Economic and Social Research Council

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LOCAL INSTITUTIONS, PRODUCTIVITY, SUSTAINABILITY & INCLUSIVITY TRADE-OFFS

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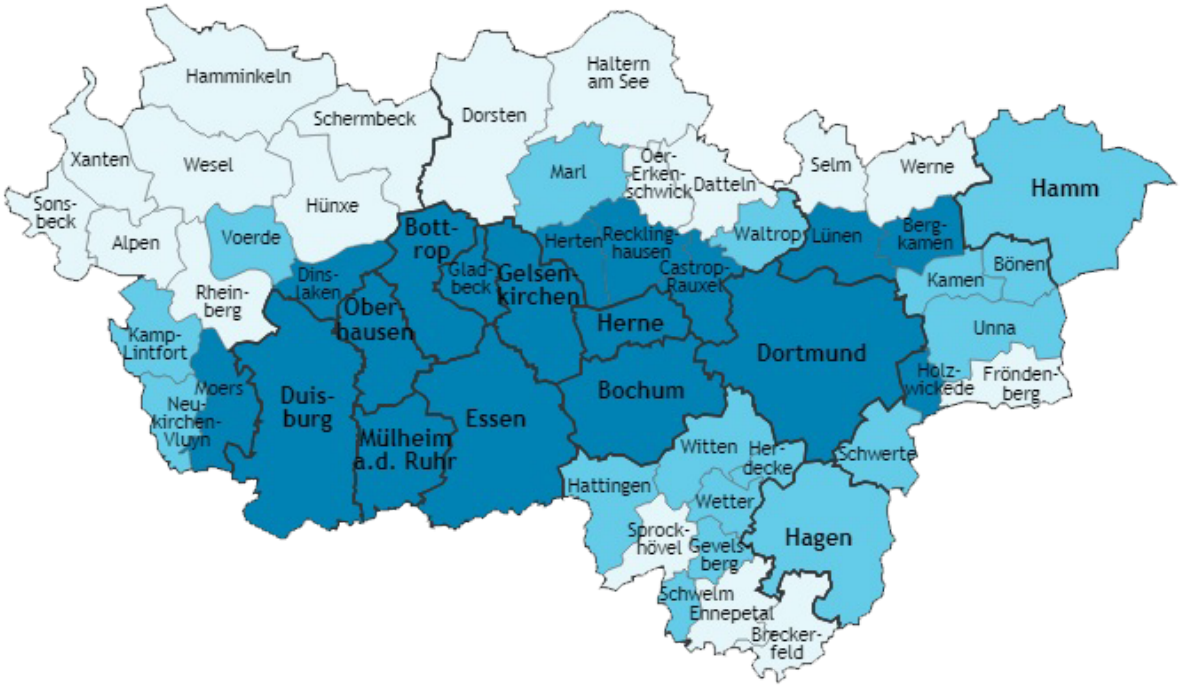
Appendix 4a: Ruhr Valley Case Study



Source: Regional Verband Ruhr

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Local Institutions, Productivity, Sustainability and Inclusivity Trade-offs (LIPSIT) is an ESRC (Economic and Social Research Council) funded collaborative project with Demos and the Universities of Birmingham, Cardiff, Surrey and Warwick. The aim of the project is to identify institutional and organisational arrangements at the regional level that tend to lead to the 'good' management of policy trade-offs associated with increasing productivity, and to make recommendations based on this. For further details of our research please visit www.LIPSIT.ac.uk.

Introduction

This document profiles the Ruhr Valley region which is part of the German federal state of North Rhine Westphalia (NRW). The region is a densely populated part of Germany and comprises the Ruhr industrial region with a per capita GDP of €35,600 in 2017, which is slightly below the national GDP of €42,076 (in 2018). The region shares its border with Lower Saxony, Hesse and Rhineland Palatinate in Germany along with Belgium and Netherlands. It is home to the Ruhr Valley region with Dusseldorf as the capital of NRW state.

This international case profile covers the geography and governance structure of the region, economic history of restructuring in the Ruhr Valley region, policies related to economic restructuring including productivity, inclusivity and sustainability, performance targets and key data. The data focusses on key aspects of the economy such as innovation, business, infrastructure and built assets, people, place and the environment.

Regional Context

The Ruhr Valley region is a heterogenous cluster of industrial area adjacent to the river Ruhr, which is part of the state of NRW land in Western Germany. Popularly known as the Ruhrgebiet, it extends across the north-west European coal belt running from Silesia through the Ruhr, Belgium and Northern France to England. It covers an area of 4,400 square kilometres and comprises of structured sub-regions or districts which includes the Ruhr zone, the Hellweg zone, the Emscher and the Lippe zone. The eleven district level municipalities are Essen, Dortmund, Duisburg, Bochum, Gelsenkirchen, Oberhausen, Hagen, Muhlheim, Herne, Hamm and Bottrup with a population size of approximate 5.1 million resident in Ruhr in 2013 (RVR Database[1]). NRW is also one of the most populous regions in Germany comprising of 22% of the national population (Eurostat, 2019).

Governance structure of the Ruhr Valley region

Geographically and politically a decentralised structure, the federal state of NRW region and its ministry shares a similar status to the national government and coordinates the entire regional policy making process, implementation and communication.

Municipalities and districts located in the Ruhr Valley cooperate in the 'Regionalverband Ruhr' (RVR), or regional association Ruhr, to have their common interests represented by a regional authority. The RVR is primarily financed by its members, although additional funds come from federal German authorities and the European Union.

The Ruhr Valley is not a separate administrative entity and is included within the RVR with its seat in Essen and employs approximately 480 employees who are engaged in spatial planning, urban development and regional infrastructure projects.

The Ruhr Valley authority continued to have limited responsibilities until October 2004 when the state parliament adopted a law that transferred regional policy autonomy to the now renamed RVR. Currently, RVR's members represent the interests of the Ruhr Valley through the 'Ruhrparlament', a parliament of 163 seats that are taken by representatives of the eleven municipalities, the four regional districts, as well as 15 mayors and district administrators (Oberbürgermeister and Landräte).

[1] In accordance with the latest RVR database information

Industrial history of the Ruhr Valley

- NRW region is one of the 16 German federal states which used to be historically one of the largest industrial areas (coal, steel and energy).
- Its decline began from the 1960s with the collapse of the steel industry following several causes: both internal and external factors. The extraneous factors included the surge in technological innovation which were imported from outside leading to the decline in the demand for coal (Taylor, 2015; Bross and Walter, 2000).
- The following table presents a brief timeline of the economic restructuring in the Ruhr Valley region.

Table 1: Brief timeline of the economic restructuring in the Ruhr Valley region

Timeframe	Phase	Characteristic feature
From 1840	Industrialisation with strong growth phase between 1894-1914	-Large-scale coal mining -Mass production of steel and iron -Foundation of large enterprises -Strong Immigration
1914-1945	Beginning of crises	-Economic recession, WWI & II -End of product cycle of coal mining
1945-1950s	Rapid growth	-Temporary increase in demand due to reconstruction and extraneous factors
1960s-1970s	Decline in coal and steel industry leading to restructuring	-Crisis of coal mining & closure of pits; international competition and location disadvantages due to changed technology
1970s onwards	Growth of service industry	-Absorption of workers in service sector -Steel crisis in the 1970s with overall decline in the region -Subsidising the coal and steel industry -Centralised regional policies to support traditional industries -Change in supply side policies to attract investment in building universities for restructuring
1970s-1989	Economic restructuring and transition phase	-Regionalisation -Decentralisation -Growth of SMEs -Diversified economy -Extra regional investment
1990 onwards and future	Consolidation & crisis Cluster approach- diversified industrial structure	-umbrella projects -bundling resources -initiating networks -stimulating foundations

Source: Bross and Walter, 2000

The decline

- Following the decline of the coal and steel industry, half a million jobs were lost leading to large-scale unemployment and other structural problems such as mass migration due to unemployment and environmental pollution at a very large scale.
- The manufacturing sector was also badly affected following the decline of the steel and coal industry contributing to a further increase in unemployment up to 15.1% in 1987-88 (Taylor, 2015; Winden et al, 2011; Hospers, 2004).
- These problems were further compounded by the contamination of the Ruhr Valley region such as locational disadvantages following soil and air pollution, poor infrastructural facilities and a negative image of the region (Sheldon et al, 2018; Taylor, 2015).
- The initial restructuring programme focussed on inward investment within the region which was prompted by the decline of the coal and steel industry and the subsequent subsidisation by the government at a national and regional level.
- Inward investments within the heavy industry sector fell short of making the necessary structural changes required to address the consequence of the decline such as reskilling needs, creation of new jobs following the closure of the traditional coal and steel companies and diversification of the economy to promote the growth of the service industry (Barnes et al, 1999; Hospers, 2004; Taylor, 2015; Sheldon et al, 2018).
- In addition, the monolithic nature of the economic structure with its predominant focus on heavy industry left little provision for other industries to thrive to support the economy of the region (Bross and Walter, 2000; Taylor, 2015).
- Inevitably, the collapse of the heavy industries had a deep impact on the economy of Ruhr Valley exacerbated by the fact that there were very few high-level technical schools and universities to provide other alternatives through a reskilling programme in the 1960s (Stroud et al, 2014; Taylor, 2015).
- The internal factors leading to the decline included the large and complex organisational structures which are hierarchical in nature especially between the SMEs and the predominant organisation (Bross and Walter, 2000).
- There was also huge localised political clout to maintain Ruhr's existing industrial structure and resist structural change by local industrialists and businesses, trade unions which in turn resulted in little political will among the local political parties in investing in entrepreneurship, innovation and flexibility (Hospers, 2004; Bross and Walter, 2000; Taylor, 2015).
- The problem was further exacerbated by the development of unplanned urban structures as local political leaders promoted a disorganised and inadequate infrastructure development in favour of traditional local enterprises (Bross and Walter, 2000).

Restructuring of the Ruhr Valley region

- These structural failures leading to economic and industrial decline required a complete rethinking of the economic restructuring of the region. This involved developing new programmes, institutional restructuring and a shift from heavy manufacturing industry to the service industry (Taylor, 2015; Dahlbeck and Gartner, 2019).
- The shift towards the service industry in the 1970s created new jobs after subsequent job losses of about 1 million in the manufacturing industry (Taylor, 2015).
- The reskilling programme under the 'green economy' programme retrained the large number of unemployed to retain the migration of the population from the Ruhr Valley region

(Dahlbeck and Gartner 2019; Schepelmann et al, 2015; Sheldon et al, 2018; Stroud et al, 2014).

- A reskilling programme also promoted inclusive growth through employment protection plans and flexible working system which made the market fit for workers and promoted their rights to active securities, providing social insurance schemes and means tested income guarantee (Schmid, 2018).
- Another feature of the economic restructuring in the Ruhr Valley region is the development of the public-private partnership programme, for instance in the revitalisation of the Emscher river region. Its main focus was the ecological, social and economic reconstruction of the entire Emscher river region which had undergone economic and social upheaval following its industrial decline (Taylor, 2015; Hospers, 2004).
- The Initiative IBA was instrumental in bringing about major institutional reforms leading to new regional policies which encouraged active participation and engagement of the local companies, towns, citizens and architects (Hospers, 2004).
- The most important feature was the region's revitalisation from within which involved the participation of various local stakeholders (Hospers, 2004).
- A restructuring programme within the public sector led to new educational institutions such as universities and technical institutes which enabled the rapid growth of the service industry and a diversified economy.
- Gradually, from 1990 onwards the regional renewal and growth programme was structured around economic clusters (a conglomeration of businesses and firms including electronics and automotive industries through the network of SMEs in a specific geographical space). Decentralised powers in the NRW gave more autonomy to the regional government to allocate resources in areas which needed prioritisation (Cooke, 1999; Bross and Walter, 2000).
- As a consequence, several cooperative projects were set up in the region such as the E-city Dortmund and Solar City Gelsenkirchen (Hospers, 2004) to name a few.
- New employment programmes included the work of the Regional Association Ruhr (Regionalverband Ruhr or RVR) and the Initiativkreis Ruhr (Taylor, 2015) which created new employment opportunities. As a result of this, employment figures gradually rose to about a million (Taylor, 2015) equating it to the number of jobs lost in 2011 (Taylor, 2015).
- As SMEs played a dominant role in the economic restructuring in the Ruhr Valley region including the state of NRW, it was estimated that 70.6% of employment was generated by 763,000 firms which contributed to a net value of 42% output (Kroll and Meyborg, 2014).
- However, overall unemployment figures continued to remain high (12.1%) when compared to Germany (7.4%) as a whole (RVR Databank, accessed June 2020).

Regional policy context

New policies and plans by the government were instrumental in the economic restructuring of the Ruhr Valley region. The policies and programmes of the NRW state government played a critical role in the transition of the Ruhr economy by clearly defined roles and responsibilities of RVR law (Gesetz über den Regionalverband Ruhr) in 2004. The RVR law enabled the Ruhr metropolitan region to gain autonomy in the area of regional policy making and specified compulsory and non-compulsory roles. Some of these roles include:

- Regional planning and development, policy for public and urban space, in coordination with adjacent regions;

- Development of formerly industrial sites, such as the Emscher Landschaftspark and the Route of Industrial Heritage;
- Development and protection of urban green areas, nature reserves and parks;
- Stimulation of the regional economy and development of tourism; and
- Analysis of data on structural development of public and urban areas to monitor progress of development and growth.

Additional tasks undertaken by RVR include:

- Regional culture and regional sports projects;.
- Cartography and measurement of areas;
- Development of recreational sites that are regional in nature;
- Climate protection and stimulation of the renewable energy industry;
- Planning and execution of projects aimed at recycling and using 'firedamp';
- Transportation infrastructure and planning; and
- Support of EU initiatives in the region.

Lastly, the municipalities and regional districts were also able to transfer project responsibilities to RVR by request.

As one of its oldest core responsibilities, an area of policy priority for RVR is environmental protection. As part of its commitment to sustainable environment development, the Ruhr Regional Association presented the Green decade of the Ruhr by compiling the 'Report on the State of the Environment in the Ruhr Metropolitan Area' in 2017 (RVR, 2017). This was following on from the 'Sky over the Ruhr must turn blue again' campaign to make the region free from air and water pollution (Schwarze-Rodrian, 2016; Taylor, 2015). Hence, the report was aligned with the existing regional strategies, plans and priorities in the Ruhr region and contributed to an integrated development of the Ruhr metropolitan region in a sustainable way.

The RVR is the largest communal owner of forests in Germany and also is engaged in the maintenance and development of recreational sites, national parks and nature reserves. Other priorities include stimulating the regional economy and the tourism sector through its subsidiaries Business Metropole Ruhr GmbH and Ruhr Tourismus GmbH. A key responsibility of RVR is to engage in large infrastructural projects, as spatial and urban planning and development has been of prime importance alongside investments in transforming previous industrial areas into parks and cultural sites and developing regional cycle pathways all of which contributes to developing the industrial heritage of the region (e.g. Emscher Landschaftspark) (RVR Databank, accessed July 2020).

Aside from environmental sustainability, policies of the national and state government were instrumental in the development of research and technology policy in various fields. It is characterised by the national and regional efforts to modernise industry and the use of appropriate technology for this, including the allocation of resources and designing of relevant initiatives to promote development in areas which are behind and in need of restructuring (Bross and Walter, 2000). Developing the ZIM Initiative is one such example where EU structural funds along with national funds were instrumental in addressing regional problems (Bross and Walter, 2000). The NRW state had initiated a number of different structural policy initiatives in partnership with key actors in the region as part of the (Zukunftsinitiative Montanregion) ZIM and ZIN initiative following the economic crisis of the coal and steel industry in the region (Bross and Walter, 2000) with its innovative characteristic of being a decentralised unit. These include partnership between universities, small and medium enterprises and firms, civil society organisations, government agencies, trade unions and other bodies. The decentralised system implied financial autonomy and the ability to invest in areas such as innovation, technology, science, research and development and

stimulating new businesses based on regional innovation policies which also provided a stimulus to the entire landscape of SMEs and firms, technology and research centres as well as universities and institutes based on mutual cooperation and trust.
Comparing expenditure on research and development with other regions such as Bavaria and Baden Wurtemberg, NRW had very low spending (1.78% of GDP) on research and development in 2004. This is below the German average of 2.49%. However, NRW had the third highest number of patent registrations in Germany after Baden Wurtemberg and Bavaria, amounting to 16.9% of all German patents in 2005 (Kroll and Meybord, 2014). This can be partly explained by national public policy on technology, discussed below which was part of the regional restructuring from 1970s onwards. Interestingly, the number of patents, including the spending on research and development increased drastically towards the latter half of the 1970s and 1980s. This is because of decentralisation which allowed the extra regional investment in the Ruhr Valley area from the 1980s. Decentralisation also encouraged various partnerships and collaboration to develop between the various initiatives and projects that were being undertaken since 1990. This also enabled the process of reviewing the progress of projects and allocated resources which was accounted for, in terms of whether the allocated resources have been utilised for the purpose for which they were set aside at the outset. The accountability section discusses this in more detail.

Functional economic areas

The Ruhr Valley has been identified as a functional area with its unique specialisation in coal and steel industry, an area which expanded across the north-west European coal belt (Hospers, 2004). It spreads from Silesia through the Ruhr, Belgium and Northern France to England. The river Rhine is situated in the western border of the Ruhr Valley landscape with the three different tributaries surrounding Ruhr (in the south), Lippe (in the north) and Emscher in between (Hospers, 2004). The region has four rivers, of which three share their name with the region and these are the Ruhr zone, Lippe zone and the Emscher zone. The industrial hub of the Ruhr Valley is located between the Emscher and the Lippe zone known as the Hellweg zone, which was originally a century old transport and trade route. Some of the municipalities that are part of the Ruhr Valley fall in this region which includes Duisburg, Essen, Bochum, Dortmund and Unna. These areas later developed into large industrial areas with the industrialisation of the Ruhr Valley and are administratively linked to the Association of Local Authorities called the Kommunalverband Ruhrgebeit.

Alignment of local and national policy objectives and priorities

The increasing pressure of globalisation and the integration into a single market by the European Union, homogenized and created an economy, which affected institutions, enterprises, industrial standards and labour markets. This prompted the creation of decentralised governance systems at a regional and local level to promote regional competitiveness (Amin, 2002; Amin and Cohandet, 1999). This was another factor which encouraged regional institutions to grow, collaborate and develop regional policies to address issues that were local and to become autonomous at a regional level (Ostrom, 2010; Amin, 1999). The polycentric system in the Ruhr Valley hence played a major role in the region's economic restructuring and growth in the following ways (see Table 2 for further information):

- National public policies from 1970s onwards including technology polices exercised a strong influence on the Ruhr economy in the areas of sectoral, regional, industrial and educational policy (Bross and Walter, 2000), explaining some of the higher innovation or patent

outcomes. However, these polices only initially targeted research institutes and large organisations with in-house research and development capacity, hence the scope of research, innovation and technology was limited in the Ruhr region in the initial phase of restructuring (Bross and Walter, 2000).

- Regional policy reflected the combined needs of the national and federal state whilst sectoral policies reflected the needs of the traditional industries and helped to perpetuate old institutional structures (Bross and Walter, 2000). A consequence of this is the reduced adaptive capacity of the region to the new and emerging challenges of the regional economy from global markets and explains why economic development in the region lagged behind in the first place (Amin and Cohandet, 1999).
- Another reason why the economic crisis in the region escalated in the 1970s is because of an initial centralised regional policy which failed to recognise the need for a structural change. The shift in policy happened gradually with the recognition for a need to introduce structural reforms when traditional industries no longer were adequate in meeting the needs of the competitive market scenario (Taylor, 2015). Emphasis was on the need to explore the resource potential in the local industry, however, since the R&D capacity was limited, applied and industry-oriented technology policy did not contribute to the industrial restructuring of the Ruhr Valley (Bross & Walter, 2000).
- An advantage of the regional industrial and technology policy is that such policies can take into account the regional needs and benefit from its direct contact with industry and SMEs (Amin, 2002).
- A specific field of regional policy are action-oriented measures (from 1970-89) such as “co-operation and co-ordination of resources in order to broaden the innovative basis, steering an innovative milieu and supporting innovation networks” (Bross and Walter, 2000:21).
- This led to a number of initiatives such as the ZIM and the ZIN initiatives to promote regional growth and development in the field of technology, science, research and innovation through the support of the NRW state including financial support from the national government.

Table 2 lists the various initiatives and policy measures to stimulate regional growth in the Ruhr Valley beginning from the 1970s until 2003 and beyond. Though the initial policies were aimed at providing subsidies to the previous heavy industry of coal and steel with less focus on diversification, this was also to enable a gradual weaning away from the coal and steel industry which was polluting the region towards a more sustainable growth which was more environmentally friendly.

Table 2: Political initiatives to restructure Ruhr Valley region

Year	Policy Measures	Aims and Impact
Mid 1970s-1984	Technology programme for coal mining and energy	-Orientation towards traditional industries -No diversification in other sectors
1978 onwards	Technology programme for the economy	-Financial incentives focussed on SMEs -Advisory services
1984 onwards	NRW Initiative for future technologies	-Promotion of innovation in modern technologies, especially environment -Promotion of technology transfer -Promotion of socially acceptable technology

1987-1991	Initiative for the future of coal & steel regions	-New approach -Integration of different funding institutions, EU, national, NRW -Bottom-up approach -Action fields
Stimulating Measures to promote growth		
1968-1973	Development Programme Ruhr	-Education, training -Traffic infrastructure
1970-1975 1979-1984	NRW programme Action programme Ruhr	Infrastructure: -Foundation of HEIs -Establishment of area development fund -Support of training & qualification
1988-1999	International Housing exhibition Emscherpark	-Conversion of polluted areas
Since 1995	Foundation Initiative NRW	-Improving industrial structure -Acceleration of the technological and economic development
2002	Ruhr Regiontriennale	To promote the concept of invention through interdisciplinary production of music, arts and drama
2003	City Region Ruhr, 2030	Voluntary collaboration between planners of the Ruhr region to exchange information on developments within the Ruhr municipalities

Source: Hassink, 1992; Schwarze-Rodrian, 2016

The next section presents some key data and statistical figures to highlight the performance of the Ruhr Valley region following its economic restructuring process.

Performance targets and related key statistics

Economic restructuring in the NRW region followed from large-scale structural changes leading to growth in key economic sectors. These include the service industry, research and innovation, and internal diversification of resources to new areas such as renewable energy, growth of technology and investment in new infrastructure within the service industry sector, automobile industry and many others. The region is one of the prominent economic centres with a regional GDP of €693.3bn in NRW and is one of the busiest regions in terms of export of goods which was approximately €192bn in 2018 (Eurostat, 2019). This section presents some key statistics to reflect the performance of the region following its economic restructuring in the subsequent years.

Table 4 shows the GDP per capita of Ruhr Valley which declined from 86.2% in 2012 to 80.9 in 2017. This is a decline from a peak of 87.6% in 2009, however the position in 2017 is not much below that of 2001 (82%), suggesting variability and a levelling rather than a continuous decline over a longer time period. This is not dissimilar to the pattern of change seen in other cities and regions however Ruhr Valley remains one of the poorer regions in Germany (OECD Stat, accessed 2020).

Table 3: GDP of Ruhr Valley from 2013 to 2018

Year	GDP Euros
2013	167,470
2014	170,066
2015	168,712

2016	168,163
2017	171,648
2018	173,490*

Source: OECD Stat [accessed August 2020]
* Provisional

Table 4: GDP per capita in the Ruhr metropolitan area as a share of the national value

Year	Ruhr Valley (%)
2012	86.2
2013	85.1
2014	84.9
2015	83.4
2016	81.1
2017	80.9

Source: OECD Stat [accessed August 2020]

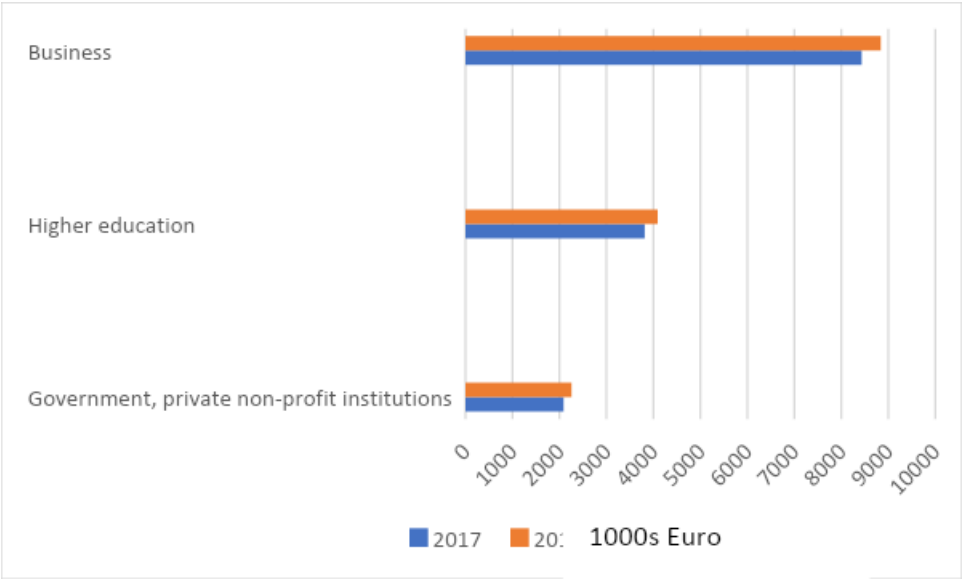
1. Innovation

Table 5: Research and development staff in NRW

Research and development staff (full-time equivalent)		
Sector	2017	2018
Government, private non-profit institutions	17,444	17,444
Higher education	30,390	31,138
Business	59,719	61,700
Total	107,553	110,282

Source: Federation Statistical Office, Wiesbaden 2020 [accessed August 2020]

Figure 1: Research and development expenditure in NRW



Source: Federation Statistical Office, Wiesbaden [accessed August 2020]

Table 6: Number of registered patents in NRW compared to Germany between 2012-17

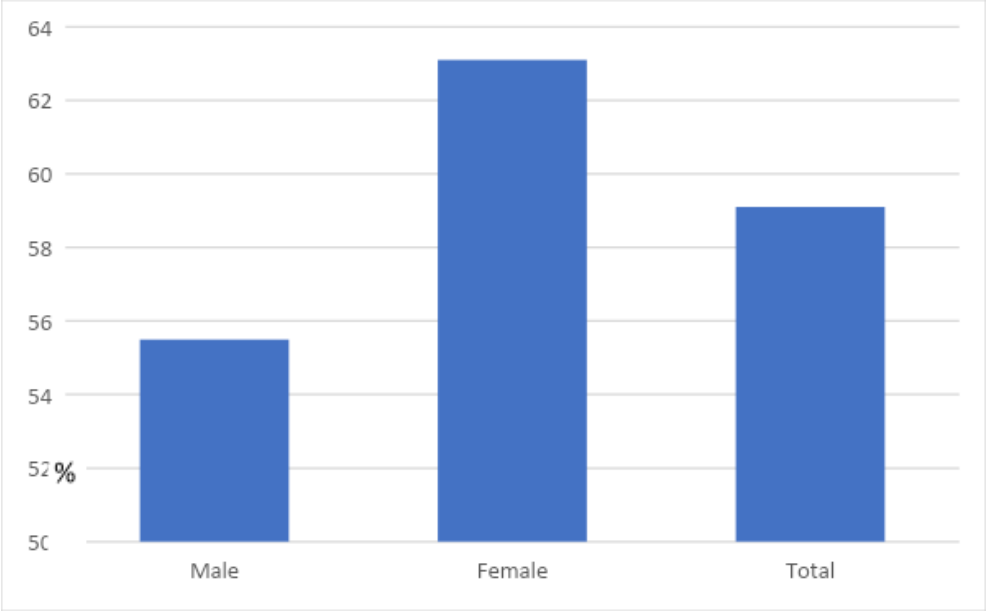
Region	2012	2013	2014	2015	2016	2017	2018
Nordrhein-Westfalen	6,762	7,073	7,116	6,875	7,068	7,209	6,856
Germany	46,649	47,336	48,144	47,377	48,454	47,779	46,609

Source: German Patent and Trade Mark Office (DPMA) [accessed August 2020]

In 2018, the number of patent application for NRW was 6,856 which was 14.7% of the total applications in Germany (DPMA, 2019). Records showed that the patents produced in the region was the third highest after (Bavaria 14,852 patents) and Baden Wurttemberg (14,608 patents) (DPMA, 2018) with 38 applications per 100,000 inhabitants. Transport, civil engineering and electrical machinery, apparatus and energy were the key sectors where patent applications were made in the NRW region [DPMA, 2018, accessed August 2020].

Higher Education

Figure 2: Rate of entry to higher education by gender in 2017

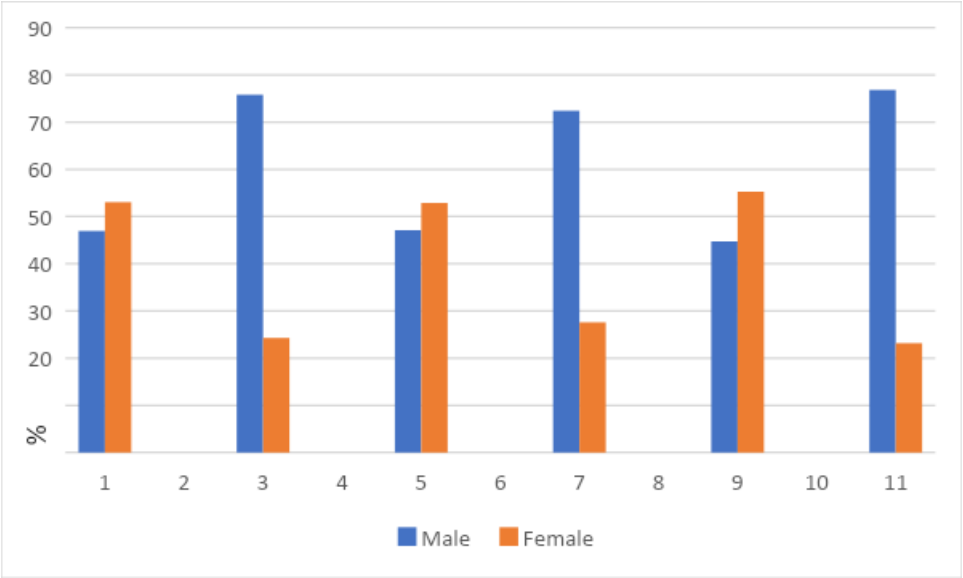


Source: Federation Statistical Office, Wiesbaden [accessed August 2020]

Vocational Academies are higher education institutions which are part of the dual education system known as Vocational Educational Training (VET) in Germany. Individual students spend some time in the schools and the rest of the time with the firms to gain work experience through apprenticeships. The main aim is to provide training to young students in nationally recognised professions. One distinct characteristic feature of the vocational academies is the partnership and cooperation between the small and medium sized enterprises and the state funded vocational schools. It is also an alternative to university level education. Once the training is completed with the firms, applicants can register into the academies supported by their training firms to acquire a bachelor's degree or a diploma or a professional title on some occasions (Schneider et al, 2007).

Figure 3 lists the percentage of males and females who completed their qualifications in the vocational academies between 2017-2019. The figure shows that the percentage of males who acquired a diploma was much higher than the percentage of females who acquired the same degree between 2017-2019. However, a higher percentage of females acquired a bachelor's degree than the males between the same years.

Figure 3: Percentage of males and females who passed vocational academies



Source: Federation Statistical Office, Wiesbaden 2020 [accessed August 2020]

Table 7: Number of students in types of vocational schools in NRW

Level	2016-17	2017-18
Part-time vocational schools (dual system)	322,684	32,1287
Pre-vocational training year	24,054	24,523
Full-time vocational schools	109,799	109,412

Trade and technical schools	51,048	49,852

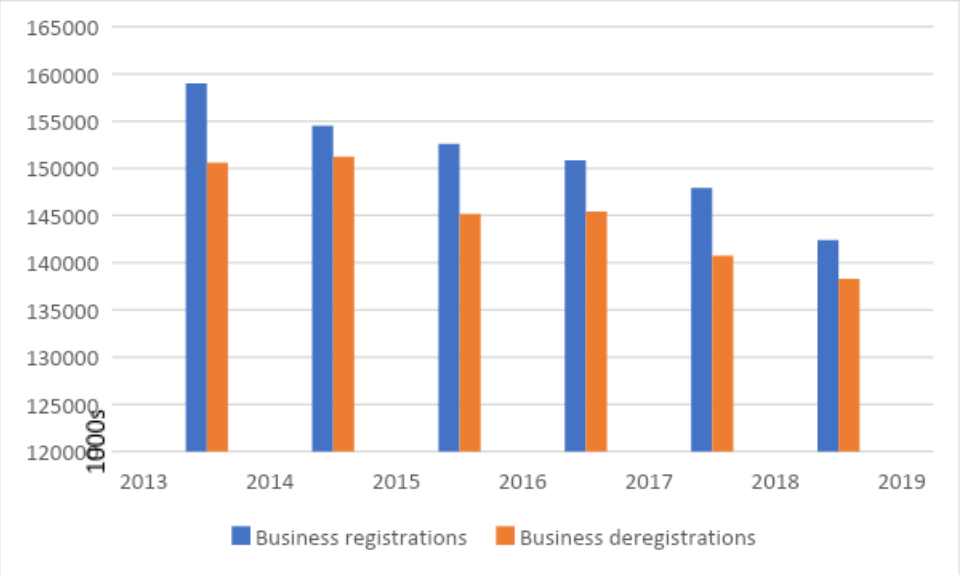
Source: Federation Statistical Office, Wiesbaden [accessed August 2020]

2. Business

Most of the businesses and industries in the region are run by a network of small and medium sized enterprises. Approximately 747,000 SMEs provide employment to about 80% of the population in the region (NRW Invest, 2016). The prevalent industries are chemicals, mechanical and pharmaceutical industries along with food, metal production and processing, automotive, metal and electrical, electronic, rubber and plastic, glass, ceramic and non-metallic products sector. Figure 4 lists the number of business registrations and de-registrations from 2013-2019 in the state of NRW.

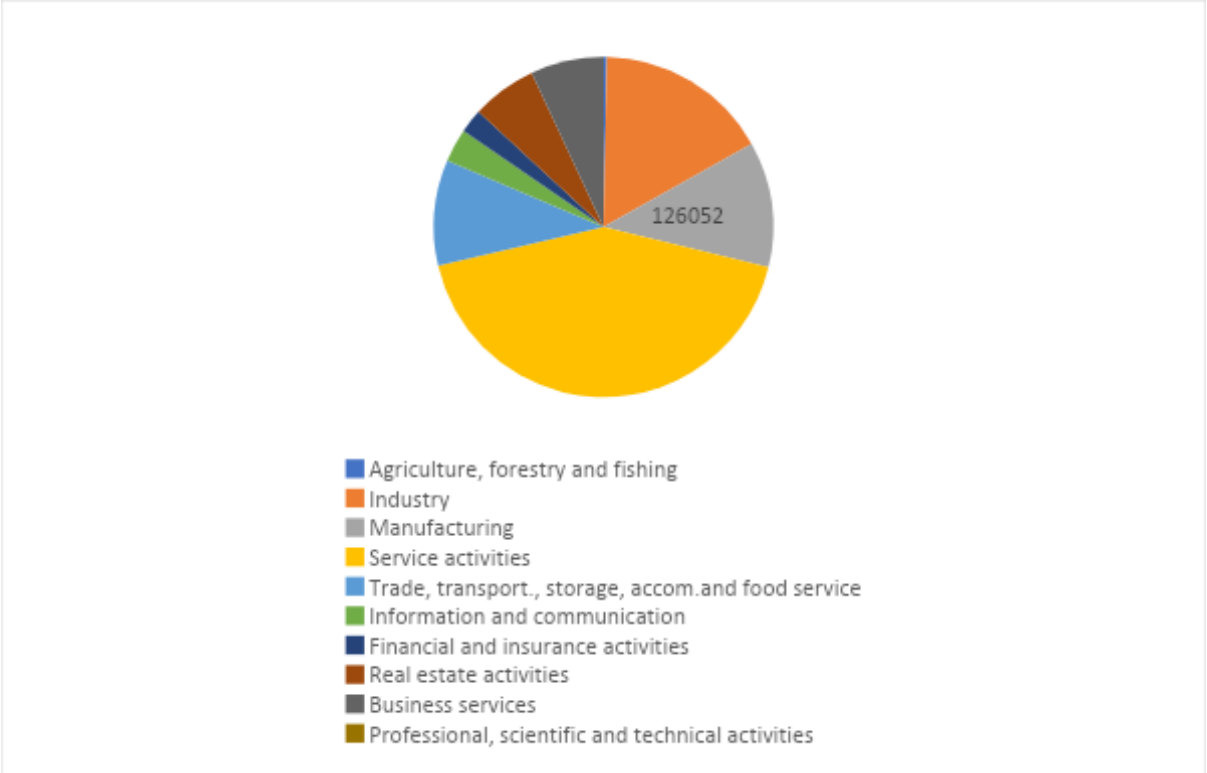
Figure 4 shows the declining number of business registrations from 2013-2019. Even though business registration numbers went down from 158,994 to 144,036, business de-registrations declined even further from 150,610 to 133,349. This is indicative of the trend of higher number of business growths within the Ruhr Valley region.

Figure 4: Number of business registration and deregistration from 2013-2019 in NRW



Source: Federation Statistical Office, Wiesbaden [accessed August 2020]

Figure 5: Gross Value Added at current prices by economic sectors in NRW in Euro million



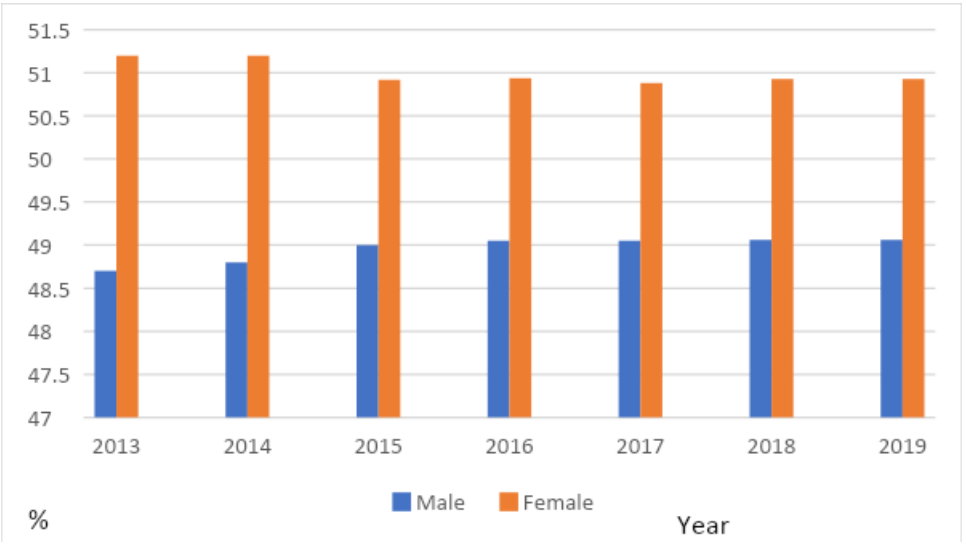
Source: Federation Statistical Office, Wiesbaden [accessed August 2020]

Figure 5 shows that the service industry has the highest gross value added at current prices compared to other economic sectors followed by industry, manufacturing and other sectors in NRW.

3. People

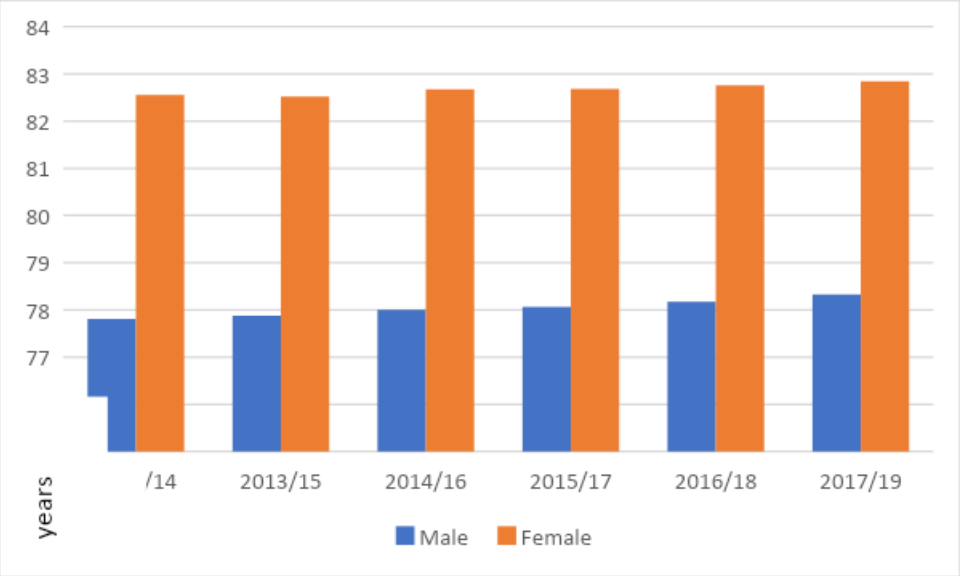
Figure 6 shows that the population percentage of female is much higher than the male between the years 2013 to 2019.

Figure 6: Population percentage by male and female in NRW



Source: Federation Statistical Office, Wiesbaden [accessed September 2020]

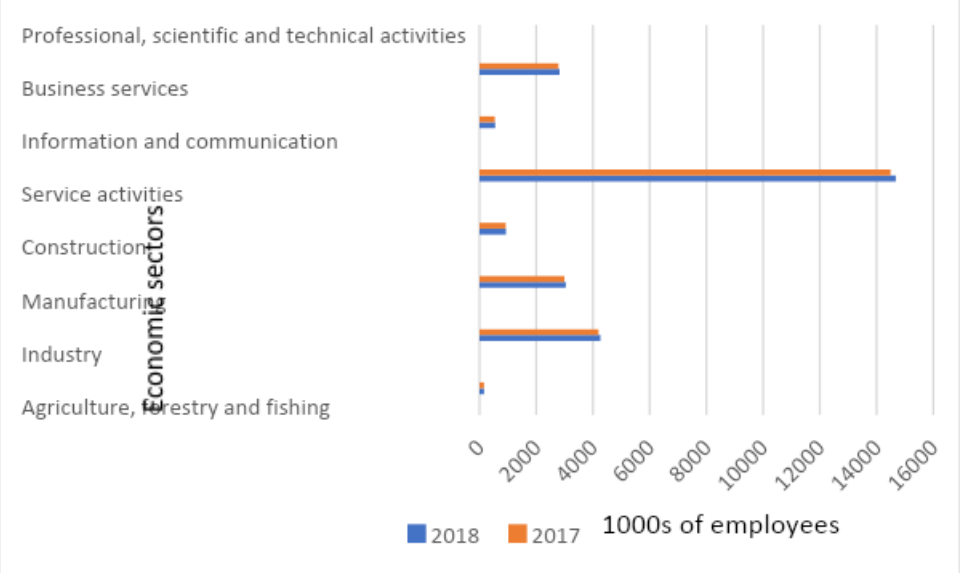
Figure 7: Average Life expectancy at birth



Source: Federation Statistical Office, Wiesbaden [accessed September 2020]

Figure 7 represents that the average life expectancy of females at birth is much higher than the males.

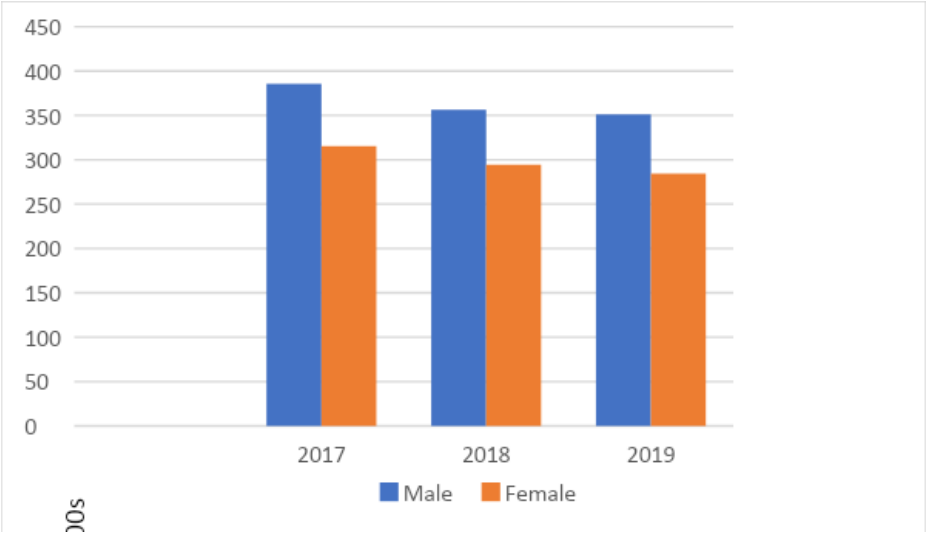
Figure 8: Number of employed in NRW by sector in 2017 and 2018



Source: Federation Statistical Office, Wiesbaden [accessed August 2020]

Figure 8 shows that the number of employees within the service sector was much higher compared to the number of employees within the other economic sectors such as industry, manufacturing and business services to name a few.

Figure 9: Number of unemployed in NRW by gender



Source: Federation Statistical Office, Wiesbaden [accessed August 2020]

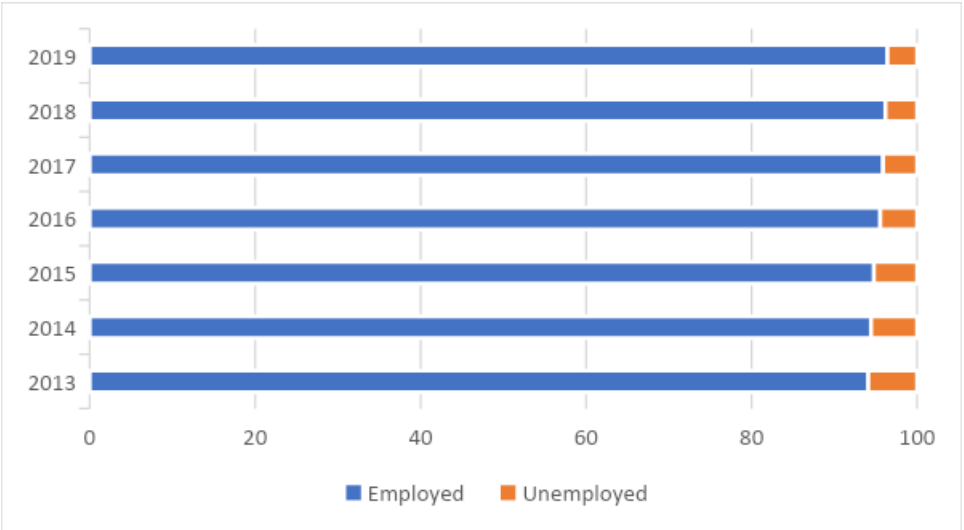
Figure 9 shows that the number of unemployed males and females were declining steadily between the years 2017- 2019

Table 8: Number of unemployed in Ruhr Valley from 2013-2018

Year	Unemployed
2013	190,692
2014	180,491
2015	170,392
2016	167,795
2017	162,002
2018	130,227

Source: OECD Stat [accessed August 2020]

Figure 10: Percentage employed and unemployed



Source: Federation Statistical Office, Wiesbaden [accessed September 2020]

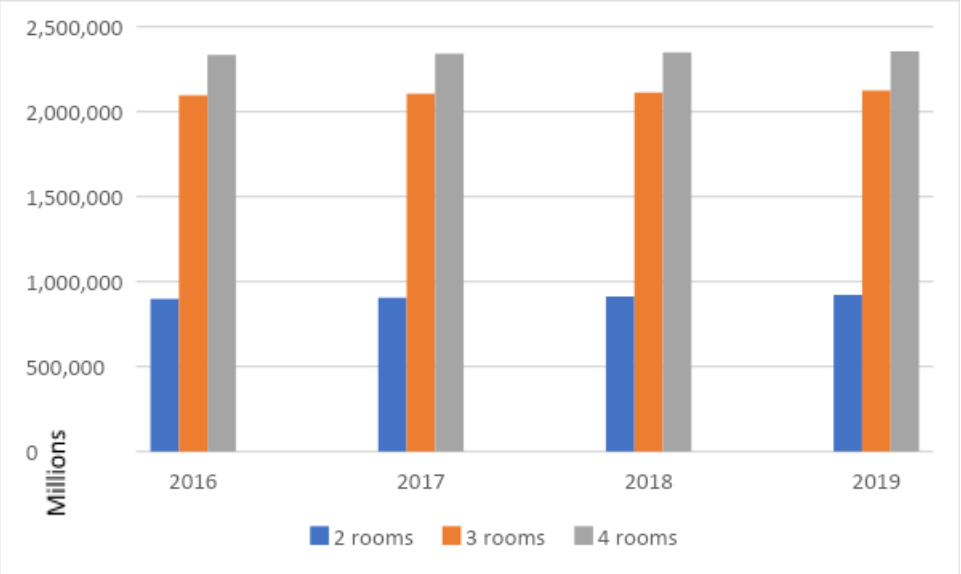
Figure 10 shows that the percentage of employed people was gradually increasing from the year 2013 to 2019 and that the percentage of unemployed was steadily declining.

4. Place

Germany has the largest housing stock in Europe with an estimated 3.1 million buildings which contain an approximate 20.8 million apartments (Savills, 2012). A large proportion of this is owned by private commercial entities. Out of the 20.8 million apartments, owner-occupied apartment is only 3 million and an approximate 8.8 million are owned by private landlords for renting purposes (Savills, 2012). The majority of the apartment stock (8.9 million) is owned by professional companies for rental purposes at a commercial scale. The availability of disposable income, declining population and the average age of the population which is estimated to be closer to age 60 by the year 2025 has resulted in a large number of people renting in 2, 3 or 4 roomed apartment instead of owning them (Savills, 2012).

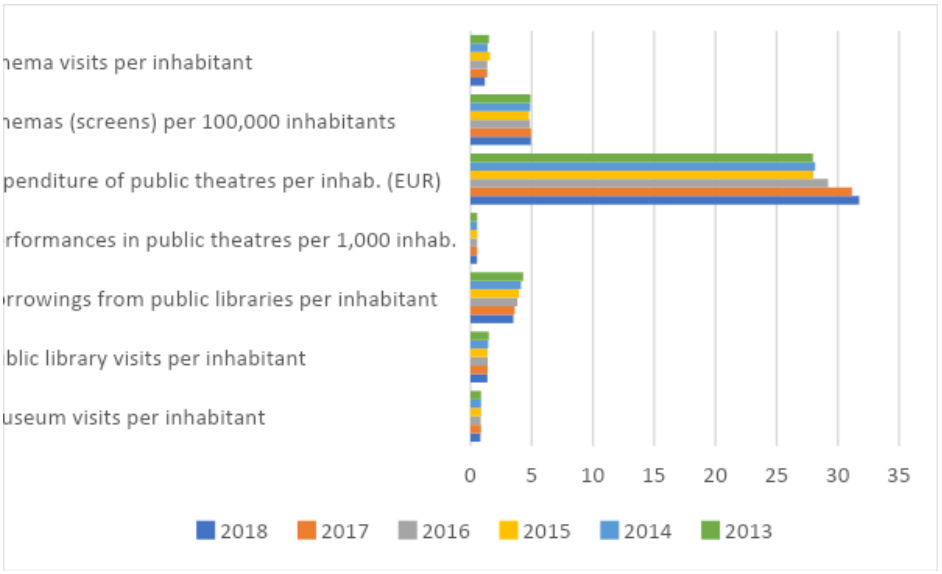
Figure 11 shows the number of dwelling stock in residential and non-residential buildings with three or four roomed residential and non-residential buildings being more in number compared to the two roomed apartments.

Figure 11: Number of rooms in residential and non-residential buildings



Source: Federation Statistical Office, Wiesbaden [accessed October 2020]

Figure 12: Cultural indicators



Source: Federation Statistical Office, Wiesbaden [accessed August 2020]

Figure 12 lists a number of Cultural indicators including number of cinema screens per 100,000 inhabitants, cinema visits per inhabitant and the highest expenditure on public theatres per inhabitant which was at 31.74 euros in 2018 and continues to remain high between the years 2013-2017.

5. Environment

The need for major reforms in policy and structural changes was escalated by the growing environmental pollution within the region (Dahlbeck and Gartner, 2019; Schepelmann et al, 2015; Taylor; 2015) due to mining and heavy industrial effluents flowing into the river and polluting the soil, air and waterbodies, subsequently.

Following the deindustrialisation of the region's fossil fuel industry and the growing emphasis on cleaning the heavily polluted region, there was a gradual shift towards the 'greening of the economy' using low carbon technology (Barnes et al, 1999; Dahlbeck and Gartner, 2019). This led to major economic restructuring.

The regional state government of NRW (NRW State, 2016) emphasised restoring the environmental health of the region by incorporating sustainability strategy within its restructuring policies (NRW State, 2016; Muller and Reutter, 2017). This led to the development of the NRW Sustainability Strategy (NRW State, 201). Of special emphasis was NRW state government's attention to the following policy areas: 'Climate Protection Plan, Green Economy Strategy, Biodiversity Strategy, Sustainable Financial Policy, Sustainable development of urban areas and neighbourhoods, Demographic change and suitable neighbourhood for the elderly' (NRW State, 2016:13). This reflects the region's focus on inclusivity and sustainability.

The NRW state government identified 19 fields which cover the 17 sustainable development goals. These include (NRW State, 2016:12):

- Climate protection and energy transition;
- Sustainable economy;
- Natural resource Protection: biodiversity, forests, water, land, soil, air and environmental health;
- Demographic change;
- Social cohesion and participation;
- Decent work—fair work;
- Integration;
- Sustainable financial policy;
- Sustainable urban development;
- Sustainable mobility;
- Sustainable consumption/sustainable lifestyles;
- Land cultivation;
- Health;
- One-world policy / European and international dimension;
- Gender equality;
- Inclusion;
- Sustainable municipalities (local agenda);
- Civic involvement / participation; and
- Education and science;

Green Infrastructure Ruhr (2017) is another strategic plan, alongside the NRW Sustainability Strategy, which promotes smart, sustainable and inclusive growth which is part of the EU Biodiversity Strategy 2020 (Rodrain, 2017). The strategy supports a shift towards a resource-efficient, low carbon, sustainable economy by investing in natural capital through the green urbanism programme where local and regional blue-green infrastructural development is supported by integrating green spaces within urban areas (Rodrain, 2017).

- This aims to reduce carbon emissions and also promote eco-friendly mobility, create green jobs, skills and knowledge (Stroud et al, 2014; Schmid, 2018).
- The shift towards a low carbon economy is promoted through the sustainable energy transition within the Ruhr and Emscher region including the NRW state and was initiated by the Federal and Regional government (Taylor, 2015; Schepelmann et al, 2015; Sheldon et al, 2018)
- The State of the Environment Report in the Ruhr Metropolitan area stated a few areas where aspects of sustainability can be improved in the future (RVR, 2017). These areas include

reduction of pollution levels such as NO2, reduction of noise, other greenhouse gases and develop new renewable energy initiatives. Public transport was also developed further to shift towards sustainability (RVR, 2017).

- Air quality guidelines set by the World Health Organisation indicates that 10 cubic metre is the average annual threshold for particulate matter (PM) in the atmosphere (WHO, 2018). Table 9 shows the gradual cleaning of the air and a declining trend of the mean population exposure to particulate matter from 2012-17, although the 2017 level remains above the recommended safe level of 10 cubic meters.
- This was a result of the 'Sky above the Ruhr must turn blue again' policy adopted by the NRW state to reduce the amount of environmental pollution and decline in air quality as a result of the coal and steel industry in the region (Taylor, 2015).

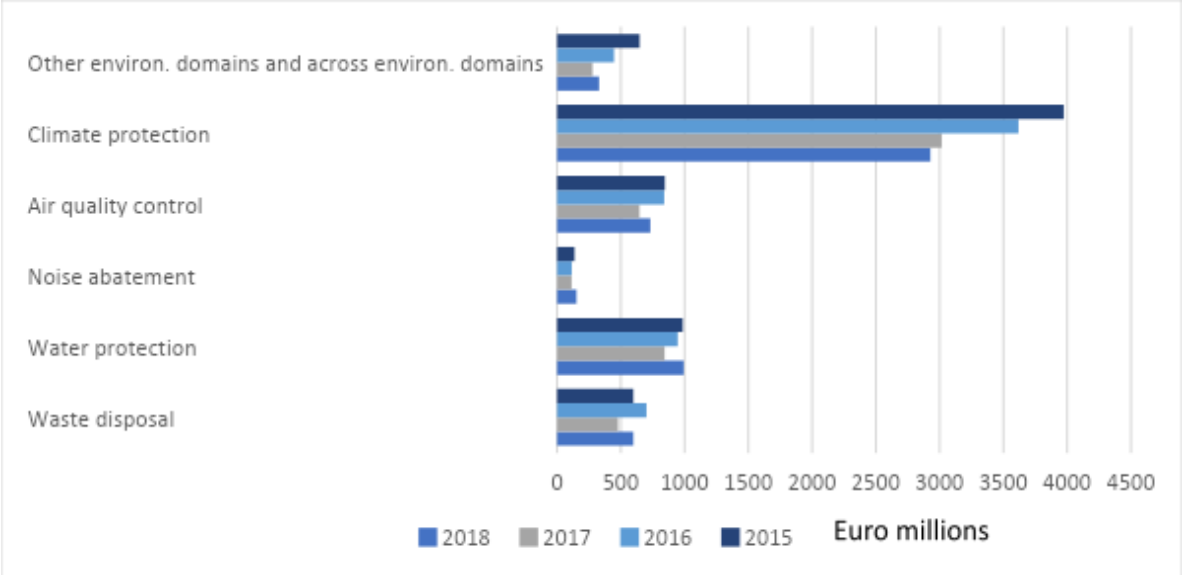
Table 9: Mean population exposure to air particles (with 10 cubic metre as the average threshold) from 2012-17

Year	Particulate matter
2012	16.9
2013	15.9
2014	15.5
2015	15.9
2016	14.9
2017	14.9

Source: OECD Stat [accessed August 2020]

Figure 13 shows that climate protection is the highest in the survey of environmental protection expenditure of goods and services in NRW state for the years 2015-2018. This was followed by water protection and air quality control and others.

Figure 13: Survey of environmental protection expenditure of goods and services



Source: Federation Statistical Office, Wiesbaden [accessed August 2020]

Analysis

Local political challenges and their resolution

- Heavy government subsidies and short-term investment following local economic restructuring within the coal and steel industry contributed to the delaying of the collapse of the industrial economy (Dahlbeck and Gartner, 2019; Schepelmann et al, 2015).
- Environmental pollution in the Ruhr Valley region played an important role in influencing policies of the regional and state government.
- New investments were made in renewable energy technology to keep pollution levels under control and new sources of employment were created within the renewable energy sector which paved the way for sustainable development in the region (Cooke, 1999; Taylor, 2015; Schepelmann et al, 2015; Sheldon et al, 2018).
- New collaborations were also established between academic institutes, centres of research, innovation and technology and the industry including development of environment and sustainability standards agency (Taylor, 2015).
- These institutions operated autonomously as part of a decentralised system and were positioned between the regional government and the local municipality. These were instrumental in engaging with local groups and stakeholders to develop priority projects that were aligned with the national and regional policies.
- They also leveraged funds and resources from both public and private organisations to implement the policies.
- These new structures were centred around the institutionalisation of partnership working based on new, effective networks and new SMEs.

Governance arrangements and capacity

- The neo-industrialisation process re-defined the role of the local, regional government including the local stakeholders in the designing of policies and strategies. The previous

nationalised, top down approach was changed to a bottom-up one with more power to and a defined role for the devolved government. This decentralisation provided the autonomy for the regional government to allocate resources in response to needs (Cooke, 1999; Bross and Walter, 2000).

- The Ruhr Valley had a polycentric or a decentralised governance system with multiple systems operating at different levels which functioned autonomously. Applying Ostrom's analysis, decisions were informed by local understandings of the problem by local actors using local knowledge (Ostrom, 2010). Solutions were designed accordingly, using a trial and error method (Ostrom, 2010).
- The restructuring process benefitted from the involvement of local stakeholders as inputs from them were used to understand local problems and develop new policy strategies as part of the solution.
- This was illustrated in the way new renewable technology policies were designed. Arising out of a need to clean the environment, the state of NRW changed its industrial policy to a new technology policy driven by environmental considerations. This encouraged the growth of environmental technology and renewable resources which paved the way for new and innovative structural and technological changes (Dahlbeck and Gartner, 2019; Hospers, 2004).
- The regional renewal programme led by private firms and local parties also was instrumental in paving the way for a new bottom-up governance structure, for example the Initiative IBA (Emscher Park International Building Exhibition) from 1989-99 (Hospers, 2004).
- Economic restructuring entailed more devolved powers trickling down to the various layers of the governance system. Capacity was enhanced through new collaborative (private and public) partnerships and clusters between industry, SMEs and academia.
- The partnerships were based on trust, co-operation and social capital where collaborations took place in a transparent way underpinned by the free flow of information (Stroud et al, 2014) and strong interpersonal relationships (Cooke, 1999).
- These inter-personal relationships have been instrumental in paving the way for innovative production between spatially proximate firms which are dependent upon each other to grow and regenerate. Such a process required firms to adopt collaborative links using the 'mittelstand model' where strong interdependencies promoted growth and economic restructuring in a region in order to promote regional competitiveness (Cooke, 1999; Barnes et al, 1999; Taylor, 2015).

Accountability

- The devolved fiscal powers of the federal state in Germany meant that the policies and programmes that were designed by the NRW state had a strong impact on the restructuring of the Ruhr Valley region.
- The engagement of external stakeholders led to autonomous review committees being set up to monitor, review and assess the progress of projects (Bross and Walter, 2000; Dahlbeck and Gartner, 2019).
- For example ZIMs, set up to create programmes to reskill workers, had their performance reviewed by an inter-ministerial committee set up by the federal state to assess strengths and weaknesses and various strategies were developed to ensure that resources are utilised for the purposes which they have been allocated.

Observations on findings and good practices

Lessons emerging from the Ruhr Valley case study are:

- **Collaborate with local stakeholders:** Change was implemented through a bottom-up approach by being inclusive and taking account of the views of different stakeholders and local participants with a strong steer from the regional organisations. This helped in rebuilding skills by engaging external organisations that were locally based (Stroud et al, 2014; Taylor, 2015). The initial failure to restructure was mainly because of institutional lock-in and deep-seated prejudice amongst larger organisations in the region, who were reluctant to diversify and to adapt to globalisation.
- **Develop an adaptive training programme:** Skills such as mechanical and electronic engineering that were relevant in the previous industrial economy were applied to the green economy (e.g. wind and solar power). Therefore, skills training in certain areas of the economy needed to respond to market needs to develop proper reskilling programmes (Stroud et al, 2014)
- **Adapt, diversify and adjust to changing market scenario**: Diversification of existing regional assets contributed to the restructuring of the region. For instance, the previous steel industry diversified by merging with new automotive, mechanical and electronics industry; and the coal industry diversified by investing in renewable energy technologies to meet the changing needs of the global, European and regional markets.
- **Plan strategically to restructure from within through internal diversification**: An important lesson from Ruhr Valley's success story is strategic planning of the Emscher river region by "revitalisation from within" and through inward investment which was one of the catchphrases of the Emscher River-restructuring programme (Cooke, 1999; Taylor, 2015).
- **Regional autonomy enabled targeted regional policies and appropriate resource allocation:** The development of targeted regional policies prompted the growth of innovation in science and technology in the NRW region including the number of patents in the NRW state. It also enabled appropriate resource allocation which provided the necessary development stimulus.
- **Regional restructuring is a lengthy process**: Restructuring of the Ruhr Valley took place in phases and the development of the region took years.
- **Restructuring should respond to region-specific issues and problems:** Hayek described complex systems as 'not self-contained units' but dynamic and everchanging (Festre, 2018). Hence, every systemic solution will need to take into account regional specifics and particularities which will lead to specific outcomes that are path dependent (Festre, 2018).

To sum up, **the factors that contributed to the Ruhr Valley's economic restructuring** were (Cooke, 1999; Hartmann 2000; Taylor 2015):

- Growth and investment in innovative technology;
- Industry specific applied research and development;
- Institutions and partnerships with non-governmental organisations, trade unions and educational institutions;
- The development of technology parks with improved transport infrastructure;
- The import of capital goods;
- Political and economic liberalisation;
- Innovative entrepreneurship; and
- Sustainable and green economic development.

Conclusion

The Ruhr Valley case study is an example of the economic restructuring of a region following large-scale deindustrialisation. It has moved to a neo-industrial system characterised by diversification in the economy which promoted innovation and new enterprises by developing new collaborative and inclusive ways of working. However, this was not a linear process. The transition took place in phases shifting from a centrally managed system where heavy manufacturing was subsidised, to a growing service sector explaining the slow economic restructuring process at the outset. With the need to meet global market demands and increase in regional competitiveness, diversification became necessary. This was achieved by investing in new technology and industries. Such inward investment and diversification including the reskilling of redundant employees necessitated the devolution of additional powers to the regional government in order to attract funds for investment in critical areas. It also required new and innovative ways of working based on trust, cooperation and extensive partnership between diverse stakeholders in the region. These factors stimulated investment which in turn facilitated the transition and restructuring of the regional economy.

References

Amin A. and Cohandet P. (1999). Learning and Adaptation in Decentralised business networks. Environment and Planning D. 17, 87-104

Amin A. (2002). An Institutionalist Perspective on Regional Economic Development. International Journal of Urban and Regional Research, Vol. 23(2): 365-378

Barnes T.J. and Gertler M.S. (1999). The New Industrial Geography

Bross U. and Walter G.H. (2000). Socio-economic Analysis of North Rhine Westphalia. Joint Research Project Inco-Copernicus. Institute Systems and Innovation Research

Cooke P. (1999). The Co-operative advantage of regions in Barnes T.J. and Gertler M.S. edited, The New Industrial Geography

Dahlbeck E., Gartner S. (2019). Just Transition for Regions and Generations. WWF Germany.

DPMA. German Patent and Trademark Office https://www.dpma.de/english/patents/index.html [accessed August 2020]

DPMA 2018. Annual Report 2018. German Patent and Trademark Office

DPMA 2019. Annual report 2019. German Patent and Trademark Office

Eurostat (2019). European Commission. https://ec.europa.eu/eurostat/web/main/home [accessed June, July 2020]

Federation Statistical Office, Wiesbaden https://www-genesis.destatis.de/genesis/online [accessed August 2020]

Festre A. (2018). Hayek on Expectations: The Interplay between two complex systems. GREDEG Working Paper Series.

Guth M. (2005). Innovation, social inclusion and coherent regional development: a new diamond for a socially inclusive innovation policy in regions, European Planning Studies, 13:2, 333-349

Hartmann C. (2008). Work Package 4: Structural Change and Globalisation. Case Study North Rhine Westphalia. Prepared for European Commission Directorate General Regional Policy, Policy Development Evaluation Unit

Hassnik R. (1992). Regional Innovation Policy: Case Studies from the Ruhr Area, Baden Wurtemberg and the North East of England,

Hospers, Gert-Jan. (2004). Restructuring Europe's rustbelt: The case of the German Ruhrgebiet, Intereconomics, Vol. 39 (3): 147-156

Kroll H. and Meyborg M. (2014). Regional Innovation Monitor Plus. Regional Innovation Report, NRW

Muller M. and Reutter O. (2017). Vision Development towards a Sustainable NRW2030 in a Science-Practice-Dialogue. Sustainability, 9:1111

NRW. Invest Germany (2016). New Opportunities in NRW. Your No.1 Investment Location in Germany

North Rhine Westphalia State. (2016). Ministry for Climate Protection, Environment, Agriculture, Nature and Consumer Protection of the State of North Rhine-Westphalia. Sustainability Strategy.

https://www.nachhaltigkeit.nrw.de/fileadmin/download/sustainability_strategy_for_north_rhine-westphalia.pdfhttps://www.nachhaltigkeit.nrw.de/fileadmin/download/sustainability_strategy_for_north_rhine-westphalia.pdf [accessed July 2020]

OECD Stat. https://stats.oecd.org/index.aspx?queryid=82437 [accessed August 2020]

OECD Stat. 2018. Regions and Cities at a Glance 2018-Germany

Ostrom E. (2010). Polycentric systems for coping with collective action and global environmental change. Global Environmental Change 20, 550-557

Regional Verband Ruhr (2017). Report on the State of the Environment in the Ruhr Metropolitan Area

RVR Databank https://www.rvr.ruhr/daten-digitales/regionalstatistik/ [accessed June 2020]

Rodrain-Schwarze M. (2017). Green Infrastructure Ruhr. Platform for Integrated Solutions. Milano

Schneider-Hippach U., Krause M., Woll C. (2007). Vocational Education and Training in Germany. Cedefop Panorama series; 138. European Centre for the Development of Vocational Training

Schepelmann P., Kemp R., Klement J., Scheneidwind U. (2015). The Eco-restructuring of the Ruhr district as an example of a managed transition. Handbook on Sustainability Transition and Sustainable Peace. ResearchGate Publication

Schwarze-Rodrian, M. (2016). Ruhr Region Case Study in Carter, D.K. (ed.), Remaking Post-Industrial Cities: Lessons from North America and Europe. Routledge

Sheldon P., Junankar R., Pontello A De R. (2018). The Ruhr or Appalachia? Deciding the Future of Australia's coal power workers and communities. Industrial Relations Research Centre

Stroud D., Fairbrother P., Evans C. Blake J. (2014). Skill Development in the transition to a 'green economy': A 'varieties of capitalism' analysis. Economic and Labour Relations Review 25 (1): 10-27

Taylor R.P. (2015). A Review of Industrial Restructuring in the Ruhr Valley and Relevant Points for China. Institute for Industrial Productivity

Winden van W., Berg van den L., Carvalho L., Tuijl V. E. 2011. Manufacturing in the New Urban Economy, Regions and Cities. Routledge, UK

World Health Organisation. (2018). Exposure to ambient air pollution from particulate matter for 2016. https://www.who.int/airpollution/ambient/AAP_exposure_Apr2018_final.pdf