed at the beginning that the Emscher Park Planning Company would exist for only 10 years, and in 1999 the program and company would be concluded with the final exhibition of results. It was also agreed that the company would fund no projects itself, and have little money of its own. The company had no political power, which might somehow threaten municipalities (Schwarze-Rodrain 2014 interview).

The response of the 17 municipalities and their citizens was robust. Over 120 projects were implemented along the Emscher River, developed by a wide assortment of groups. Some E 2.5 billion was collected from different sources to fund the projects, with about one-third from private sector sources. The project brought many visible improvements which became a source of pride. Work on clean-up and renewal of the Emscher River has since continued beyond the IBA initiative, in different programs, including a large-scale investment program by the region's water utility. Finally, and especially important, the IBA program fostered a new development dynamic involving bottom-up project development combined with regional planning coordination that has continued to serve the Ruhr region in many programs (RVR website, www.iba-emscherpark.de).

The Dortmund Technology Park, created in 1988, expanded rapidly to help bring a new focus on technology-based activities in Dortmund, one of the largest municipalities in the Ruhr. The technology park developed soon after the new Technology Center at the Technical University of Dortmund. The Technology Center at the University was designed to be an incubator for young enterprises and for the research and development departments of established companies. After a start-up phase of 5-7 years, the new firms were required to leave the Center. Three-quarters of them transferred to the new Technology Park, nearby. The Technology Park grew to include a variety of research, development and manufacturing firms involved in information technologies, biomedicine, logistics, robotics, and microsystems as well as industrial production technology and environmental management technology (RVR 2013, Huggins & Thomalla in Cooke, 1995).

The close connections between the Technical University of Dortmund, several key research institutes at the new hub, the new firms located at the Technology Park, and commercial companies engaged in



production helped create a general success. When Thyssen-Krupp moved to close their steelworks in Dortmund, the city promoted the concept of “E-City Dortmund”, using the strengths developed, aiming for further transition from “steeltown to e-city” (Hospers 2004). By 2013, the Technology Center and Technology Park included almost 300 companies, creating 8500 jobs (RVR website). While the new start-up technology companies offered few opportunities for older workers, they offered new possibilities for the younger generation, including recent university graduates (Hospers 2004).

While the spawning of new firms through technology centers and parks connected with the new universities or research entities in the region brought some success in Dortmund, this approach proved difficult to easily duplicate in other cities and towns. There also were examples of new technology centers developed as islands to themselves, which tended to produce mediocre results as connections to other businesses or local strengths were too weak (Rehfeld, 2014 interview).

New business development did best when the business related to some type of regional strength, comparative advantage or experience base, typically related to the region’s industrial past. As markets were rapidly becoming more global, global product and service demand trends also became increasingly critical. Although new business lines might be related to regional strengths, they needed wider markets. Finally, a certain degree of public infrastructure support and/or coordination with the region’s still present core industrial companies was often helpful (Hospers 2004, Rehfeld in Cook 1995).

Development of a new environmental management industry became a leading success case. Awareness of environmental protection needs, followed by increasing action and investment, began to pick up in the Ruhr from the 1970s. While there was much discussion about the newly-imposed investment costs of environmental protection, it also was soon recognized that environmental protection actions could create new markets and jobs. New environmental measures were organized in a way that facilitated the transformation of environmental problems into market opportunities (Rehfeld in Cook, 1995).

Thus the proximity of both problem-causing and problem-solving industrial activities in the Ruhr provided a practical advantage. In the early years, nearly one half of German industrial investment in environmental technologies occurred in NRW, primarily in the Ruhr. While new local skills in research, analysis and strategic management in the environment area needed to be developed over time, relevant practical experience existing in the region, including, for example, a long tradition in waste management (especially scrap collection for recycling), experience in the construction of ventilation systems (for mining), and traditions of company and local government cooperation (especially in energy and water supply), and experience in transportation of hazardous waste (Rehfeld in Cook, 1995).

Today, the Ruhr and NRW have become a leading area in Germany for the provision of environmental remediation project design and execution, and various environmental management technologies and services. Its root may have been local, but the market for this new industry is global.

Although national attention moved to eastern Germany with German unification, the labor market in the Ruhr improved substantially in the 1990s, compared to the 1980s. A wave of new firms and business start-ups in the region was an important factor. As one indicator, the share of self-employed rose from 8.4% to 13.4% of the working population between 1995 and 2000 (Hospers 2004).

2000 to now: Moving into the new millennium

Since 2000 there have been various adjustments to government policies relating to economic



restructuring. A landmark decision was made in 2007 at the national level on the closing of the last underground hard coal mines in Germany and the elimination of the coal sales subsidy. At the state level, the NRW state government is now focusing especially on the development of emerging business “clusters,” helping to channel various types of public and private sector support to local initiatives to support these business lines. Despite the adjustments, however, the blending of bottom-up project identification, design and implementation with regional guidance and coordination remains the dominant development approach in the Ruhr.

There is national agreement on the closure of coal mines. In February 2007 the German federal government, the NRW and Saarland State governments (where hard coal mining still took place), and RAG, the coal mine company owning and operating all of the Ruhr’s coal mines since 1969, reached agreement on the final phasing out of underground coal mining in Germany and its subsidies by 2018. The final mine closure in 2018 will be the Prosper-Haniel mine in Bottrop in the Ruhr. The mine workers union supported the national agreement, with the majority of workers reaching retirement age by 2018.

A particularly noteworthy aspect of the agreement, and the subsequent Hard Coal Mining Financing Law passed in December 2007, is how the agreement established a financial trust to fund and oversee RAG’s fulfillment of social obligations and obligations for the perpetual management of environmental and other legacies that will remain from the many decades of past mining activities. The RAG Group was split into two: the RAG Corporation, which continues for now its coal mining and processing operations; and Evonik Industries AG, a profitable, global industrial corporation focusing on specialty chemicals, made up of chemical companies previously owned by the RAG Group. The assets of both were transferred to a new RAG-Stiftung (Foundation), which became the sole shareholder of each. The RAG-Stiftung is charged by law with the responsibilities to meet RAG’s agreed social obligations and also the funding and oversight of the perpetual management of the mine site legacies (in the Ruhr, a key legacy is the need for perpetual pumping of water from the underground mines). With assets totaling E 3.9 billion in 2013, the financial strength of the RAG-Stiftung to meet its long-term obligations arises primarily from its ownership of the majority of shares of Evonik Industries (RAG-Stiftung 2013 Annual Report, RAG.de, RAG-Stiftung.de, evonik.com).

The State of NRW’s cluster and lead market development programs have now been in operation for over a decade in both the Ruhr and the other parts of NRW. With funding and political support from the EU, national government, state government and a variety of local groups and private companies, these initiatives aim at strengthening local networks for cooperation and mutual support for further innovation along the value-added chain of key business sectors with particular promise for the future. Special emphasis is given to cooperation between university/research institutions and commercial companies, to support for small and medium-sized enterprises (especially assisting in their participation in international markets), and to knowledge exchange on new technologies and emerging opportunities. The State of NRW’s NRW Cluster Agency advises and supports the various clusters, each of which is managed by specific staff from among the cluster’s companies and groups (www.exzellenz.nrw.de).

As of early 2015, sixteen cluster organizations were in operation in NRW for clusters including: the energy economy; energy research; chemical technologies and the chemical industry value-added chain; automobile manufacture and automotive supply industries; logistics; machine building and industrial production technologies; nanotechnology, advanced materials, and microsystem and optical technologies; artificial materials; biotechnology; environmental technology; nutrition; health;



pharmaceuticals; creative business; information and communication technology; and digital media (www.exzellenz.nrw.de).

The clusters are networks in which companies, research facilities, political and non-profit institutions cooperate all along the value chain. The automotive cluster, for example, describes its work as “acting as a communicative nexus for the exchange of innovative ideas in vehicle technology.” By pooling knowledge and expertise, it helps to connect the right partners in the automotive value-added chain and related clusters, unite industry and academia, and provide the industry with much-needed support from economic and political circles. Management of this cluster is undertaken by two cluster member organizations, combining skills—one member organization with experience in management of business networks and another member organization with extensive experience in technical research and development (AutoCluster.NRW).

Some clusters are quite large. For example, 3300 companies and institutions are members in NRW’s energy economy cluster. Three-quarters of the companies involved are small and medium-sized enterprises. About 5200 individuals participate in the cluster’s working groups and networks. Sub-networks within the cluster include networks for solar photovoltaics, power plant engineering, fuel cells and hydrogen, biomass, fuels and engines of the future, energy-efficient and solar building construction, geothermal energy and wind power (EnergieRegion.NRW).

Many other programs, projects and activities are organized completely outside of the government. Three examples include the work of the Regional Association Ruhr (Regionalverband Ruhr or RVR), the Initiativkreis Ruhr, which is formed by leading companies in the Ruhr, and local programs such as the InnovationCity Ruhr in Bottrop.

In existence for over 80 years, the Regional Association Ruhr (RVR) has been especially active in regional planning and support for local project implementation relating to urban and industrial change since the Emscher IBA initiative. The RVR promotes the regional identity of the Ruhr (as the Ruhr is not a government administrative unit), planning and development cooperation between the municipalities and districts, local project development and implementation, and a positive view of the future, viewing “change as opportunity.” The RVR is formally responsible for the regional planning of the Ruhr, as well as the sponsor of some major projects. It collects and disseminates data and information about the Ruhr. All municipalities and districts in the Ruhr are members. The RVR is funded by the municipalities and districts and grants from NRW, the federal government and the EU (metropoleruhr.de).

Since 2007, the RVR has promoted a process of bottom-up project development guided by regional themes under its Konzept Ruhr program. The EU has provided funding for the overall 2007-2013 organization effort, while funding for individual projects is mobilized from a variety of public and private sources. As of 2012, 77 projects had been completed, 193 were under implementation, and preparation for a further 172 was underway. Some E 2.0 billion in public funds and E 6.15 billion in private funds had been mobilized for completed or ongoing projects listed under the overall program (RVR Konzept Ruhr Statusbericht 2011/2012). A new, prospective program to 2020 has been prepared, using the same basic approach (RVR Konzept Ruhr & Wandel Als Chance Prospektive 2014).

The InitiativKreis Ruhr is an association created by 67 leading companies, many of which are national or international, but which operate in the Ruhr. The InitiativeKreis Ruhr supports social and economic development projects with a focus on innovation in the Ruhr for corporate social responsibility



purposes.

One of the projects developed and supported by the InitiativKreis Ruhr is the “InnovationCity Ruhr” in Bottrop. This project provides private sector support for one of the key new focus areas for innovation and development in the Ruhr—new and renewable energy and energy efficiency, related to Germany’s “Energiewende” (Energy Transition). The InitiativKreis set up a competition among municipalities for selection. Requirements included commitment to a goal to halve carbon dioxide emissions between 2010 and 2020, commitment to increasing housing, broad participation by the local population, and a program that could be replicated in other Ruhr municipalities. The slogan for the initiative is “energy transition from below.” In 2010 the City of Bottrop won the competition.

A municipality with a population of 116,000, Bottrop was built around a cluster of coal mines and related industrial plants. The city was hit hard by the collapse of the coal industry and decline in related industry. However, the city has made major efforts to clean up and redevelop seven old coal mining sites in or near the city center into a new, more sustainable urban environment, thereby creating new jobs. While challenges remain, especially with the closure of the city’s last mine coming in 2018, the unemployment rate in 2014 was only 8.2% despite the loss of many of the city’s previous core industries (Mayor Tischler 2014).

As part of its winning application for the InnovationCity competition, organizers collected signatures of 20,000 inhabitants in the project pilot area of 70,000 people, promising support. A local company was formed to help organize the City’s ambitious efforts to half carbon emissions. Company operations are being funded initially with E 500,000 from the InitiativKreis and E1.5 million from related companies. Specific projects also mobilize funding from other sources. Companies often develop projects to pilot new ideas or technologies. Project development and implementation involves a high degree of participation of local inhabitants, especially as many projects involve public and residential buildings. More than 200 projects had been launched by 2014 (Innovation City Management GmbH 2014, www.i-r.de). Compared to many other eco-friendly urban development efforts, InnovationCity Bottrop is especially noteworthy in its bottom-up approach, involving wide participation of scientific institutions, business, the city government and, especially, local inhabitants. Interestingly, the 15 other cities in the Ruhr that participated in the InitiativKreis competition have now created a network for learning from the experiments and solutions developed in Bottrop (Scheleppmann 2013).

Renewable energy and increased end-use energy efficiency are now likely to be new areas of growing economic activity in the Ruhr, an area once known so well as a coal production and use base. In 2013, NRW became the first German state to pass a Climate Protection Act. The State launched into the development of a progressive, new NRW Climate Protection Plan, which took two years of intensive work and was approved by the State in April 2015. The Act and Plan require a reduction in total greenhouse gas emissions by at least 25% by 2020, and at least 80% by 2050, compared to 1990 levels. Although other states have been required by German federal government to prepare climate protection plans, the NRW plan is especially noteworthy in how it was developed with extensive bottom-up participation of over 400 groups. Coordinated by the Wuppertal Institute for Climate, Environment and Energy near the Ruhr, plan preparation involved extensive discussion with the participants on areas where new scientific innovation may be brought to bear, and what could be realistically achieved. Although time-consuming, it is hoped that prospects for implementation of the plan’s many activities and projects will be greatly improved with the upfront attention to local specifics and increased buy-in



from involved groups (Fischedick 2014).

Certainly, there are still many challenges ahead for the Ruhr Valley's continuing transitions. The final coal mine closures and the expected closure of Opel's automobile factory in the Ruhr add to the continuing challenge to reduce unemployment. The Ruhr's inhabitants are also concerned. Yet, viewed from afar, the success achieved in navigating such a dramatic downturn in the region's mono-structural economy to a more diversified service economy is remarkable. For other regions facing similar types of difficult challenges, it is useful to reiterate the importance of key elements of the approach adopted by the Ruhr since the late 1980s: the creation of an inspiring and concrete vision that is shared by most of actors, the development of institutional platforms for strategic thinking, special innovation projects acting as stepping stones for the transition process, and the operation of special transition institutions largely outside of government (Scheleppmann 2013). Two of the Ruhr's most interesting projects—the Emscher River IBA effort and the InnovationCity Ruhr at Bottrop—have relied on the establishment of positive visions with clearly-defined outcomes. They have rallied wide participation around popular visions of change, acting as frameworks for local people to develop and propose new projects. Managing entities have helped guide the bottom-up efforts (rather than impose projects on localities), and played a key role mobilizing the needed outside funds from many sources (Scheleppmann 2013).

Perhaps one of the many new and innovative project proposals that typifies the motto “change as opportunity” is a plan to utilize abandoned coal mines as pumped-storage hydroelectric power stations with underground reserves (providing storage for a more renewable-energy-based grid and geothermal power for district heating) (Scheleppmann 2013). The plan was developed by researchers at two of the relatively new universities in the Ruhr, founded at the beginning of the economic restructuring.

4. SUGGESTED TOPICS OF INTEREST FOR CHINA'S INDUSTRIAL RESTRUCTURING

Overview of differences and similarities

The industrial restructuring pressure and impact facing China since 2013 are both similar to and different from the restructuring pressure, impacts and emerging renewal that the Ruhr has faced. Core drivers are similar: a softening in core industrial product demand—bringing surplus capacity, production slowdown, and increasing plant closures—and an increasing imperative to deal with environmental pollution from industry. However, the nature of the industrial restructuring, regional and industrial sector size and scale, and the prevailing role of government and institutional framework for development are different:

- In China, industrial restructuring has a different setting and color. The market and regulatory forces driving restructuring are strong, and the impact on some regions or localities is likely to be dramatic. For example, due to surplus capacity and air pollution concerns, the central Government has mandated that the Province of Hebei, with a population of almost 75 million, to reduce steel production capacity by 60 million tons from its 2013 level of about 190 million. Industrial restructuring in China over the next decade will be about dealing with a much slower growth in production, compared to the double-digit growth of the past, with perhaps a modest decline in production in certain subsectors. The issue is not a prospective radical collapse in Chinese coal, steel, building material and heavy chemical industries—all of which are the world's largest. The issue is how to find new sources of growth, especially in the service sector, to sustain further growth in per capita



income, which still remains low relative to that in developed countries. The issue is also how to deal with the impacts of local downturns, which are likely to be more dramatic than the broader, macro trends. Finally, a key issue facing China is how to proceed with industrial restructuring in such a way as to bring maximum environmental benefit, to stem the tide of the country's worsening environmental pollution.

- China's size and industrial scale are both far larger than Germany's as a whole (not to mention the Ruhr). Industrial restructuring issues and impact will vary dramatically between localities in China. Some regions will witness continuing robust growth in basic industries even if most do not. Dealing with inter-regional impacts and opportunities is a big part of the overall restructuring issue.
- The strong vertical hierarchy of China's government (comprised of central, provincial, prefectural, and county levels) and the role of the government in China's economy are different from that in Germany. The institutional frameworks for developing local restructuring strategies and projects that are so important in both countries need to cater to different institutional environments.

Despite such differences, there also are many key similarities between the industrial restructuring that many Chinese localities are now facing and the restructuring that has taken place in the Ruhr:

- China faces a long-term restructuring trend. As occurred in the Ruhr, some localities may deny the change, continuing to hope for the return of days past. But the macro factors forcing change are clear. As in the Ruhr, a central issue for Chinese localities is dealing with the impact of economic restructuring on labor—how to deploy workers used to a mono-structural industrial economy (e.g. workers who have worked for many years at the key plant in town which now must shed jobs), how to ensure suitable social safety nets for those facing hardship, and how to create new jobs.
- Chinese localities seek to develop higher value-added manufacturing and service businesses as a new source of economic growth and employment opportunity. When faced with heavy industry plant downsizing, localities are often advised to develop new service businesses. Often, too, the response of local representatives is “How?” In many cases the economic base for such development is weak. The Ruhr has wrestled with similar hopes and challenges for many years, with some successful results, even if there also have been disappointments.
- China faces serious air, water and land environmental pollution problems, with industrial pollution a leading cause. The Ruhr also faced such severe environmental problems (although air pollution problems were confronted and basically resolved many years ago). The Ruhr's experience in dealing with toxic pollution of land (for example, from coking plants) may be of special interest to China, where awareness of the extent of this problem and needs to address it is just beginning. The Ruhr's approach of viewing environmental problems as an opportunity for the development of new businesses is also of certain interest to concerned Chinese.
- China faces the need to responsibly redevelop degraded urban land discarded by industry, similar to the needs experienced in the Ruhr, where cities and towns were built up around core mines and industries. In China, industry has typically been built in suburban areas around cities, but many of the older industrial areas have now been overtaken by city expansion, and are hence also in core urban areas. Chinese groups involved in urban



redevelopment of industrial sites have much to learn from the Ruhr's experience in dealing with key legal, financial, and planning issues, as well as the strengths of efforts in the Ruhr in fostering local participation and the use of redevelopment to create new local spirit, pride and jobs.

- Although localities facing restructuring issues typically are short of funding in both countries, public funds can be mobilized from higher levels of government in both cases. The Ruhr has benefited from public funds allocated by or mobilized from the state government, the federal government and the EU. In China, the central government, many provincial governments and international development institutions are also willing to devote substantial funds to assist localities. A key issue in China, often asked by policymakers, is how to gain the most benefit from allocation of such funds. The Ruhr has a mix of experiences. Of special interest are the ways in which programs in the Ruhr have used a bottom-up approach for developing projects and activities on the ground, but with planning guidance and assistance in packaging projects to mobilize funds.

Ideas on further exchange between Chinese and German experts

People in the Ruhr are likely to be the first to say that they do not have all the answers to the many difficult questions involved in economic restructuring. There remains much to do in this region, with continuing challenges. However, people in the Ruhr in fact have much rich experience from the last five decades, and lessons that Chinese and others could greatly benefit from.

Many Chinese groups have visited the Ruhr in recent years to try to understand the region's experience in industrial restructuring. However, for reasons including insufficient time, language and cultural barriers, and insufficient focus, it appears that most groups have not been able to gain a full enough understanding of specific programs, activities and institutional operations in the Ruhr to be able to distill lessons and experience for practical application back home. First, a general understanding of the history, policies and general results of the Ruhr experience is important for context. It is hoped that this overview may provide some help in that regard. In addition, however, it is highly recommended to pursue more in-depth exchange of knowledge, experience and lessons learned between Chinese and Germany experts, focusing on specific topics particularly relevant for China. One or two senior Chinese researchers, with language assistance, could visit the Ruhr for several weeks for in-depth and focused research and exchange on one of many useful specific topics. Below is a preliminary list of several specific topics for possible consideration, in addition to a possible further in-depth exchange on overall policy development:

- A. Survival strategies of the steel companies
- B. Mechanisms for redevelopment of degraded industrial land
- C. Developing high-tech and innovation centers
- D. Developing third-party institutions that operate between regional government and enterprises/individual actors
- E. Dealing with coal production decline and coal mine legacies

A. Survival strategies of the steel companies

German steel companies based in the Ruhr responded to competitive pressure in basic carbon steel production, and the resulting declines in capacity utilization, in a number of ways.



One strategy has been to further improve scale economies and adopt the most efficient technology possible to help reduce costs. For example, Thyssen-Krupp has made substantial investments in its plant at Duisburg—the largest continuing integrated steel works in the Ruhr—including completion of construction of a new blast furnace in 2007, which was then the largest in the world. Investments in pollution control measures accounted for about a third of the new blast furnace investment. Additional modernization investments at the Duisburg plant have included upgrades to hot strip mills, converters at the oxygen steelmaking plant, and the development of an environmentally-friendly, state-of-the-art coke oven (Kessler interview 2014, www.thyssenkrupp-steel-europe.com).

Another strategy of many of the core Ruhr steel companies was to shift investment in steel production to facilities in other regions and countries. In addition, most companies have also diversified their overall business into a variety of other, non-steel business lines, although these new business lines might be somewhat related (e.g. in machine building). Some companies have left the steel business entirely, in favor of other business. For example, Mannesman, through a subsidiary, became an industrial machinery producer but also entered the telecommunications equipment production business and others (Cooke, in Cooke 1995).

A final core strategy is to focus primarily on specialized, high-value products, including custom products demanded by related downstream industries with which the steel companies may form a long-term business collaboration. For example, Thyssen-Krupp's Duisburg plant now focuses entirely on the production of premium flat steel. The company works closely with national and international customers, especially in the automobile industry. The Duisburg plant is able to complete warm pressing of automobile plant products according to customer specifications (Kessler 2014).

It is worthwhile to note that strategies to continue production at existing plants, and involving plant upgrading and adjustment in the product mix, have been accompanied by major improvements in labor productivity, and hence substantial reductions in worker employment, even as production continues.

These approaches are familiar to most major Chinese steel producers as well. Should a small group of Chinese steel producers be interested in exchanging views with German companies operating in the Ruhr, such as Thyssen-Krupp, an exchange event could probably be arranged to discuss experiences and potential areas of commercial collaboration. Before undertaking such an exchange, however, it is recommended that the Chinese group completes or compiles a more detailed review of the German steel industry experience (and not only in the Ruhr), and consider what specific areas may be of greatest interest for discussion and potential commercial business.

B. Mechanisms for the sustainable redevelopment of degraded industrial land

As older, inefficient industrial plants are closed, the abandoned industrial sites remain an eyesore, a waste of land, a safety hazard and a continuing source of environmental and health hazards. The environmental and health hazards posed by abandoned steel and chemical plants, as well as mines, are often very serious unless systematically dealt with, representing a continuing source of groundwater pollution by toxic oils, heavy metals and other toxic substances, and a long-term source of health issues for nearby inhabitants.

Especially where such “brownfield” sites are located in urban areas, there is potential to redevelop the land for other high-value property use, such as commercial or residential building complexes. In China, such redevelopment can be quite profitable, especially when population densities in the



redevelopments are high. However, it is essential that the environmental legacies of the abandoned heavy industry are dealt with before redevelopment. Simple site clearance followed by building construction is a recipe for serious, long-term environmental and local health problems that will be outrageously expensive to try to solve later.

The key is to ensure that legal and regulatory oversight of the land transfer and redevelopment process guarantees that responsibilities for environmental clean-up are clear and are met, and that profits generated by land redevelopment are in effect used to cover much of the clean-up cost.

For China, the need to build mechanisms to better ensure environmentally acceptable redevelopment of polluted brownfield industrial sites is now very urgent. The extent of the current problem and potential for long-term environmental and health effects are only now beginning to be better understood. More importantly, China is now entering an industrial restructuring phase that will involve the abandonment of many more steel plants, chemical plants and mine sites over the next decade than ever before. Furthermore, the sites to be abandoned will tend to be the most backward and most polluted. Cities need to come to grips with the environmental legacy and potential redevelopment issues for the growing number of sites in a systematic and effective way. Cities are naturally very concerned about potential clean-up costs. Mechanisms are needed to assess the problems objectively and scientifically, clarify responsibilities, set priorities, and identify financing solutions (including through redevelopment revenue).

There is rich experience in the Ruhr on the sustainable redevelopment of polluted former industrial sites. This includes experience in the technical assessment of environmental issues, identifying technical solutions, and trying to balance the costs and benefits of solutions. In addition, and perhaps of special interest to Chinese authorities and experts, are the institutional, legal and financial mechanisms for the transfer of ownership and responsibilities, the clean-up and the land redevelopment. Some of the issues confronted include:

- Clarification of legal responsibilities of original land-owners for environmental legacies, and how (and at what costs) original owners are absolved of these responsibilities through the ownership transfer process;
- Institutional arrangement for the process of land ownership transfer and clean-up, including the role of the original company, local government, third parties and redevelopment entities;
- Financial arrangements for land purchase, land clean-up, and (partial) reimbursement of these costs from the eventual development. Financial engineering may be required as part of the overall process;
- Maximizing local participation in redevelopment solutions to engender enthusiasm and innovation for aligning redevelopment solutions with the aspirations of local inhabitants for urban renewal. Local participation also helps fosters transparency in decisions of long-term consequence.

One specific approach used in the Ruhr that is worthy of review is the Ruhr Property Development Fund, which operated on a broad scale in the Ruhr beginning in 1980, but eventually closed. The Fund was administered by the LEG, the Development Agency of NRW State. The Fund acquired 150 sites during 1980-1997, and oversaw the clean-up process and transition to redevelopment. A significant proportion of the purchased and cleaned-up sites were resold for new industrial purposes. Others were reclaimed



for urban function as green spaces or recreation zones, and a few became residential developments. The fund was subsidized with public funds, especially as the previous large core coal and steel companies demanded high prices for land. However, the details of its operations and the many lessons learned merit study (Noll interview 2014, Maggi 2000).

Other cases worthy of review were led by municipal governments. In the city of Bottrop, for example, one of the abandoned coal mines located in the city center was cleaned up by the coal company, under the supervision of the municipal government, and with some public financial support. The land was then transferred to the municipal government at no charge, with the condition that the municipal government absolves the coal company of any further responsibilities. The land has subsequently been developed into urban residences. Another example of a different model in Bottrop involved the redevelopment of land previously occupied by a coking plant into a golf course. In this case, the municipal government now owns and operates the site above ground. However, below ground remains under the ownership of the coal company, which is responsible for handling the pollution legacy, and must continue to filter the underground water (for benzene and other toxic substances).

A further initial understanding of the Ruhr's experience in this area might best be gained if 1-2 Chinese researchers visited the Ruhr for about two weeks to learn about the various different mechanisms used there over the last 35 years, complete an analysis of aspects relevant for China, and prepare recommendations for the consideration of local governments in China.

C. Developing high-tech and innovation centers

The development of high-technology and technology innovation centers is a common approach to try to foster high value-added service industry development. In China, most cities have been promoting such centers, with municipal governments typically allocating land, aiding in infrastructure development and providing certain subsidies. Development of high-tech and innovation centers in the Ruhr began in the 1980s. While the center in Dortmund is considered a success by most people, other centers have seen a mixture of some successes but also disappointments (Rehfield interview 2014). The experience of the municipalities in the Ruhr may be instructive to Chinese cities.

One of the lessons from the Ruhr is that new high-tech and innovation centers need some type of comparative advantage compared with other centers (such as a first-mover advantage into a new area) and linkages into areas of existing expertise. Such centers cannot usually operate well in isolation, without many vibrant businesses, human and knowledge linkages with other institutions of innovation, and engaged outside companies. In some cases, it was not realistic to try to develop an isolated high-tech center in towns where coal mines and steel mills had dominated economic activity and, if some success was generated, the center's employees largely came from outside and hence the center brought little relief to the town's unemployment issues. One expert on development in the Ruhr notes that "it was finally realized that modern high-tech technologies per se, without a base in the industrial past, simply were a 'bridge too far' for the region" (Hospers 2004). The successful case at Dortmund had key linkages with the broader university and research community, and its new businesses included those with linkages to areas of expertise developed under the traditional heavy industry economy, as well as a first-mover advantage.

Chinese professionals and municipal authorities interested in learning from experience abroad in the development of high-tech and innovation centers may wish to consider a review of experience in the



Ruhr. It provides examples of efforts to foster such centers in a region not previously known for high technology development, but hoping to diversify its economy.

D. Developing third-party institutions that operate between regional government and enterprises/individual actors

Bottom-up project development approaches are an important part of the Ruhr's economic transition and adjustment story. Success in tapping into the creativity, innovation and aspirations of local groups has been, and continues to be, a key ingredient for success.

The development and operation of specific, regionally-focused third-party institutions has made the bottom-up project development approaches possible. Another key factor that also helps make the institutions effective is vibrant and open exchange of information, often aided by the internet.

Examples of third-party institutions that operate in the Ruhr in the space between regional (state) government and municipalities, local groups, companies and individuals include the RVR, the Emscher Park GmbH (now closed), the InitiativKreis Ruhr, the NRW cluster organizations (and their management teams), and the Innovation City Management GmbH in Bottrop. There are others as well.

These institutions all operate with autonomy from the government. However, some institutions have a government background (such as the Emscher Park GmbH which is owned by the state government), while others are totally autonomous (such as the InitiativKreis Ruhr). Some institutions have been permanent fixtures of the institutional structure operating in the Ruhr, while others were explicitly established as temporary institutions, operating to achieve a specific, dated goal. All of the institutions listed above are involved in assisting localities and local groups to develop projects within defined topics, and all of them must help mobilize financing from other sources and strategic partners.

It would be very worthwhile for Chinese parties to review and consider how these types of institutions were formed and how they operate, in order to gain good ideas on how such third-party institutions at provincial levels (and especially lower levels) could be formed or strengthened, and then used to help inject local creativity, spirit and relevance into the economic transition project development and implementation process. Such institutions could prove to be good mechanisms for identifying good project concepts for funding from both government and possibly corporate sources.

A recommended approach to complete such a review would be to send several Chinese experts to the Ruhr for a study visit of about two weeks. The experts should visit at least most of the above institutions operating in the Ruhr, and probably a few other recommended by counterparts in the Ruhr. Background literature needs to be reviewed, followed by completion of interviews with the different institutional groups as well as local experts with institutional memory, completion of an analytical report, and preparation of recommendations that can be followed up on by provincial and/or prefectural authorities. Several suggested specific topics for review and analysis include:

- *Institutional formation and structure.* How was the institution created, and who are its key owners and stakeholders? What is the management history and what is the staffing arrangement? What are the operational budgets and how are they financed?
- *Institutional operational goals.* What are the defined goals and purposes for the institution? How, and by whom, is its work evaluated? What constitutes success for the institution?
- *Project development.* What types of projects does the institution promote? How, specifically, does the institute work with project-proposing groups, and what type of



guidance or project criteria are provided? How does the institution balance desires for competition, consensus and creativity/innovation?

- *Project funding.* What financing sources does the institution mobilize for the projects identified? What are the specific roles of the institution in project packaging and solicitation of funds? What are the results achieved in actual project implementation and what recommendations may the institutional management have for others?

E. Dealing with declines in coal mining and coal mine legacies

Legacy issues associated with coal mining—including environmental pollution that continues after mining is suspended, dealing with mine waste, and training and social protection for mine workers facing unemployment due to mine closure—are already major issues in many parts of China. However, these legacy issues are likely to become even more severe in the future, as more mines are abandoned and the industry faces stagnant and then negative growth. It is critical for both the central government and coal-producing regions to consider how these problems can best be mitigated over the longer term and to plan ahead.

The Ruhr Valley region has more than 50 years of experience of wrestling with land use, environmental pollution legacy and labor issues associated with underground coal mining decline. Relevant Chinese authorities and experts could benefit greatly from the lessons learned in dealing with coal mining legacies. In the author's opinion, two areas of particular interest would be:

- a. Review and understanding of the micro-level problems and implemented solutions at municipal levels; and
- b. The foundation and operation of the RAR-Stiftung as one model for how long-term legacy management may be financed once revenues from local coal mining have seriously declined or halted altogether.

The State of NRW and the Province of Shanxi have an ongoing formal exchange relationship. Dealing with coal-mining legacies could be considered in this exchange relationship. In addition, it would be useful if central government authorities and experts were also involved in a potential exchange of experience, considering how the mining legacy issue is both long-term and national.

5. CONCLUSIONS ON LESSONS FOR CHINA FROM THE RUHR VALLEY'S EXPERIENCE

The Ruhr Valley experience provides a good example of how a region can successfully undertake a transition from a coal and steel heavy industry mono-structural economy to a more diversified economy led by the service sector. But the Ruhr Valley experience also shows the many difficulties involved in such a transition. Challenges also remain in the Ruhr, and few feel that the transition is complete. Much effort continues to promote new sustainable development initiatives and to create more jobs for local inhabitants.

One lesson from early experience is that it is little more than a waste of time to ignore the broad, macroeconomic forces driving structural change, to hope that 'the old days will return', or to wait for big companies or outsiders to stem the increasing decline of the former core economy. Perhaps the most insightful part of the Ruhr's redevelopment story, then, is how the region moved to success through strategies of "revitalization from within"—one of the slogans of the Emscher River-IBA program—and grasping "change as an opportunity", as exemplified by the development of a new environmental



management service industry initially launched by efforts to solve the environmental problems of the older core industries. A critical part of these successful efforts has been a bottom-up approach to project development, building on the ideas and aspirations of local people, but with overall guidance and coordination from regional organizations. The local participation involved in the bottom-up approach has been important for building local spirit, development enthusiasm and pride as well as practical skills. The region's many third-party organizations have played an essential role in the effort, and the focus and operation of these organizations may be one of the most interesting facets of the Ruhr's experience to outsiders.

There is a wealth of experience and knowledge in the Ruhr on how to deal with the environmental legacies remaining from old mining and industrial sites. As more backward mines and industries are closed in China, Chinese authorities and experts can learn much from the Ruhr Valley's decades of experience on the technical, legal, institutional and financing issues involved. The Ruhr also has a long history of first confronting severe air pollution, and then tackling particularly difficult water pollution and toxic solid waste issues stemming from heavy industry.

Rather than conduct relatively broad and short visits to the Ruhr, it is recommended that Chinese groups focus on specific topics in the Ruhr's five-decade-long experience that may be of greatest relevance for issues now faced in China. Sufficient time and focus is needed to understand and analyze both history and details. Five potential topics are listed above for initial consideration. In the process, a number of specific local program cases can also be reviewed, such as the InnovationCity Ruhr, Dortmund Technology Park, or several of the livelier cluster organizations, to name just a few. Perhaps, through such specific study and exchange, some of the rich experience and lessons of the Ruhr region can benefit China as Chinese localities move to address similar restructuring and environmental issues.



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