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The long and winding road from black to green

Decades of structural change in the Ruhr region

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The Ruhr region in Western Germany used to be one of the most important industrial regions in Europe. Centre of coal mining and steel works, it was the major supplier of the German war machine in the twentieth century's two world wars. One of the aims of setting up the predecessor of the European Union, the European Coal and Steel Community (ECSC) in 1951, was to make another European war "not only unthinkable but materially impossible", as Robert Schuman, the French foreign minister, said in his famous Declaration on 9 May 1950. The Treaty of Paris the following year created a common market for coal and steel among the six Member States, aimed at removing the need for competition between European nations over natural resources, especially in the Ruhr region.

Since that time, the Ruhr's iconic industrial landscape has seen major deindustrialization and economic diversification; while it has kept its industrial backbone, the region's main strength now lies in a knowledge-based service economy.

In this article, we refer to the decades-long transformation of the Ruhr region as an exemplary case of managing the change from traditional industry-based, resource- and material-intensive economic activity towards a knowledge-based, resource-efficient economy. The geographical characteristics of the region are briefly described in box 1.

In the twenty-first century, Europe (like the rest of the world) faces the major challenge of turning an economy that is still energy-, material- and resource-intensive into a sustainable, green and low-carbon one. This process requires a fully fledged restructuring of the entire economy. The main question this necessary restructuring poses to trade unions is how to manage it in a socially balanced way whereby the inevitable burdens and costs are fairly shared by all major actors. A "just transition" is one of the key demands of trade unions and has also been taken up by the United Nations Framework Convention on Climate Change (UNFCCC).[1] The Ruhr experience delivers several lessons in bringing about a just transition: the economic diversification of the once mining-dependent region was actively managed by the federal and regional governments, and restructuring processes were embedded in an industrial relations culture in which workers' participation plays a major role. *Montanmitbestimmung* (Peters, 1979), a stronger version of the German co-determination practices, was based in the mining and steel industry. The case of the Ruhr is instructive not only because of its outcome, but also through the ways it was achieved: industrial and regional development policies and the roles played by the major actors.

The first section of this article describes the challenge of transformation towards a low-carbon and resource-efficient economy, a challenge that many European regions face today and that will increase in the next decades.

1. The UNFCCC is based on annual intergovernmental conferences of the parties (COP).

Box 1. Main characteristics of the Ruhr region

The Ruhr region is the largest urban agglomeration in Germany, with a population of some 8.5 million (2010). It consists of several large industrial cities bordered by the river Ruhr to the south, the Rhine to the west, and the Lippe to the north. In the southwest it borders the Bergisches Land. The Ruhr region is part of the larger Rhine-Ruhr metropolitan area of more than 12 million people. The region includes the cities of Duisburg, Oberhausen, Bottrop, Mühlheim an der Ruhr, Essen, Gelsenkirchen, Bochum, Herne, Hagen, Dortmund and Hamm, as well as parts of the more rural districts of Wesel, Recklingshausen and Unna. The most populous cities are Dortmund (approx. 572,000), Essen (approx. 566,000) and Duisburg (approx. 486,000). The Ruhr area does not have an administrative centre; each city in the area has its own administration, although there exists the supra-communal *Regionalverband Ruhr* institution with its centre in Essen. Historically, the western Ruhr towns such as Duisburg and Essen belonged to the historic region of Rhineland, whereas the eastern part of the Ruhr, including Gelsenkirchen, Bochum, Dortmund and Hamm, was part of the region of Westphalia. Since the nineteenth century, these districts have grown together into a large complex with a vast industrial landscape, inhabited by some 7.3 million people including Düsseldorf and Wuppertal. This agglomeration is the third largest urban area in the European Union after London and Paris.

Source: Regionalverband Ruhr (RVR).

Section two provides an overview of the long process of structural change in the Ruhr region, including its economic and employment structure. Section three focuses on the policies of the public institutions at various levels, while section four looks at how a just transition works in practice. The fifth section discusses the role of the main actors, with special emphasis on trade unions and co-determination. Finally, we draw conclusions on how these practices in the Ruhr region in managing a broad restructuring process can provide useful lessons for other European regions facing similar challenges.

The challenge of the green transformation

Combating the irreversible process of climate change is clearly a major long-term challenge of our century. Although the revision of the growth model in the wake of the deepest crisis since the Second World War focuses narrowly on financial and economic sustainability, the pre-crisis growth model that was based on an abundance of liquidity and material and environmental resources cannot be restored. Any lasting recovery of the real economy will necessarily take the shape of a more resource-efficient production model. This is a declared objective of long-term political strategies such as Europe 2020, while featuring also in the broader, global-level context in the UNFCCC round of negotiations. Although hard-core policy tools to underpin these targets are still lacking, the process is thus irreversibly under way. Key

issues, however, include how the objective of a resource-efficient low-carbon economy will be reached and how the transition is being managed.

Is the scenario compatible with keeping a strong industrial base in Europe? While we argue that only a more ambitious and comprehensive European climate policy framework would have a chance to deliver the 2050 climate targets, this does not mean that Europe needs to give up its industrial base and its related competences. In order to manage this, a targeted industrial policy is needed.

The future restructuring process will be unique in the sense that it will be directly induced and shaped by explicit policy targets to mitigate climate change, implemented by means of a policy mix. This is genuinely different from restructuring processes that were driven by market forces (e.g. globalization) and where the role of policy-making was more indirect, in the form of liberalization and deregulation practices without explicit policy targets, and only later involved attempts to shape policy in terms of industrial and regional policy interventions and subsequently address their impact through labour market and welfare policies. The green transformation climate policy targets and accompanying policy framework are at the centre of launching a long-term and comprehensive restructuring process. The green transformation takes place and proceeds by design. Anticipation of change – already crucial in market-driven restructuring – can now be more straightforward and explicit through policy-triggered restructuring. Responses to its challenges can be planned and integrated into the policy framework from the outset. Above all, this would include the design of targeted labour market policies to ease necessary transitions, together with matching education and training measures. The most urgent step would be a proper assessment of the effects that actual, planned climate-mitigation policy measures would have on employment. How to manage this process in a socially sustainable way, what role trade unions would have and what strategies they should follow are all vitally important questions.

As is always the case with major restructuring processes, managing transformation through appropriate policy instruments with the involvement of the social partners will be a decisive factor in its final success. How the costs of the transition will be distributed among the various actors and within society is a crucial question. Trade unions have a key role in managing a successful green transformation, but also face huge challenges and contradictions between short-term and long-term opportunities.

A decoupling of energy and resource use from economic growth can theoretically be made in two main ways: through a broad restructuring of a national or regional economy where energy- and resource-intensive activities are downscaled or abandoned and other activities for value generation are developed (e.g. services, finance, etc.). Luxembourg and the United Kingdom are examples of this in Europe, as demonstrated by their high resource efficiency and their economic structure. What works however for national economies would not work at the level of the 500 million-strong

population of the EU27. Deindustrialization is not the way for Europe as a whole to meet climate targets, and not just because the magnitude of that restructuring would have a high price in terms of employment and human resources. Industry is a major component of Europe's competitiveness, and without industrial competences neither business-related services nor an eco-industry can function. If industrial goods were imported from other parts of the world where lower climate standards apply, global emissions and resource use would not benefit either.

The only way ahead is through eco-innovation and higher resource and energy efficiency of an industrial base that is maintained and continuously upgraded in Europe. In this regard, industrial policy is a key element of a climate policy framework.

From post-war reconstruction to deindustrialization: A broad overview of restructuring processes in the Ruhr Valley

Post-war reconstruction of the Ruhr Valley industrial infrastructure in mining and steel had just been completed by the end of the 1950s, when the first coal mines were closed down. Although most analysts – such as the Rheinisch Westfälisches Institut für Wirtschaftsforschung (RWI, 2006) – put the date of the first coal crisis at 1960, this was not perceived by the policy-makers and main actors of that time. The 1960s were still dominated by the myth of unlimited growth, and "guest workers" were being massively hired. It was only in 1968 that the government of North Rhine-Westphalia first addressed the issue and launched a policy package to support structural change.

Even if deindustrialization is a process that European and national policies at present justifiably try to avoid and even reverse (EC, 2014), this is what happened in the Ruhr region from the late 1950s. Reindustrialization – as we will show – followed several decades later and proceeded in several waves.

It should be noted that the downscaling of the coal and steel industries between the 1960s and 1990s did not take place due to policy choice and environmental concerns, but as a result of market forces. More and more coal mines had become exploited and in order to maintain extraction volumes one had to go deeper and deeper underground. At the same time, trade liberalization was opening the way to large-scale imports of cheap coal from elsewhere in Europe and the rest of the world.

Between 1960 and 2001, the number of mining industry workers was reduced to 10 per cent (39,000) of the 1960 level (390,000), while output fell to almost one-sixth, from 115.4 million tonnes in 1960 to 20 million tonnes in 2001. By the early 2000s, the share of miners in the total employment of the Ruhr region was only about 2.5 per cent of the workforce – approximately equivalent to employment in car repairs.

In the iron and steel industry, employment in the same period fell to one-fifth (52,600) of the 1960 level, while output in 2001 was 80 per cent of that achieved in 1960, including an interim peak of 140 per cent in 1973. The main employment trends spanning almost 80 years are shown in table 1. These data also indicate a substantial increase of labour productivity in both sectors over the same period.

The downscaling process of mining in the Ruhr region is a much older phenomenon, however: in 1922, mining employment was 545,000, as table 1 indicates. This degradation had been partially absorbed by the expanding iron and steel industries in the 1960s and 1970s, and then later by the electrical (plants such as Grundig, Nokia, Blaupunkt), chemical (Evonik) and automobile sectors (Opel).

For comparison, table 2 shows the development of employment in coal mining for the entire Federal Republic of Germany. Although coal mining was concentrated to a large extent (at approximately 80 per cent in terms of employment) in the Ruhr region, the trend was the same at the national level. Employment in coal mining shrank from 607,300 in 1957 to 14,500 by the end of 2013.

In 2007, the Federal Government and the state governments of North Rhine-Westphalia and Saarland agreed to phase out the annual coal subsidies

Table 1. Number of employees in mining and steel in the Ruhr region, 1922–2001 (in thousands)

	1922	1957	1960	1980	1994	2001
Mining	545.0	473.6	390.0	140.0	77.6	39.0
Steel	84.0	333.8	263.0	184.0	89.5	52.6

Source: RVR Databank.

Table 2. Number of employees in coal mining in Germany, 1957–2013 (in thousands)

1957	1965	1970	1980	1990	1995	2000	2005	2010	2012	2013
607.3	377.0	252.7	186.8	130.3	92.6	56.1	38.5	24.2	17.6	14.5

Source: German Coal Association, 2014.

Table 3. Mines in operation in the Ruhr Valley: Scheduled closures and employment, 2008–14

Mine	Location	Closure	No. of employees
West	Kamp-Lintfort	31 December 2012	3460
Walsum	Duisburg	1 July 2008	1936
Prosper Haniel	Bottrop	Phase-out until 2018	4265
Lippe	Herten	1 January 2009	1998
Auguste Victoria	Marl	Phase-out until 2018	3791
Ost	Hamm	30 September 2010	2452
DSK Anthrazit	Ibbenbüren	Phase-out until 2018	2466
Total as at June 2008			**20368**
Total as at January 2014			**11448**

Sources: Weingarten, 2010; German Coal Association, 2014.

of €3.5 billion by 2018 and close the remaining eight mines (seven in the Ruhr Valley and one in Saarland) by that time. Table 3 shows the stages of the coal phase-out by mine and follows the development of employment. In 2008 in the Ruhr area, 20,368 persons were employed in the seven mines still in operation. By January 2014, two mines were still in operation, with a total of 11,448 persons employed.

Table 4 compares the development of employment of the Ruhr with the average in West Germany and shows structural and dynamic deficits in the region (Helmstädter, Lehner and Nordhause Janz, 2000). Employment in the primary sector, dominated by mining, was radically reduced in the 40 years up to 2000 and had been halved by 2010. The Ruhr was also on a downward trend in its share of manufacturing over the period, although from an extremely high level in the early 1960s (over 60 per cent). By 2000, the share of manufacturing in the Ruhr area had fallen to around 33 per cent, which

Table 4. Employment structure in the Ruhr Valley and the Federal Republic of Germany (FRG), 1961–2000 (percentages)

Sector	Primary (agriculture, mining)		Secondary (industry)		Tertiary (services)		Unemployment rate (%)	
Year	Ruhr	FRG	Ruhr	FRG	Ruhr	FRG	Ruhr	FRG
1961	13.6	2.4	61.3	46.6	36.3	36.8	n.a.	0.5
1970	9.1	1.5	58.4	49.4	40.0	41.5	0.6	0.5
1980	5.3	1.4	51.7	45.3	47.0	49.4	5.3	3.5
1990	3.6	1.2	44.4	40.6	54.4	55.8	10.8	6.6
2000	2.5	1.2	33.3	33.5	65.4	64.0	12.2	8.1

Source: RVR Databank, 2014.

Table 5. Main stages of structural change in the Ruhr, 1840–2000

Period	Phase	Characteristics
Up to 1840	Pre-industrialization	• Small coal mines, iron and textile factories • Agricultural areas with low population density
1840–1914	Industrialization	• Large-scale coal mining and development of coal chemistry
1894–1914	Industrial peak with highest growth rates	• Mass production of iron and steel • Foundation of large enterprises • Strong immigration
1914–1945	First signs of the crisis	• First and Second World Wars, economic depression, dismantling of product lines after the Second World War • End of product cycle in coal mining
1945–1957	Rapid growth	• Temporary demand pull due to post-war reconstruction and the effects of the Cold War
1957–1990s	Restructuring and transition with lock-in	• Crisis in coal mining and closure of pits: international competition and location disadvantages due to changed technology • Absorption of workers into other sectors (1960s) • Steel crisis in 1974 with overall decline of the region • Still locked into steel- and coal-based industries until the mid-1980s
From the 1990s on	Diversification, reindustrialization	• New frontiers in knowledge-based economy, renewable energy, eco-industry • Industrial heritage

Sources: Bross and Walter, 2000; Hospers, 2004.

was average for Western Germany but still high compared to other European countries. Although this trend can be called deindustrialization, it would be more appropriate to call it putting an end to over-industrialization.

There were also trends in structural change, with significant differences within the Ruhr region. While the share of employment in mining and steel fell below 5 per cent in Oberhausen, at the steel stronghold Duisburg as well as in Gelsenkirchen, Hagen and Hamm, the share of the sector remained above 15 per cent. The services sector, on the other hand, dominated in the centres of Essen and Dortmund (each about 78 per cent, comparable to Cologne and Düsseldorf). The main periods of structural change in the Ruhr over the long term (1840–2000) are presented in table 5.

Policy responses and outcomes

Hartmann (2008) argues that while the most visible external events affecting the coal and steel complex were the coal crisis in 1957 and the steel crisis in 1974, the decline of the region has to be understood as a process going back to the first half of the last century (see also Dege and Kerkemeyer, 1993).

While the coal and steel industries were already approaching the end of their lifecycles during the first half of the twentieth century, the structural problem remained hidden behind short-term changes in demand, and for a long period the regional ruling elite failed to acknowledge the need for a dramatic reorientation of the Ruhr economy (Bross and Walter, 2000). Active change by means of diversification in the industrial structure was pursued only relatively late, and the initial steps started in the 1970s did not prove to be sustainable in the long run (Butzin, 1993).

Muddling through and lock-in

Up to the early 2000s, the phases of the process of structural change can be split into two periods. Hospers (2004) calls the period from 1960 to the mid-1980s the period of "reindustrialization and lock-in". "Reindustrialization" may sound promising, but what is meant by most authors was actually preservation of old structures around coal and steel.

- Until the 1970s, planning initiatives at the federal and state level all supported the existence of the traditional industries in the region. Initial attempts to attract extra-regional capital were made, but these did not have a sustained effect, partly due to internal blockades. The most future-oriented decisions were to foster the creation of universities in the Ruhr area.
- The period from the late 1970s to 1989 was marked by the consequences of the 1974 steel crisis. The Hoesch group nearly went bankrupt in 1981,

resulting in severe employment losses (from 24,000 jobs in 1957 to 13,000 in 1987), while closures of steel plants in Hattingen and Rheinhausen in 1986 and 1987 shook social stability in the region.

Hospers (2004) and Grabher (1993) identified this lock-in position along three dimensions: economic, institutional and cognitive. The Ruhr monostructure resulted in economic lock-in, also referred to as a "specialization trap", because most firms were directly linked with a few large companies that dominated the regional economy, paralysing entrepreneurship, innovation and flexibility. The institutional lock-in meant that a self-sustaining coalition of local businessmen, politicians and trade unions had one shared interest: the preservation of existing structures. The cognitive lock-in appeared as seeing the crisis to be cyclical instead of structural. From the point of view of outsiders, the cognitive lock-in meant that the region was seen as an unattractive, polluted industrial region not worth investing in.

Two examples demonstrate the cognitive and institutional lock-in. Gustav Krupp commented on the establishment of the Ruhr University: "What we need in the Ruhr are muscles, not brains." And large concerns often refused to sell their unused land which could have attracted outside investment projects (see box 2).

Box 2. Obstacles to structural change

Factors that impeded and delayed restructuring in the Ruhr:

- **Blocking of property development:** For fear of new competitors in the labour market, regional companies retained their large properties or sold them at excessive prices. New investors were thus kept away.
- **Blocking of educational opportunities:** Up to 1964, there was no university in an area with 5.4 million inhabitants. Since Bismarck's time in the nineteenth century, universities and university students have been regarded as sources of unrest, unwanted in Germany's economic heartlands. Not until the 1970s and 1980s were a series of universities founded, establishing a knowledge base urgently needed for the rebuilding of the region.
- **Lost ability of innovation:** The monostructure of the coal and steel industry required highly specialized suppliers. The quantities and qualities of materials, machines and services to be delivered were precisely planned. Consequently, as these suppliers were little inclined to improve and innovate, the ability to innovate could not be sufficiently developed in the small and medium-sized firms that otherwise could have become the engines of structural change.
- The problem of **the regional image:** Up to the turn of the millennium, the Ruhr was plagued by a persistent negative image concerning wages, housing conditions and leisure potential, so that both outside investment and an in-migration of highly qualified human capital remained rare exceptions.
- The **missing impulses for growth** increased competitive pressure on stagnating or shrinking local communities. The struggle for jobs, local taxes and inhabitants led to entrenched local egoism. Inter-communal or even regional forms of cooperation were only exceptions to the rule.

Source: Butzin, 2013.

It still bears mentioning that initiatives to diversify the economic structure of the region did take place in this period. The state government took initiatives to attract outside investment into industries such as electronics, automobile and chemicals.

A more aggressive approach to structural change followed from the mid-1980s. Structural policies in the Ruhr area took on a more dynamic and future-oriented character, referred to in the literature as "neo-industrialization". This can be interpreted as genuine reindustrialization, in contrast with previous reindustrialization attempts to restore and preserve already existing structures.

Interim diversification attempts

From the mid-1980s large enterprises started to diversify, although initially outside the region. A new industrial and technology policy started to emerge and the planning focus shifted towards regionalization. Active structural change in contrast to passive accommodation of declining industries was promoted, most notably by strengthening the role of SMEs and by promoting technology transfer and the diversification of industry. During this period, initial signs of economic recovery could be observed, mostly due to growth in the service sector. Not all initiatives were successful, as shown in box 3.

From 1990 until the middle of that decade, the Ruhr experienced a short boom and then a crisis in the wake of German unification. The steel industry went through a phase of consolidation, with strong rationalization and takeovers or mergers between the major players, such as the takeover of Hoesch by Krupp in 1993 and the merger between Krupp and Thyssen in 1997. The economic crisis of 1992–93 hit the North Rhine-Westphalian economy especially hard, with the loss of almost half a million jobs, partly due to the high dependence on exports of the steel and manufacturing sectors.

In the 1990s, the Federal Government pursued an active modernization policy and this was matched with bottom-up initiatives. The foundations of a new Ruhr had been laid down, and after 30 years of restructuring efforts (see box 4) the breakthrough finally came.

Towards a breakthrough in restructuring: "Aktionsprogramm Ruhr"

The change in orientation came first from the large coal and steel concerns themselves: they recognized that staying in their traditional business was a dead-end strategy and realized that industrial decline was not a cyclical but a structural trend. Firms such as RAG, Thyssen and Krupp diversified beyond coal and steel, and invested in related growth branches such as plant

Box 3. The case of Nokia Bochum

An interim reindustrialization and diversification strategy for the Ruhr region that proved unsustainable in the long run was to attract foreign investors into the electronics sector. In 1988, Nokia, then the largest mobile phone manufacturer in the world, established a production facility to assemble mobile phones in Bochum and received approximately €60 million in subsidies from North Rhine-Westphalia between 1995 and 1999. Between 1998 and 2007, the company received a further €28 million in research funds from the federal German Government.

In January 2008, Nokia announced the closing of its factory in Bochum, resulting in a total job loss of 4,300 in the Ruhr. In addition to the 2,300 workers employed directly by Nokia, another 1,000 temporary workers were affected, together with a further 1,000 working in firms supplying the Nokia factory and 200 employed by the German Post Office subsidiary DHL, responsible for the shipment of the finished mobile phones.

The North Rhine-Westphalia state government made a claim for Nokia to repay some €17 million in state aid received by the company in 1999, on the basis that it had guaranteed that at least 2,856 jobs would remain in Bochum until September 2006. Although the employment guarantee had expired in 2006, the dispute focused on the temporary workers. Nokia's 1,000 temporary workers were employed under particularly poor conditions. Although registered as employed full time, temporary workers were only given contracts for 110 or 60 hours a month. Instead of the already low €1,120 monthly salary, they received only €442. The IG Metall union and the works council spoke about a "disaster for Bochum", and tried to negotiate the best possible social plan for the workers. A social plan and a transitional company were set up, but a reversal of Nokia's decision was not possible.

Ultimately, low value added assembly work that was not embedded in the region could not provide a long-term perspective in a high-wage region like the Ruhr in a competitive global environment.

Box 4. Regional structural policy programmes in North Rhine-Westphalia, 1968–2000

Time period	Programme	Budget (DM billions)
1968–1973	Ruhr Development Programme	17.00
1970–1975	North Rhine-Westphalia Programme	31.00
1974–1984	Technology Programme Mining	0.60
1974–1984	Technology Programme Energy	1.60
1979–1989	Technology Programme Steel	0.50
1980–1984	Aktionsprogramm Ruhr	7.00
1987	Future Initiative for Steel and Coal Regions	1.07
1992–1995	Action Framework Coal Regions	1.00
1994–1997	Community Action for the Industry Location North Rhine-Westphalia	2.00

Source: Heinze et al., 1998.

engineering, environmental technology and control services. It is estimated that today these new activities make up about two-thirds of the turnover of the former coal and steel giants.

In parallel, the local authorities played an important part in bringing about a "break-out" from the Ruhr's lock-in situation. In 1984, the state of North Rhine-Westphalia changed its industrial policy into a technology policy and developed a programme aimed at "sunrise technologies" with a focus on environmental technology. It was decided to concentrate on innovation and to set up local technology transfer centres that provided advice and services to starters. Within a decade, the Ruhr boasted 29 such centres. Dortmund Technology Centre generated 3,700 jobs over ten years.

The most prominent example of genuine reindustrialization ("neo-industrialization") has been the diversification strategy into environmental technology. Competence in this field has its roots in the local coal and steel industry, which was constantly in search of innovative ways to keep pollution levels as low as possible. Due to the strict environmental rules and the high demand for clean technologies on the part of local firms, the Ruhr was able to accumulate much expertise in how to counter environmental damage and has grown into the centre of environmental technology research in Germany. The cluster has created new employment in the region as well: about 100,000 people were working in this branch by the mid-2000s. Local firms, universities and research institutes (e.g. the Soil Protection Centre and the Environmental and Packaging R&D Centre) were involved.

The Ruhr has developed a comparative advantage in energy supplies and waste disposal. Due to the massive amounts of energy resources needed and waste produced by the coal and steel plants, R&D in renewable resources, recycling and waste combustion was encouraged from a relatively early period.

The manner in which structural change was organized also differed from the past. To stimulate the region's endogenous potential, a bottom-up approach was chosen rather than a top-down strategy. The Emscher Park International Building Exhibition (IBA) initiative, which lasted from 1989 to 1999, was a focal point for this shift towards decentralizing responsibilities in matters of structural change in the Ruhr. This public–private project was aimed at the economic, ecological and social reconstruction of a densely populated area of 800 square kilometres near the river Emscher that had suffered considerably from industrial exploitation (see box 5).

Inspired by the experiences of the IBA, public and private actors in the Ruhr have launched several new projects on the way to "neo-industrializing the region". Representative examples of such projects are the cases of E-City Dortmund and Solar City Gelsenkirchen. The E-City Dortmund project was set up in 2000 as an answer to the decision of Thyssen-Krupp to close the local steelworks.

The Zollverein industrial complex, also initiated within the framework of the Aktionsprogramm Ruhr, was formerly the largest and most modern

Box 5. The Emscher Park (IBA) initiative

Core functions

- renovation of the Emscher Landscape Park
- ecological improvement of the Emscher River
- new utilization of industrial buildings
- development of new working locations
- development of new housing and municipal districts

As an initiative conducted by the state government, the IBA Emscher Park implemented a strategic approach to link urban development and landscape, and to combine private investment and architectural quality implementing systematic cross-border planning of 17 municipalities in the northern part of the Ruhr region. Over 120 projects were completed, with a total investment value of €2.5 billion. Since the year 2000, the cities and municipalities in the area have continued to work on IBA themes such as the regional Emscher Landscape Park and the changing of the Emscher System. New master plans have been made to link IBA principles with the new demands of the 21st century. In December 2007, 35 cities and three municipalities presented "Concept Ruhr", the first initiative for the sustainable urban and regional development of the whole Ruhr area. Concept Ruhr focuses on the "Ruhr-basics" – five guidelines for the development in the next decade – and includes 274 projects with a total investment of €6 billion.

The German Government has pumped billions of euros into the Park, in part to recruit new businesses to the region; as a result 5,000 jobs have been created and 7,500 new homes constructed. Much of the new employment creation is in IT, logistics and nanotechnology.

coal mining site in the world and has become the flagship initiative. It is listed as a World Heritage Site as a testament to modern industrial architecture; it was the central location of the Ruhr 2010 Cultural Capital of Europe events and is now a tourist destination. Former coal miners have found new opportunities in the site's "restoration economy"; they are renovating the buildings, lining the roof with solar panels, and helping to create a series of green spaces spanning 800 square kilometres of the northern Ruhr Valley.

Many of the components of renewable energy technologies originate from mining technology. Some of the world's leading producers of wind turbine parts, Voith Turbo, BHS Getriebe and IBC Wälzlager GmbH, were originally producers of coal mining machinery. Siemens once produced conventional coal-fired power plants for the Ruhr area, and now the company is developing biomass generators. Instead of helping companies dig for coal, mining suppliers such as Teramex are providing drilling machinery for geothermal energy. In addition to components for renewables, Ruhr engineers are exploring whether hydrogen can replace the fossil fuels that now power steel production. New employment opportunities are also arising from development that combines renewable energy and other efforts to green the Ruhr

Valley. As part of Emscher Park's 2010 master plan, the city of Dinslaken is negotiating with the coal company MGG to convert a former mine site into a forest plantation. As much as 10,000 hectares of willows and poplars could be grown for biomass feedstock to provide heating. According to the International Economic Platform for Renewable Energies, a German research institute, 3,100 renewable energy companies already exist in North Rhine-Westphalia, with one-third of them located in the Ruhr Valley.

Policy responses by the state and federal governments with the involvement of European funds, 2000–06

The programme strategy 2000–06 for North Rhine-Westphalia built on the successful change of course in the development of the region that took place in the 1990s. It can be seen as an integrative strategy that continues the efforts of the preceding decade to complete the turnaround of an old industrial area into a modern, diversified industry and service location. As specific path dependencies have been shaping the agenda of regional policy for decades, several dimensions of structural change are dealt with. The programming strategy is thus closely interlinked with and adjusted to other regional policy programmes.

The programme strategy 2000–06 made use of complementarities between the European Regional Development Fund (ERDF) and the European Social Fund (ESF) in all four priority areas:

- wage subsidies for the reintegration of the unemployed and those threatened by unemployment;
- labour market policy support for enterprise development;
- combined promotion of employment and infrastructure; and
- integrated development of urban problem areas.

The comparative advantages of the Ruhr area were concentrated in traditional energy production: in 2001 about 28 per cent of the electricity produced in Germany originated from North Rhine-Westphalia, with coal accounting for 87 per cent of the fuel input for production (Rheinisch-Westfälisches Institut für Wirtschaftsforschung, 2006). The regional base of enterprises in technology fields is strongly associated with renewable energy production. Renewable energy generation in North Rhine-Westphalia developed rapidly in the period 2000–06: employment in the sector doubled and output rose by 196.1 per cent. Subsectors of particular importance in terms of employment were those involved in the production of wind energy (31.4 per cent), bio-energy technologies (19.3 per cent), and photovoltaics (14.4 per cent). Employment at firms involved in the development of fuel cells grew by nearly 50 per cent in just the two years 2003–05. These trends demonstrate that the demand for technological knowledge in the renewable

energy sector in the regional innovation system grew considerably during the period and became the main driver of development in the region.

Just transition in practice

In this section we address two major pillars of the just transition framework that had a particular significance for the mining industry, and then also devote attention to gender-related policies during the transformation process.

Socially responsible downsizing practices

As shown above in tables 1 and 3, mining employment in the Ruhr area has been radically downsized in recent decades, from 473,000 in 1957 to 11,448 by the end of 2013. Nevertheless, it was not until 1993 that the bargaining parties first signed an agreement guaranteeing a socially responsible approach to the manpower restructuring programme. At the beginning of 1993, as a result of developments in the steel industry, coal sales in general – and coking coal in particular – suffered a significant decline. Plans for capacity adjustments had to be brought forward and this in turn created a manpower surplus. The workforce agreed to forgo a wage increase and, in order to avoid compulsory redundancies, a work redistribution programme was introduced in the form of additional non-working days – referred to as "free shifts".

Meeting the challenges posed by a personnel restructuring process of such a magnitude requires a targeted and coordinated set of statutory, collective bargaining and contractual regulations and initiatives. Early retirement has been and will be an important instrument for the socially responsible downsizing process. The legal framework for this is based on the transition payments system (APG) for coal industry employees introduced by state legislation in 1972. These payments take the form of financial bridging support, paid monthly, that is made available for a maximum period of five years to workers after early termination of employment and until they first qualify for the pension insurance scheme. All employees who lose their jobs before 31 December 2022 are entitled to receive such benefits as soon as they reach the specified age threshold and period of service.

Even if the early retirement potential is exploited to full capacity, the degree of downsizing required between now and the final closure of the industry cannot be achieved without the use of additional instruments. Of the 18,000 employees still on the industry's books at the beginning of 2012, some 1,700 are not entitled to APG benefits. About 500 of this group can, of course, be kept in employment in order to enable the industry to meet its long-term operational commitments after 2018. However, about 1,200 staff will have to leave the industry by 2018 at the latest. The nature of

this challenge is such that even the collective bargaining and contractual instruments that have supported the restructuring process for so long will be unable to guarantee that coal production and manpower downsizing targets can be met in the run-up to 2018. As in the past, the bargaining parties have therefore faced up to their socio-political responsibilities and created a new unified concept that is geared towards achieving these objectives.

The agreement on the closure of the German coal industry by 31 December 2018 that was negotiated between the German Coal Association (GVSt) and the trade union for mining, chemical and energy industries (IG BCE) came into force on 1 April 2012. The agreement provides a framework for the balance of interests, building on a social compensation plan and various work agreements. The provisions apply to all permanent employees of the Rhine-Westphalia and Ibbenbueren coal mining industries. On the one hand, these rules guarantee the highest possible level of protection in respect of working conditions and a high degree of social security for both APG and non-APG employees.[2] On the other hand, employees are called upon to show a high level of flexibility. This means that in the event of their job ceasing to exist, they accept that they may have to take up another free post in another part of the country, either in the coal industry or at an RAG subsidiary company. Any post that the employee is able to fill after a maximum three-month introduction period, or at the most a nine-month training period, can be considered as eligible under this arrangement.

The rights and obligations of both employee groups are tailored to their specific situation and are well-balanced in terms of labour law. The collective bargaining regulations for the two groups of employees are shown in table 6.

The primary aim of these measures is to ensure that employees have been transferred to new jobs by 2018 or special Personnel Development Centres (PDC). PDCs are to be established in the Ruhr coalfield and at Ibbenbueren mine and will remain in operation until the end of 2018. Non-APG employees may be moved to the PDC, where training will be provided with a view to alternative employment both within the RAG group as well as in the wider job market.

Table 6. Social plan for APG and non-APG employees

APG employees	Non-APG employees
Company redundancy protection until APG requirements are met	Company redundancy protection until 30 June 2018
Wage safeguards	Wage safeguards
Group-wide posting	Personal Development Centre
Temporary transfer	Reasonable posting
Qualifications	Qualifications
Duty to cooperate	Duty to cooperate

Source: German Coal Association, 2014.

2. Criteria of eligibility for APG are based on age and the number of years in service.

As trade unions were involved in the elaboration of the socially responsible dismissals framework, the IG BCE union sees it as a success guaranteeing job protection for all miners in the coal phase-out process. Debates were focused on the terms and conditions of the flexibilization measures, i.e. under what circumstances and how many times workers can be moved between different and often geographically distant plants, but ultimately the conditions were found to be a fair compromise. Trade unions and works councils are also actively involved in designing individual measures.

Health and safety provisions

The German coal industry also fulfils all international norms when it comes to occupational health and safety and environment protection. Health and safety results have maintained a positive trend, reflected by a continuous drop in notifiable accidents. The high priority of workplace safety is to be sustained right down to the finishing line. RAG has laid down a strategy for "Staying safe until 2018". The commitment of the industry's management and workforce to health and safety matters is not only limited to Germany, for their expertise is also being applied at the international level – including involvement in the International Social Security Association (ISSA).

The total number of accidents recorded per million hours worked (the accident rate) is now at a low level and continues to fall. The accident rate at RAG has for several years been below the average for the German trade and industry sector as a whole, despite the special operating conditions that still prevail in the coal industry, particularly as regards work under ground. In the business and commercial sector as a whole, the accident rate for 2010 rose as the economy started to recover and the figure of 16.22 accidents per million hours worked nearly reached previous year's level. The coal industry, by comparison, was able to keep its accident rate on a downward trend. The accident rate for all those parts of the company under mining authority supervision fell by 7 per cent to 4.22, while for underground workers alone the rate was 6.29 accidents per million hours worked (down by 8.3 per cent).

Since 2001, the accident figures for the business sector overall have fallen by 28.1 per cent, while the corresponding decrease for the coal industry as a whole is 82.6 per cent, with the underground sector recording a drop of 82 per cent. Because of the special working conditions that exist in the coal mining industry, occupational medical checks have been a statutory requirement for many years. To this effect, RAG has established a number of well-equipped and professionally manned occupational health centres (OHCs). In 2011, some 26,000 people received medical checks at the company's three OHCs.

With regard to air quality, the various measures already stipulated by the European Union have resulted in a significant reduction in the concentration of pollutants such as dust particles, sulphur dioxide, lead, nitrous

oxides, carbon monoxide and benzene. Europe also practises a flow management system whose objective is to achieve a closed materials cycle that prevents the discharge of large amounts of waste. By comparison, coal-fired power stations in the United States present quite a different picture; the technology they use requires large amounts of residue material to be disposed of at landfill sites. The same applies to mercury separation, a process that has been agreed and decided but is still a long way from being implemented. It should be noted in this context that Germany is one of the few countries to have introduced any kind of limit for mercury emissions. German coal-fired power stations not only comply with these limits but in fact operate well within the threshold. The German approach also delivers high separation rates for sulphur and NOx compounds in conjunction with a material flow management system.

Gender equality

Given the nature of the coal and steel industries and the different waves of restructuring, it is overwhelmingly the male workforce that has been affected. As a diversification strategy has always been a central element of regional development and industrial policies, job creation for female employees has been an important priority since the 1970s. The North Rhine-Westphalia Programme (1970–75) had a specific target for creating female jobs and attracting investments that primarily employ a female workforce. In the case of state subsidies for the settlement of new businesses, equal pay conditions for men and women were a key condition.

Overcoming the hurdles: The role of the main actors and institutions during the four decades of restructuring

The role of the social partners

The Ruhr is a special place, not least because of its central position in Europe's industrial landscape, the role its industrial giants played in two world wars of the twentieth century and because it inspired European integration. In addition, due to this history there was close interaction throughout the post-war decades among the main actors – the regional government, municipalities, employers and trade unions – in managing the economy and its transformation. Germany and Rhineland capitalism is famous for its cooperative industrial culture where co-determination by employees is a core value.

Co-determination in the German coal and steel industries has a specific version: *Montanmitbestimmung* (Peters, 1979) grants stronger rights for employee participation and co-determination. At enterprises in the coal and steel

industry with more than 1,000 employees, there is full parity at the supervisory board: 50 per cent employer and 50 per cent employee delegates, one external person on the employee side and a representative member of the employees on the board of directors *(Arbeitsdirektor)*. These strong co-determination rights mean that any major decision in these large enterprises is subject to negotiation and thorough coordination between employers and employees. In a crisis situation such as times of mass dismissal or company closure, this process is crucial in finding compromise solutions and, in the worst case, managing the unavoidable exit in a socially balanced way, as was done – largely thanks to the trade unions that were well organized – during the factory and mine closures such as the Hattingen steel plant and the Nokia plant.

Active labour market policy

Measures were also taken to facilitate the labour market transitions of dismissed workers. In larger cases this was done via targeted agencies that specialized in employment promotion and training *(Beschäftigung und Qualifizierungsgesellschaft)*. The model developed in the Ruhr region was widely used during the transformation of the East German economy after German reunification. Box 6 provides an illustration of this policy, using the example of the Ruhr Coal Vocational Training Society *(Ruhr Kohle Bildungsgesellschaft)*.

This high degree of cooperative culture offers a great potential for managing change, but it is not the guarantee for success in itself.

Institutional cooperation in managing restructuring

Coercive institutional cooperation may lead to blockades and a lock-in situation, as in the case of the Ruhr for almost two decades from the mid-1960s to the mid-1980s. Although a thorough analysis of the reasons for the obstacle that held up structural policies until the mid-1980s would require a separate study, a few factors still need to be mentioned here. High concentration of capital and industrial power in a few large enterprises may have played a role, especially when these were refusing to sell their unused land to outside investors. A high concentration of supplier SMEs massively reliant on the large enterprises and their old production model meant that any innovation or enterprise development was blocked. The state government could certainly have had a more proactive strategy for industry renewal from an earlier stage. Finally, it took a while to recognize that top-down strategies work less well than bottom-up initiatives.

A further feature of the Ruhr was its highly decentralized settlement structure. Cities and municipalities had a high degree of autonomy and identity, whereas the Ruhr region as a whole did not. Organizational changes

Box 6. The Ruhr Coal Vocational Training Society (RKB)

The Ruhr Coal Vocational Training Society (RKB), a 100 per cent subsidiary of Ruhr Coal AG, was in charge of addressing the structural change in the Ruhr by managing labour market transitions in the mining industry. The context for the operation was high unemployment as a result of the decline of the steel and mining industries, and vague perspectives on the future development of industrial structure and the labour market. The basic approach of this institution was to develop a solution in the absence of clear lines of development on the labour market. This made it necessary to work together with the regional government, companies and other institutions on a strategy to be developed, in the first instance to determine a basis for expected or already-existing demand for skills objectives, as well as content, duration and type of measures in the form of a problem-specific solution.

The thorough preparation of staff employed as teachers or in education management was essential for success. Qualification measures also created jobs directly, as far as possible by employing locally based or regional staff in the training. The staff of the RKB took a leading role in defining model projects according to the expected skills demand in the region: mechanical, electrical and computer engineering (mainly for the transfer of knowledge and skills from the new technologies); training for trades in carpentry and plumbing; and a training programme for business and technology.

The following steps were necessary in advance of the training programmes:

- coordination with the employment office on the qualification goals, depending on local conditions and the potential / current labour market needs in viable areas; and
- provision of educational infrastructure in order to obtain reasonably priced training facilities, supported by the regional government.

At company level, information was provided through the following initiatives in consultation with the Executive Board, the works council and workers likely to be affected by reorganization or dismissal:

- organization of a training exchange with the participation of 20–25 further education providers to create transparency of the retraining and training opportunities. The objective was to find a balance between individual ideas and their feasibility in the context of a training measure;
- training staff for operations and training consultants who perceive an interface between the company and training programmes. With the establishment of trust, individually designed training and counselling is possible that is matched to company demand;
- a series of lectures on everyday problems (taxes, insurance) for the integration of employees whose commitment to the company is interrupted by short-time work.

The decisive criterion for success was a placement rate of 80 per cent and this was reached through the RKB initiative.

such as the creation of the Regionalverband Ruhr for increased cooperation and coordination within the region certainly helped. The shock of the steel crisis in the mid-1980s may also have given the final kick to the key players – beginning with the decision of the state government and the major enterprises to embark on a more dynamic development model.

The Aktionsprogramm Ruhr (APR) launched in 1979 and implemented in 1980 (see box 4), was built on systematic coordination between the largest interest groups and the state authorities, including the practice of inter-ministerial working groups. The main target of APR was the settlement, facilitation and development of small and medium enterprises.

In the next stage of structural policy, the Future Initiative for Steel and Coal Regions (*Zukunftsinitiative Montanregionen*, ZIM) transferred the formulation, implementation and execution to local actors with the aim of overcoming horizontal and vertical coordination problems of the APR programme. With the more pronounced local focus, economic development policy had been brought down to the level of urban development policy; this also included urban planning, environmental policy and the cultural sector. Within the framework of this programme, 290 structural policy-relevant projects with a budget of DM 1.07 billion were carried out (KVR, 2000).

From 1988, the ZIM approach was refined and extended to the whole Ruhr region in the form of the Future Initiative for Regions in North Rhine-Westphalia (ZIN) and was linked to the EU Structural Funds (KVR, 2000). The ZIN initiative can be regarded as a first approach toward a cooperative regionalized structural policy, in accordance with the principles of long-range planning. The regions involved in the programme were no longer defined by the regional government, but were formed autonomously. Fifteen such regions were formed and "brought about the most ambitious approach so far of a regionalized structural policy under way" (Kremer, 1992). Each had set up a regional conference to plan joint development concepts. Programme coordination among the different regional actors functioned as follows:

- organization of municipal neighbours into specified ZIN regions;
- regional conferences with all relevant actors;
- joint planning of development concepts;
- examination and authorization of the development concepts by the regional government; and
- project financing and implementation.

On this new and dynamic path, all the institutional strength and coordination was mobilized to turn the region into what it is today, a knowledge-based industrialized service economy with key competences in renewable energy generation and eco-industry while also preserving its industrial heritage.

Conclusions: Can the Ruhr experience be seen as a model?

To what extent can the restructuring and industrial diversification of the Ruhr area – from an economic model dependent on a natural resource, monostructural and depleting its materials and resources, towards a knowledge-based green economy stronghold – be seen as a model case? Can this development be seen as an example for other regions in Europe, and more importantly, is the pattern reproducible? Given the specific situation of the Ruhr addressed in this paper, and also the time dimension of the process of change – it took four to five decades – this is certainly not the case. Nevertheless, a number of valuable lessons can be drawn and other regions facing similar challenges can certainly benefit from them.

What are these main lessons?

First of all, a change of this magnitude takes time. It does not necessarily require 40 or 50 years, but in the Ruhr example even the breakthrough phase took some 15 years (from the mid-1980s to the early 2000s). A cooperative industrial structure with active roles for the government, the municipalities, the employers and the trade unions is a prerequisite for a successful and just transformation. In the Ruhr, this was the case even in times of crisis when tens of thousands of jobs were lost. Workers were not left alone, social plans and, even more importantly, support for labour market transition in terms of training programmes and assistance in finding new jobs were provided. As we have seen, however, a cooperative culture, although necessary, is not sufficient for success. Strategies, concepts and a clear vision of the future are also essential. It is important to evaluate the potential and the core competences of the regional economy. In the Ruhr, this also took some time.

Reindustrialization attempts that did not adequately take account of the key competences in the region proved to be short-lived. In this high-wage region, the Nokia investment dependent on semi-skilled assembly work and without proper regional embeddedness proved to be a bridging solution without a long-term perspective. On the other hand, the establishment of higher education institutions and the creation of technology centres laid the foundations of a knowledge-based economy at a time when the economy was still locked in coal- and steel-centred activities.

One element of the Ruhr's success is due to a policy practice that might provide important lessons for other regions trapped in a resource- and energy-intensive industrial structure. Even in the heyday of coal and steel, North Rhine-Westphalia had adopted strict environmental standards and put much emphasis on environmental protection. Given the higher costs of implementing stricter environmental norms, such a policy might have been seen as hampering competitiveness or placing unnecessary burdens on an

industry that already had problems, but on the contrary, it proved to be one of the key elements of future success. From early on, energy-intensive industries in the Ruhr had to cope with high environmental standards and develop respective competences. The steel industry in the Ruhr region is a champion of recycling technologies; it specializes in high-quality steel and provides important inputs for the eco-industry. These environmental and eco-industry competences proved to be the future engine of growth: there are more jobs in eco-industry nowadays than in coal and steel.

As a general conclusion, the Ruhr experience also shows that a complex process of restructuring from a resource-intensive industrial base towards a green, energy-efficient economy requires a comprehensive policy framework. Structural and regional policies in the Ruhr included not only industrial regional development and urban recreation policies, but also education and labour market policies, which were equally important. Moreover, in what proved to be a decisive moment, land use and building regulation were also of key importance. A new concept for the utilization of land in the form of industrial and landscape parks gave new impetus to regional development, whereas in previous decades large firms had prevented the establishment of new projects by jealously holding on to the vast land surfaces they were not using.

The new concepts introduced by the Zollverein and Emscher Park projects were also a turning point for the Ruhr's external image: it was no longer seen as a stagnant, polluted area of sunset industries, but as a place for innovation.

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