Regional Studies

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/cres20

# From the city of steel to Germany's 'China City': economic restructuring, the EU–China transcontinental railway and infrastructure-led development in Duisburg

Kean Fan Lim & Kristin Limbach

**To cite this article:** Kean Fan Lim & Kristin Limbach (2023) From the city of steel to Germany's 'China City': economic restructuring, the EU–China transcontinental railway and infrastructure-led development in Duisburg, Regional Studies, 57:9, 1731-1746, DOI: 10.1080/00343404.2022.2149727

**To link to this article:** https://doi.org/10.1080/00343404.2022.2149727



Published online: 05 Jan 2023.

REGIONAL STUDIES
2023, VOL. 57, NO. 9, 1731–1746
https://doi.org/10.1080/00343404.2022.2149727



# From the city of steel to Germany's 'China City': economic restructuring, the EU–China transcontinental railway and infrastructure-led development in Duisburg

Kean Fan Lim[a] and Kristin Limbach[b]

**ABSTRACT**

This paper critically evaluates the prevailing World Bank recommendation for city-regions to drive infrastructure-led development through targeted spatial plans. Introducing a novel analytical framework to conceptualize Duisburg's evolution into the primary European gateway for the EU–China transcontinental railway, the paper demonstrates how key actors and institutions operating across multiple scales enabled this previously deindustrializing German city to benefit from the new transcontinental rail connection. It argues that one-off spatial planning is insufficient for actualizing infrastructure-led development: this process involves a dynamic interaction with inherited industrial pathways that recursively stimulates the repurposing and/or the revision of infrastructure-oriented developmental plans.

**KEYWORD**

infrastructure-led development; deindustrialization; steelmaking; EU–China transcontinental railway; Duisburg; China

**JEL** O18, O52, R11

**HISTORY** Received 19 May 2022; in revised form 7 November 2022

## 1. INTRODUCTION

> Duisburg has become by far the most important hub in Europe for Chinese trains. Every map you see in China there are two cities illustrated for Germany: Berlin and Duisburg — very often Duisburg is printed a little bit bigger.
> (Erich Staake, chief executive officer (CEO) of Duisport, *Politico*, 2018)

On 11 April 2016, 16,000 steelworkers rallied in the German city of Duisburg to protest against deindustrialization, unfair international competition and a potential loss of employment. Widely known as the city of steel, Duisburg is the home of the largest plants of ThyssenKrupp, a major steelmaker in the European Union (EU). The protests generated substantial attention after it became apparent that ThyssenKrupp was seeking to scale down its European steelmaking operations, a prospect that could lead to thousands of job losses. Underpinning the protest was the suppression of world market prices by Chinese steelmakers – that is, price dumping – as production volumes increased by 623% in China between 2000 and 2015 while the Duisburg region experienced a 7% decline over the same period (IHK Niederrhein, 2016).

Yet, in a development that reflects emergent new economic geographies from the 2008 global financial crisis, Duisburg was also the location where the Chinese President, Xi Jinping, visited in 2014 to officially celebrate the EU–China transcontinental freight rail connection (Figure 1). Rail connections between Duisburg and other Chinese cities have increased substantially since the first link was established with the interior Chinese city-region of Chongqing in 2011. The city's mayor, Sören Link, proclaims 'We are Germany's China City' after data in 2018 reveals around 80% of all EU-bound trains from China would first arrive at Duisburg (*The Guardian*, 2018). This new role reflects the economic

**CONTACT** Kean Fan Lim keanfan.lim@newcastle.ac.uk
[a] Centre for Urban and Regional Development Studies (CURDS), School of Geography, Politics & Sociology, Newcastle University, Newcastle upon Tyne, UK
[b] University of Strasbourg, Strasbourg, France

This article was originally published with errors, which have now been corrected in the online version. Please see Correction (http://dx.doi.org/10.1080/00343404.2023.2166701)
This article has also been corrected with minor changes which do not impact the academic content of the article.


**Figure 1.** Transformative conjuncture: key actors celebrating the EU–China transcontinental rail connection in Duisburg, 29 March 2014: (from left) Lord Mayor of the city of Duisburg, Sören Link; Vice Chancellor of Germany and Economy and Energy Minister, Sigmar Gabriel; President of China, Xi Jinping; Prime Minister of the German State of North Rhine-Westphalia, Hannelore Kraft; and chief executive officer (CEO) of Duisburger Hafen AG (Duisport), Erich Staake.
Note: The roles of these actors refer to the official positions they held at the time the photograph was taken.
Source: © Duisport/Rolf Köppen, reproduced with kind permission.

benefits of Duisburg's position as a break-of-bulk point in the transcontinental railway. Once the hallmark of West Germany's impressive post-Second World War economic recovery and then a focal point of deindustrializing pressures after the mid-1970s, Duisburg's economic resurgence and its enhanced positioning within global logistics and production networks appear to exemplify a globally oriented form of infrastructure-led development that Schindler and Kanai (2021) term 'getting the territory right'. If this is the case, how, then, did Duisburg get it 'right'?

This paper addresses this question by conceptualizing Duisburg's evolution into a global logistics hub through a multi-actor, multi-scalar and historically grounded analytical framework. It delineates and explains how key actors and institutions operating across multiple scales – the Ruhr region, the German federal state, the EU, the Chinese metropolis of Chongqing, and global trading and production networks – enabled Duisburg to benefit from infrastructure-led development. In doing so, the paper adds a conjunctural dimension to Schindler and Kanai's (2021) observation that infrastructure-led development has become a major growth strategy after the 2008 global financial crisis. The key focal point of this conjunctural approach is not only how historical events explain a particular process, but also how spatial relations produce and/or sustain this process. It provides an analytical framing of infrastructure-led development in Duisburg (and potentially other deindustrializing city-regions) as a *dynamic interaction* between inherited developmental pathways established well before 2008 and the changing spatial relations of these pathways.

Of historical significance is the longstanding role of steelmaking as the predominant developmental pathway in Duisburg since the Second World War. How Duisburg got its developmental strategy 'right' occurred *in tandem* with continuities and changes in its steelmaking-oriented economic structure. These processes overlapped but could not be exclusively attributed to the two historical periods – 'neoliberal rollback' (early 1970s to late 1980s) and 'neoliberal rollout' (late 1980s to 2008) – that Schindler and Kanai (2021) presented as preceding the post-2008 infrastructure-led developmental moment. In Duisburg's case, the sectoral enhancement of logistics occurred *during* the 'neoliberal rollback' and 'neoliberal rollout' periods, largely in response to deindustrializing pressures. While new infrastructural capacities established during these periods were insufficient for jumpstarting strong growth, local actors in Duisburg created and repurposed assets and capacities through leveraging connections to the EU. These restructuring efforts enabled the Duisburg logistics sector to join a new global growth coalition when the opportunity to launch the EU–China transcontinental railway emerged.

Specifically, infrastructure-led development in Duisburg gained international prominence following a distinct change in EU–China political–economic engagement that Casarini (2006) terms 'from constructive engagement to strategic partnership'. This change was and remains enabled by the 'Go Abroad' programme and the Belt and Road Initiative (BRI) in China that encourage Chinese firms to drive transnational production networks as 'lead firms' in and through

developed economies in the EU and North America (cf. Lim, 2010; 2018). Underpinning this globalizing process is the Chinese state's strategic emphasis on enhancing transnational infrastructural connectivity. These emergent scalar interdependencies emplaced steelmaking and port logistics, once so inextricably intertwined in Duisburg between the 1950s and the 1980s, within increasingly parallel developmental pathways. Yet it is noteworthy that the logistics sector generated growth not simply because of one-off spatial planning for the transcontinental railway – its emergence was embedded within economic restructuring efforts over the past three decades.

This evolutionary process will be examined through the juxtaposition of four empirical sources derived through four years of fieldwork (2017–20), namely (1) statistics and policy documents published in Germany; (2) media and research reports on the EU–China transcontinental railway, particularly those published in Germany and China; (3) semi-structured interviews with 15 business representatives in Duisburg; and (4) interviews with six managerial executives who have been directly involved in Duisburg's engagement with China through the transcontinental railway. Because the executives waived anonymity, these interviews allow the paper to present a more precise cross-reference to and validation of information from the first three sources. In turn, they enhance the paper's explanation of a new wave of growth in Duisburg after the EU–China transcontinental railway started operations in March 2011.

The remainder of the paper is structured as follows. Section 2 addresses what Glass et al. (2019, p. 5) term the 'fundamental and complex' question of how infrastructure drives regional development by foregrounding the conjuncturally specific roles of actors and institutions. Three key concepts in evolutionary economic geography – path generation, path dependency and lock-in – are integrated in this framework to demonstrate how the growing importance of logistics emerged out of a longstanding restructuring trajectory that previously did not show promising signs of rejuvenation. Section 3 demonstrates how the Duisburg economy recovered from the Second World War through a dynamic steelmaking pathway before new growth pathways such as logistics emerged. Section 4 examines how political and economic actors at the city-regional (especially within Duisport), national (Germany) and transnational (EU and China) level built on the pre-existing restructuring efforts to deepen EU–China economic integration through the transcontinental railway. The conceptual contributions of the analysis and two future research directions are presented in the conclusions.

## 2. INFRASTRUCTURE-LED DEVELOPMENT IN DEINDUSTRIALIZING REGIONS: A CONJUNCTURAL ANALYTICAL APPROACH

Globally oriented infrastructure-led development has re-emerged as a major growth strategy for subnational regions. Espousing this strategy is a group of World Bank consultants who believe the essence of new growth after the 2008 global financial crisis lies in enhancing place-based competitiveness through global connectivity (World Bank, 2009). 'Spatial planning', Schindler and Kanai (2021, p. 45) observe, 'is identified as the missing ingredient in earlier rounds of neoliberal reform', so the World Bank's post-2008 policy recommendation 'is to "get the territory right" through internationally coordinated investments in networked infrastructures, and to produce territories that can be "plugged in" to competitive global networks of production and trade'. Insofar as regions possess the necessary infrastructural preconditions, so the logic goes, their chances of partaking in and benefiting from the global circuits of production, trade and investments would be augmented. While this recommendation appears to be built on seemingly universal themes of connectivity and economic integration, it is immediately complicated by the conjunctural nature of shifting developmental needs in time and place. Where, indeed, are the territories that can distinguish themselves as 'right' at a particular point in time?

From a global systemic perspective, the 'right' territory would arguably offer what Danyluk (2018, p. 630) terms a 'logistical fix' to the 'chronic problem of overaccumulation'. The production of such a 'fix' through infrastructural construction would sustain the generation of surplus value through goods circulation, service provision and localized investments. This perspective is especially salient for understanding why Duisburg became an important hub for EU–China economic integration. After all, as Danyluk (2018, p. 641) correctly observes, 'emerging production centers in China, Japan, and Southeast Asia had to be articulated with existing consumer markets in the global North by way of rapid and efficient systems of goods movement'. And Duisburg clearly offered a 'logistical fix' – first for China-based producers and subsequently for European businesses – by enabling two-way access between the EU and China markets through the transcontinental railway.

This said, a global systemic angle cannot fully explain why some places develop capacities to become the 'right' logistical fixes while others are unsuccessful even after trying. In Duisburg's case, it does not explain why, despite the longstanding attempts to develop the logistics sector as part of the city's economic restructuring efforts, these sectors could *not* offer the degree of global economic integration (and its associated growth benefits) *until* Duisburg became the hub of the EU–China transcontinental railway. As this paper will show, the emergence of a new logistics-oriented developmental pathway in Duisburg was part of a longstanding attempt at economic restructuring in the Ruhr region rather than an outcome of one-off spatial planning (see next section). Understanding infrastructure-led development from this evolutionary vantage point raises two specific questions.

First, there is a need to consider the economic contributions (or lack thereof) of *pre-existing* regional-level infrastructure and the extent to which these capacities could meet longer term developmental goals. Second, it is necessary to determine what kinds of flows – trade, travellers, workers, raw materials, etc. – are required to drive

new growth *holistically* through either repurposing existing infrastructure or adding new capacities. This approach entails shifting the geographical focus *beyond* the territory seeking the 'right' infrastructure: it asks (1) what flows across different geographical scales – urban, regional, national, transnational – are required to generate new growth opportunities; and (2) the extent to which these flows require infrastructural upgrades within a particular region. More importantly, what count as opportunities at one point in time may no longer be so in the future. And this is where a conjunctural approach to explaining infrastructural-led development in Duisburg becomes critical.

Conjunctural analysis, to follow Peck (2017, p. 10), must be 'attentive to issues of contextual, positional and situational specificity, resisting the temptation to read off global trends from particular circumstances'. To understand how this 'specificity' has come about entails understanding how events built up over time to produce place-specific phenomena. At the same time, however, the analytical focus cannot be solely temporal. As Leitner and Sheppard (2020, p. 495) argue, conjunctural analysis needs to be 'spatialized' because this:

> stretches explanatory frameworks not just backwards in time, but also outwards in space (identifying how local events are shaped by distant processes), and upwards and downwards in terms of geographical scale (whereby events at a particular scale may be shaped by both higher and lower scale processes).

A spatialized conjunctural analysis of Duisburg's recent ability to enhance its global logistical connectivity through the EU–China railway therefore needs to focus on both the *historical conditions* that produced this ability as well as the *changing spatial relations* that shaped these historical conditions.

This conjunctural approach directly problematizes the World Bank's cross-contextual policy recommendation on spatial plans for infrastructure-led development: any territorially targeted plan *necessarily* interacts with that territory's *evolving* positions within regional, national and transnational economic structures. As such, this paper adds to recent research that demonstrates how regions are made and remade by logistical infrastructural investments (Coe, 2020; Glass et al., 2019; Hesse, 2020) by spotlighting how the 'remaking' process does and could not occur on a tabula rasa. Specifically, the process of transforming regions into 'logistical fixes', to reborrow Danyluk's (2018) term discussed above, could be more incisively understood and explained through an evolutionary approach that incorporates the preceding and prevailing regional industrial structures. To this end, the paper proposes in Figure 2 a framework for analysing deindustrializing regions that were *already* well-connected to other regions and countries through earlier rounds of infrastructural investments (more on this shortly). For these regions, the core developmental challenge is whether repurposing and/or additional investments in infrastructural capacities could generate a new developmental path that supersedes the decline of the former growth-generating pathway(s).

Here, it would be helpful to focus on the *region-wide* aspects of economic path generation, path dependence and 'lock-in' in deindustrializing regions. Arguably the most common definition of path dependence, first developed in research on historical institutionalism, is the dependence of current and future actions/decisions on the outcomes of previous actions or decisions. As Page (2006, p. 89) puts it, path dependence 'requires a build-up of behavioural routines, social connections, or cognitive structures around an institution'. Economic-geographical research has extended this institutional focus to dominant industries, firms and/or institutions within specific regions (Hassink, 2010; Martin & Sunley, 2006). Central to this process is the eventual formation of what Grabher (1993) terms structural 'lock in' within a particular region, whereby an industry or sector becomes effective or feasible because many people within this region have actively become embedded within this industry/sector. Groups of 'locked in' actors are thus very likely to resist path alterations because their interests could be compromised by the proposed changes.

Cognizant of how focusing on path dependence and 'lock in' has overshadowed studies of how and why paths *emerged*, Martin and Sunley (2006, p. 408) call for an understanding of 'path as process', through which 'the process of economic evolution must be understood as an ongoing, never-ending interplay of path dependence, path creation and path destruction'. Research has further situated the path creation process through a geographical political economy lens that considers not only the immediate territories in which firms and industries are located, but also the interconnections between these territories across multiple scales. As Pike et al. (2009, p. 178) explain, this approach would enable research on regional evolution and development to 'dissect the causal relations, mechanisms, and processes that matter to our explanations'. Similarly, MacKinnon et al. (2019, p. 116) argue for research on regional path creation to consider 'broader processes of capital accumulation, state regulation, and uneven development'. These foci on intra- and extra-region relations correspond to and underpin the spatialized conjunctural approach as outlined above.

Building on these conceptual advances, this paper develops a dynamic analytical framework for examining infrastructure-led development in Duisburg as a conjuncturally specific process. Presented in Figure 2, this framework situates new path generation through globally oriented infrastructure development plans within regional contexts shaped, to varying degrees, by path dependencies. As the top of Figure 2 indicates, infrastructural developmental plans *interact* with pre-existing developmental challenges, many of which could not be overcome within a short period of time. This is because the shocks generated by deindustrialization need not instantly trigger transformative change. MacKinnon (2012, p. 234) offers an incisive perspective in this regard: 'While new paths can emerge out of crisis scenarios and the destruction of previous paths, they are also associated with a range of other circumstances related to adaptation, incremental change and growth.' As the middle part of Figure 2 indicates, new path formation through

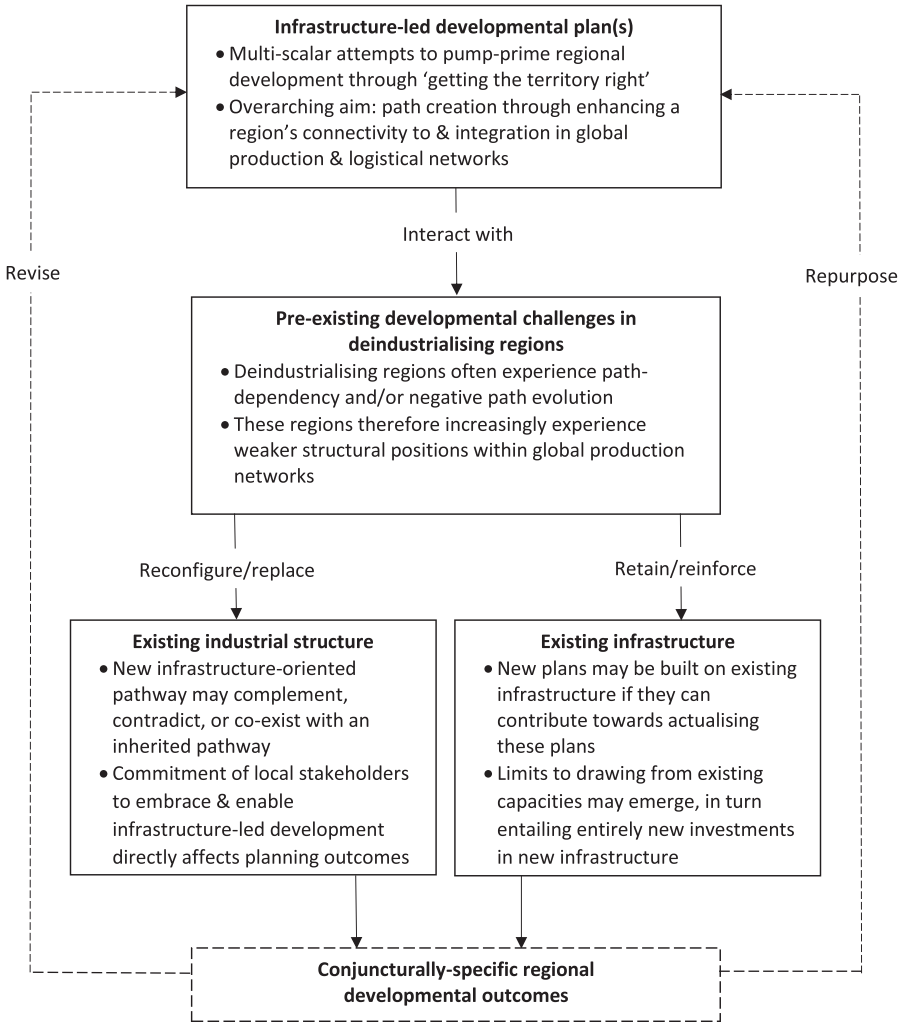


**Figure 2.** A conjunctural analytical framework on infrastructure-led development in deindustrializing regions. Source: Authors.

infrastructure-led development plans is an open-ended process that involves negotiating the pre-existing economic structure as well as the inherited infrastructure. And even so, growth at both sectoral and regional levels could not be predetermined. The outcomes, as the next two sections will elaborate, are conjuncturally specific and could lead the actors involved to revise and/or repurpose existing infrastructure development plans.

## 3. PATH AS PROCESS: DEINDUSTRIALIZATION, STRUCTURAL CHANGE AND THE EMERGENCE OF INFRASTRUCTURE-LED DEVELOPMENT IN POST-SECOND WORLD WAR DUISBURG

### 3.1. The emergence of path instability

Duisburg experienced a growth trend during the immediate post-war period (1945–50) after coal production resumed in the broader Ruhr region. A decline in economic activity ensued after the coal market shrank at the beginning of the 1950s. Protests and strikes against the closure of steel plants prolonged the transition period. The majority of the working population worked in a small number of large steel plants, to the extent that 40% of workers were employed in 0.3% of all firms in the region by 1985 (Zimmermann et al., 2017). The regional labour market primarily depended on these plants.

Problematic signs emerged during the 1950s. A serious mining crisis was followed in 1958 by a coal crisis which lasted an entire decade. With the Western Alliance opening up to international markets, cheaper coal imports from the United States as well as cheap oil from the Gulf States began competing with local energy providers. These developments sent the Ruhr region into economic recession in 1967 (Röhl, 2019). In 1968, all mining companies merged into Ruhrkole AG, produced fixed amounts of coal (which dropped from 123.2 to 8.6 million tons annually), and were subsidized through the National Coal Act (Keil & Wetterau, 2013). The year 1973 saw not only the oil crisis but also the steel crisis due both to intensifying global-level market liberalization and an increasing preference for plastic and ceramics rather than steel for lightweight constructions. New falls in oil prices and further imports of cheap mining products occurred in 1980 (Röhl, 2019).

This rolling series of crises generated severe economic decline in Duisburg. The city was among those with the

highest gross value added, highest tax revenues and lowest debts in 1970, but its position changed dramatically shortly thereafter. A strong reliance on the manufacturing sector emerged, providing 58.5% of total employment. Reflecting path 'lock in', this focus barely changed in the 1990s (44%), even though the total number of employed shrunk drastically (IHK Niederrhein, 2016) (see also section 2). Across the Ruhr region, the share of employment in the secondary sector decreased from 61.3% in 1961 to 33.3% in 2000 (Hospers, 2004). Demand for mining products (i.e., hard coal, steel and coal industry) had permanently decreased since the 1960s (Rommelspacher, 1998). A total of 470,000 jobs were lost by 1995, representing a 26% contraction in employment. As Tables 1 and 2 indicate, Duisburg experienced a substantial population loss in 1977, while unemployment rates remained persistently high at an average of above 14% between 1998 and 2015 (vis-à-vis 0.6% in 1970; Wódz, 1998).

Apart from contributing to a negative debt-to-tax ratio, the high unemployment rate generated increasing demands for social public assistance in Duisburg and thus increased the fiscal budgetary burden (Rommelspacher, 1998). Many ex-mining workers were re-employed in the automotive industry (Opel in Bochum), but older workers remained unemployed and required unemployment benefits (Kopp, 2014; cf. Bosch, 1992). A strengths, weaknesses, opportunities and threats (SWOT) analysis conducted in the late 1980s revealed severely underdeveloped research and development (R&D) capacity that consequently inhibited structural modernization and future competitiveness (Zimmermann et al., 2017).

To be sure, crisis management initiatives were introduced shortly after the nascent signs of trouble. The North Rhine-Westphalian (NRW) state politicians decided in 1968 to launch the 'Ruhr Development Program', which provided an investment volume of DM17 billion (approximately US$4.5 billion, 1968 prices) over a period of five years (Röhl, 2019). Path-changing proved particularly difficult, however. Because the Ruhr region had developed a growth pathway based on good wages in the mining and steel industries, new businesses struggled to operate on lower labour costs. In addition, the stakeholders in the coal and steel industry were reserved about new incoming industries that offered alternative employment (Röhl, 2019). This could be attributed to a general interpretation of the negative pressures in coal and mining as a temporary growth crisis and the consequent disregard for the structural changes in the energy market (Keil & Wetterau, 2013). Regional economic restructuring was, in short, 'locked in' by vested interests in capital, labour and the local and regional states.

### 3.2. The tensions of path generation

A subsequent wave of programmes was implemented to kickstart structural change. Notable for Duisburg are the Future-Initiative Programme for the Mining/iron/steel-area ('Zukunftsinitiative Montanregionen' – ZIM) and the Future Initiative Programme for Regions in North Rhine-Westphalia ('Zukunftsinitiative für die Regionen Nordrhein-Westfalen' – ZIN), although several others were implemented simultaneously with other cities in the Ruhr region. In the Future Initiative, a regional concept was developed that sought the inclusion of technology and innovation funding, qualification measures, investments in infrastructure and in the environment (Röhl, 2019). While this did not reverse the overall structural focus in the Ruhr area (Röhl, 2019), a key result of these restructuring programmes – and one that carved out a new growth path that is now being reinforced through the rail links with China – was the expansion of the Port of Duisburg into Europe's largest inland harbour.

Underpinning this expansion was the introduction of measures for international competitiveness and foreign business attraction in 1990. The port territory was declared duty free and trimodal transportation – that is, the connection of road, rail and waterway at one interface – was enabled with the construction of a railway station for combined bulk goods. A Euro-Logistic-Center was established shortly thereafter in 1991 to develop endogenous regional potential for restructuring the economy towards the service sector (Friedrichs & Küppers, 1998). These new initiatives engendered a temporary economic rebound through strong service sector growth (57.6% Duisburg, 76.2% NRW in 1995). Between 1985 and 1996, the number of firms doubled (up to 400 new companies) and generated an equivalent of 8450 new jobs (Bensch, 1997). Path-generating projects contributed a substantial proportion of these new jobs, namely the inner harbour area re-development into a multimodal service centre (400 jobs), the establishment of a harbour area service centre (300 jobs), the introduction of a technology park (360 jobs) and a new investment by the steel manufacturer Krupp-Hoesch (1000 jobs).

These developments are of conceptual significance for understanding the current moment of infrastructure-led development as presented by Schindler and Kanai (2021): they occurred *during* the periods of 'neoliberal roll back' and 'roll out' and do not overlap neatly with the conjuncturally specific processes of getting institutions and prices right. Institutional support for restructuring has been strong within West Germany since the 1960s and was subsequently reinforced by EU support, while logistics providers were generally price competitive. Yet research continues to demonstrate lingering effects of path dependence and 'lock in' up until the 2000s.

In an influential study by Findeisen and Suedekum (2008) that contrasts churning (employee turnover) with employment growth in German cities, Freising, Munich and Landshut are identified as 'highflying' cities because high turnover is positively correlated to growth. However, highly specialized urban economies (such as one anchored by steelmaking or coal mining) are, by definition, unlikely to have such flexibility, which increases their vulnerability to high degrees of unemployment (and hence lost income) in times of economic adversity. These cities are termed 'depressed' and represent both low churning and low employment growth. Of the 20 'depressed cities', Duisburg had the worst indicator (Findeisen & Suedekum, 2008). This finding corresponds with a study by

**Table 1.** Incoming, outgoing and net population flows for the city of Duisburg, 1977 and 2015

| | State of origin/ destination | 1977 | | | 2015 | | |
|---|---|---|---|---|---|---|---|
| | | Incoming total population | Outgoing total population | Excess incoming total population | Incoming total population | Outgoing total population | Excess incoming total population |
| 01 | Schleswig-Holstein | 166 | 320 | −154 | 111 | 140 | −29 |
| 02 | Hamburg | 78 | 146 | −68 | 99 | 124 | −25 |
| 03 | Niedersachsen | 566 | 794 | −228 | 528 | 693 | −165 |
| 04 | Bremen | 64 | 96 | −32 | 55 | 56 | −1 |
| 05 | Nordrhein-Westfalen (NRW) | 9522 | 14869 | −5347 | 13,375 | 17,103 | −3728 |
| 06 | Hessen | 312 | 731 | −419 | 386 | 586 | −200 |
| 07 | Rheinland-Pfalz | 406 | 766 | −360 | 305 | 356 | −51 |
| 08 | Baden-Württemberg | 376 | 694 | −318 | 450 | 543 | −93 |
| 09 | Bayern | 338 | 651 | −313 | 483 | 493 | −10 |
| 10 | Saarland | 71 | 47 | 24 | 79 | 40 | 39 |
| 11 | Berlin | 151 | 166 | −15 | 213 | 226 | −13 |
| 12 | Brandenburg | . | . | . | 91 | 57 | 34 |
| 13 | Mecklenburg-Vorpommern | . | . | . | 65 | 64 | 1 |
| 14 | Sachsen | . | . | . | 150 | 120 | 30 |
| 15 | Sachsen-Anhalt | . | . | . | 120 | 68 | 52 |
| 16 | Thüringen | . | . | . | 117 | 56 | 61 |
| 17 | Germany without NRW | 2528 | 4411 | −1883 | 3252 | 3622 | −370 |
| 18 | Germany | 12,050 | 19,280 | −7230 | 16,627 | 20,725 | −4098 |
| 19 | Foreign countries | 6236 | 7209 | −973 | 19,703 | 8844 | 10,859 |
| | Total | 18,286 | 26,489 | −8203 | 36,337 | 29,570 | 6767 |

Source: Statistik der Bundesagentur für Arbeit (2017). Authors' compilation.

Schierenbeck (2010, p. 375), who found the coal and steel sectors contributed to the loss of 50,000 jobs in Duisburg between 1980 and 2000 to a level of only 157,000, a loss of every fourth job, while these traditional sectors with low growth rates were still overrepresented, accounting for one in eight jobs and every second job in the processing industries. These studies made it apparent that the reconfiguration of the existing economic structure – and the concomitant introduction of infrastructure-led development – was underpinned by dynamic tensions with path dependence and structural 'lock in'.

### 3.3. The rise of logistics as a new growth pathway

It was arguably the closure of the Krupp steel mill in 1997 that catalysed the rise of logistics as a new growth pathway in the Duisburg city-region. Interestingly, the idle capacities of the steel plant in proximity to the harbour generated a fresh approach to make use of the city's geographical position to enhance its logistics capacities. Important in the shipment of mining extracts along the Rhine River since the 18th century, Duisburg had lost most of its freight volume at the end of the 20th century. Breaking with the lock-in associated with serving the city's steelmaking sector, the Port of Duisburg purchased the land of the largely idle Krupp plant and created the initial foundation for capacity expansion via the establishment of what is now termed 'Logport 1' (World Port Source, 2017). This transformative project enabled an intensified specialization in multi-modal logistics through the establishment of the Duisburg Intermodal Terminal (DIT), the Duisburg Trimodal Terminal (D3T), the Duisburg Multi-Purpose Terminal (DKT) as well as the construction of the secondary railway station in the Logport 1 area (Crouch et al., 2004; Duisport, 2022).[1] This creation of path-generating assets built on capacities inherited from the prevailing dominant pathway reinforces Martin and Sunley's (2006) previously introduced argument that new path creation is latent in path dependence. At the same time, the convergence of latent potential into actual

**Table 2.** Unemployment rate in Duisburg and North Rhine-Westphalia (NRW) as a share of the total workforce.

| | Duisburg | | NRW | |
|---|---|---|---|---|
| Year | Unemployment rate relative to all dependent employment[a] | Unemployment rate relative to entire labour force[b] | Unemployment rate relative to all dependent employment[a] | Unemployment rate relative to entire labour force[b] |
| 2015 | 14.6 | 13.2 | 8.8 | 8 |
| 2014 | 14.6 | 13.1 | 9.1 | 8.2 |
| 2013 | 14.3 | 12.9 | 9.2 | 8.3 |
| 2012 | 14.2 | 12.8 | 8.9 | 8.1 |
| 2011 | 14.5 | 13.1 | 8.9 | 8.1 |
| 2010 | 14.6 | 13.2 | 9.6 | 8.7 |
| 2009 | 14.5 | 13 | 9.9 | 8.9 |
| 2008 | 14.1 | 12.7 | 9.4 | 8.5 |
| 2007 | 15.5 | 14.1 | 10.6 | 9.5 |
| 2006 | 17.6 | 16.3 | 12.6 | 11.4 |
| 2005 | 19 | 17.7 | 13.2 | 12 |
| 2004 | 15.3 | 14.3 | 11.2 | 10.2 |
| 2003 | 14.9 | 13.9 | 10.9 | 10 |
| 2002 | 14.2 | 13.2 | 10.1 | 9.2 |
| 2001 | 13.8 | 12.9 | 9.6 | 8.8 |
| 2000 | 14.5 | 13.5 | 10.1 | 9.2 |
| 1999 | 15.9 | 14.8 | 11.2 | 10.2 |
| 1998 | 16.7 | 15.6 | 11.7 | 10.7 |

Note: [a]Unemployment rate relative to the entire labour force without soldiers; and [b]unemployment rate relative to all dependent employment without soldiers.
Source: Statistik der Bundesagentur für Arbeit (retrieved on 26 April 2017).

capacities was not delimited to the region; it took place within a *broader context* of uneven institutional support across different administrative scales.

One particular challenge confronting regional and city governments in Germany during the 1990s was the mobilization of internal resources and the cooperation of multiple corporate actors. Local funds have been largely exhausted, however, due to the economic decline, shrinking tax revenues and rising expenditures for public assistance. Unsurprisingly, then, the sustenance of restructuring programmes was premised on the attainment of – and hence competition for – subsidies from local, *Land*, federal and/or EU funds. Increased inter-city competition ensued and was most pronounced within the Ruhr area where Duisburg is located (Bensch, 1997). Eventually, the EU classified the Ruhr area as a 'target-2 region' and it became eligible for economic restructuring funds (Jakoby, 1997, pp. 141–148).

To allocate funds efficiently, the Ruhr region was to specify concrete economic clusters of developmental potential. Instead of simple financial allocations, so-called 'real transfers' (real services allocated to specific target groups) obliged the local authorities to implement the resulting development strategies (Glassmann & Voelzkow, 2004). In Duisburg, the strategy 'impulse.duisburg' was implemented in 2001 to develop six competence fields or 'impulse sectors', of which logistics is one (Schierenbeck, 2010, pp. 378–380). The ensuing clustering of specialized firms in targeted locations underscored a clear *multi-scalar* institutional commitment to reconfigure Duisburg's economic structure.

Published economic data suggest these strategies generated positive outcomes. Table 3 shows the share of manufacturing (e.g., mining) in employment has dropped from its high of 66% in 1978 to 28% in 2016. Accounting for 30% of employment in 1970, services accounted for 71% of the employed population in 2015 (Statistik der Bundesagentur für Arbeit, 2017). Mirroring this shift is the consolidation of a new growth path in logistics, as Erich Staake, CEO of Duisport, reveals employment at the port grew from 19,000 in 1998 to 50,000 in 2018 (*The Guardian*, 2018). Simultaneously, as Table 1 shows, the city experienced net negative outflows of workers to other parts of Germany and a substantially positive net inflow of foreign workers in 2015. This development indicates the problems of path dependence are now reduced as the new workers are not tied to the steelmaking legacy.

By making use of EU Structural Funds, the logistics sector has been exogenously reshaped for the distribution of consumer goods. For many logistics businesses, the supportive political environment as well as the trimodal access to transportation and market proximity have been decisive for locating their subsidiaries in Duisburg (Glassmann & Voelzkow, 2004). Connected to a close waterways canal network giving direct access to the North Sea, dense motorway links, the intermodal rail terminal and Düsseldorf's international airport located only 15 km away, Duisburg's location exhibits optimal transport costs (Keil & Wetterau, 2013, p. 40).

While these developments underpinned the strong performance of the logistics and transport sector,

**Table 3.** Formally employed employees in Duisburg's manufacturing sector (i.e., employees subject to social security deductions from their wages).

| | | Manufacturing sector | | | | Manufacturing sector | |
|---|---|---|---|---|---|---|---|
| Year | Total | Total manufacturing | Percentage of total employment | Year | Total | Total manufacturing | Percentage of total employment |
| 1977 | 232,904 | 145,639 | 63% | 1997 | 157,511 | 64,574 | 41% |
| 1978 | 212,622 | 140,848 | 66% | 1998 | 156,741 | 62,507 | 40% |
| 1979 | 228,154 | 138,450 | 61% | 1999 | 157,403 | 60,584 | 38% |
| 1980 | 220,890 | 133,997 | 61% | 2000 | 158,461 | 59,135 | 37% |
| 1981 | 217,514 | 129,274 | 59% | 2001 | 157,653 | 57,250 | 36% |
| 1982 | 200,882 | 113,537 | 57% | 2002 | 155,894 | 55,597 | 36% |
| 1983 | 195,591 | 110,258 | 56% | 2003 | 154,699 | 53,483 | 35% |
| 1984 | 192,015 | 104,191 | 54% | 2004 | 154,292 | 52,242 | 34% |
| 1985 | 192,649 | 104,191 | 54% | 2005 | 150,010 | 50,368 | 34% |
| 1986 | 191,382 | 103,178 | 54% | 2006 | 149,532 | 50,181 | 34% |
| 1987 | 187,599 | 99,075 | 53% | 2007 | 153,054 | 50,472 | 33% |
| 1988 | 186,005 | 97,011 | 52% | 2008 | 156,609 | 51,231 | 33% |
| 1989 | 188,108 | 96,747 | 51% | 2009 | 157,016 | 50,991 | 32% |
| 1990 | 187,193 | 92,547 | 49% | 2010 | 155,094 | 46,965 | 30% |
| 1991 | 187,143 | 90,533 | 48% | 2011 | 156,560 | 47,051 | 30% |
| 1992 | 185,778 | 88,998 | 48% | 2012 | 158,486 | 48,154 | 30% |
| 1993 | 179,479 | 83,538 | 47% | 2013 | 159,693 | 48,141 | 30% |
| 1994 | 167,629 | 72,763 | 43% | 2014 | 163,051 | 47,429 | 29% |
| 1995 | 164,483 | 69,000 | 42% | 2015 | 164,055 | 46,703 | 28% |
| 1996 | 161,636 | 64,921 | 40% | 2016 | 165,788 | 45,784 | 28% |

Note: Employees are subject to social security deductions; calculations of the Niederrheinischen IHK. Due to currency conversion (from DM to euros), a comparison of the period 1993–2008 with previous years is possible to a limited extent only. The data before 1991 are non-revised data. Small deviations may also result because a conversion from DM to euros was undertaken (€1 = DM1.95583). The employment statistics were revised in 2014, with employment data retroactively revised up to 1999.
Source: Statistik der Bundesagentur für Arbeit (2017).

infrastructure-led development could not fully overcome path dependence. Indeed, the broader Duisburg economy was still unable to enter a strong growth phase even up to a decade ago. A primary reason, as outlined in detail in Schierenbeck's (2010, pp. 387–389) research on firms located in or were considering moving to Duisburg, was due to the lack in entrepreneurial support structures and insufficient use of the local university in spite of enduring deficits in a well-qualified workforce. And it was unclear if logistics could become the next dominant growth path. The situation changed, however, when a particular opportunity emerged in the early 2010s: the opportunity to deepen Germany's engagement with global economic networks through the launch of a transcontinental rail connection to the interior Chinese metropolis of Chongqing.

## 4. TRANSFORMATIVE CONJUNCTURE: FROM THE CITY OF STEEL TO GERMANY'S 'CHINA CITY'

### 4.1. The possibility of infrastructural reinforcement: inter-scalar connections

Duisburg's emergence as Germany's 'China city' – in terms of both its role as an inland logistics hub as well as a new operational hub for Chinese firms – can arguably be traced to the logistics strategy of a Dutchman, Ronald Kleijwegt. It reflects, in turn, the pivotal importance of individual agency in shaping conducive spatial relations for infrastructure-led development. While working as a director for global logistics strategy for Hon Hai Foxconn (a major supplier of computing parts for Apple), Kleijwegt was instructed to explore opportunities to transport Foxconn's productions to Europe via rail. This plan was then hatched concretely after he joined Hewlett Packard (HP) and proposed the plan to the government of Chongqing, the central Chinese city-region that was to launch the transcontinental rail connections to Duisburg (Figure 1). In an exclusive interview with *Forbes* (2016), Kleijwegt recounted how the 'breakthrough' came when Russia and Kazakhstan came to a customs union agreement with China and the EU, which consequently gave trains from Chongqing non-stop access to EU markets. The platform was therefore established for high-speed rail connection that reduced travel time between China and the EU from around 36 days by sea to the current average of 14 days by rail. Because of its earlier efforts at charting a new growth path as a logistics hub, Duisburg was identified by the Chinese authorities as the first gateway for Chinese freight to the EU.

Central to this decision was the Chinese authorities' commitment to subsidize freight flows from China to the EU. Subsidies were first provided through the Chongqing government's budget before they were augmented by the 'New Silk Road Fund' in 2014. While the exact subsidy figure was not revealed, information from Chongqing indicated a progressive commitment to equalize rail transport costs with sea transport costs, despite the latter enjoying vast economies of scale on a per trip basis (i.e., one typical sea freight liner can carry substantially more volume with 10,000 containers than one 60-container train). When the idea for the railway was mooted in 2011, the estimated cost was US$1/km for each standard (20 foot-equivalent unit – TEU) intermodal container, and this was reduced to US$0.55/km in 2015, the same price it costs for sea shipments (*21st Century Business Herald*, 2015). These developments collectively underscore the importance of situating Duisburg's emergence as a rail hub for transcontinental trade with China – and its corresponding impact on the city-region's economic concomitant – within a broader global context as first introduced in section 2: it is the *combination* of calculations from corporate and state actors at national and supra-national levels that contributed to this new economic relationship with China.

## 4.2. Deepening industrial restructuring through infrastructure-led development

One primary reason why Duisburg appeared attractive as a 'logistical fix' was its relative operational independence and highly proactive logistics sector, particularly the role of Duisport. The port actively sought to explore business opportunities and growth, and this meant establishing a pathway that need not be framed deeply within funding conditions imposed by the EU. Reflecting on the establishment of the Logport that was introduced in the previous section, Thomas Schlipköther, a member of the Executive Board of Duisburger Hafen AG, explains:

> The Logport was financed with EU funds, these funds were partially paid back to the EU in order to decrease dependencies and monitoring, and this meant more freedom in decision making and concept development compared to purely administrative port authorities such as Rotterdam, Antwerp and Hamburg.
>
> (authors' interview, July 2017)

With reference to the analytical framework presented in Figure 2, Duisport's proactivity exemplifies the deeper reconfiguration of Duisburg's economic structure: the movement into logistics was followed by a strategic move that leveraged EU funds without having to address new constraints imposed by the EU. It was this strategic calculation, a clear expression of local agency, that engendered a more *defined* process of path de-locking and path generation – Duisport was able to address new demands from external growth sources that were not directly related to the longstanding steelmaking pathway.

Another reason for its proactive approach to seek investments was that funding support from political institutions were not frequent to begin with. Lars Nennhaus, the-then Managing Director and Head of Development and Strategy at Duisport, puts the situation in perspective:

> National funds for terminals are provided rather sporadically, it is not an option to wait for funding from national or European institutions in order to advance on projects. Support is granted slowly and infrequently as a means of fuelling and kicking off projects rather than to assure long-term financing.
>
> (authors' interview, August 2017)

Duisport's strategic flexibility and quest for growth meant businesses from China became a more plausible 'option' to secure revenue despite being keenly aware of the broader implications of these links. Erich Staake, CEO of Duisport, sums up the firm's pragmatic approach: 'This is not a gimmick, this is not a symbol. … It is driven by geo-strategic reasons of the Chinese government … to enlarge their influence in other parts of the world. But it offers a lot of opportunities' (*Politico*, 2018). And the potential impact of this connection via Duisport – and more specifically, the enhanced logistical capacities generated by the Logport developments since the late 1990s – is fully shared by Sören Link, Mayor of Duisburg (Figure 1):

> The visit of the Chinese President [in 2014] is a strong signal for Duisburg … Xi Jinping is showing great interest in Duisburg as a business location, because Logport is the gateway to the Western European markets for China. … The arrival of the Yuxinou [Chongqing–Xinjiang–Europe] train is an impressive sign of the international potential of Duisburg as a business location.
>
> (Stadt Duisburg, 2022a, n.p.)

## 4.3. The interactive effects of path creation through infrastructure-led development

In a clear reminder that path creation is an open-ended process, the 'opportunities' presented by the transcontinental rail connections to China did not immediately generate a positive spillover effect on broader restructuring strategies in Duisburg. Indeed, sharp growth did not occur even within the logistics sector. There are two reasons for this. First, initial freight volumes were low because the straight-through trains were mainly serving only shipments originating from Chongqing. Second, manufacturing firms within the Ruhr region as well as from the EU more broadly were not plugged into the rail connection by way of exports. Containers arriving in the EU from China would often have to be transported back empty. As data from the DIT, one of the terminal operators at Duisport, indicates, exports lagged imports in percentage terms between 2013, the year when the direct train connection was established, and 2016, the last year when data was publicly available (Figure 3).

Hans Reinhard, Chairman of the Board of Interrail, the Swiss-based rail company that uses Duisburg as a hub, identifies the lack of exports as a major issue for his firm in the initial phase of transcontinental rail links, but it was one that Chinese businesses and, perhaps most important, government authorities in China, were willing to accept:

> Indeed, this is our toughest challenge and the base for a long-term success of these train operations. Without eastbound cargo, we fail to be able to return locomotives, waggons and containers thus this is very cost ineffective. Secondly, European customers are very conservative and it takes time for them to approve such new logistics possibilities. However, Chinese platform companies with access to subsidies have meanwhile well understood that this is key for long-term success, thus eastbound container rates [back to China] are even higher subsidised then westbound rates.
>
> (authors' interview, March 2017)

The focus on 'long term success' is particularly important for assessing the impacts of this new rail connection on Duisburg's regional development. It underscores how new infrastructure-led developmental plans need not generate immediate results but rather may take time to interact with pre-existing restructuring efforts. With reference to Figure 2's focus on how multi-scalar attempts at infrastructure-led development affect existing industrial structures and infrastructural capacities, subsidies from China now add to institutional support measures at the EU and subnational levels to uplift Duisburg's connections with and importance to global production networks (particularly networks that are firmly embedded within China). This conjuncturally specific outcome has come about in two complementary ways.

First, the popularity of the rail connection soon spread across many Chinese cities, and major industrializing cities such as Chengdu, Zhengzhou and Wuhan have subsequently become competing hubs. There is, in short, expanding demand for these connections, which led to the second reason for positive growth: railway companies and the local terminal operators responded by choosing Duisburg as an operational hub and increasing investments. As Reinhard notes, Interrail has since chosen

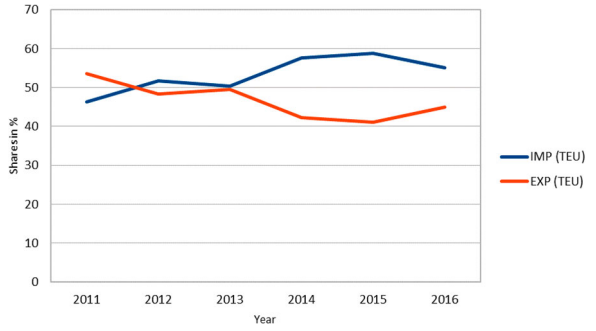


**Figure 3.** Percentage of import and export volume (in TEU) at Duisburg Intermodal Terminal (DIT).
Source: Erxleben (2017).

Duisburg as its hub for its rail links to the Commonwealth of Independent States (CIS, or countries previously part of the Soviet Union) after they began running connections to China:

> InterRail was running since over 30 years ago a block train between Berlin and CIS border Brest/Malascewicze and vice versa, which we now have moved to Duisburg as gateway. Thus the Chinese business has indeed enlarged our quantities and Duisburg with its geostrategic location has also helped to develop the trains to Madrid and recently, to London. Duisburg, with its good links to Benelux, Southern Germany and France, indeed helps to start new train destinations in Europe which at test phase are unable to produce an own full block train.
>
> (authors' interview, March 2017)

Mirroring Interrail's move is the transport and logistics company, Kuehne + Nagel, which began using Duisburg as a hub for its 'full container load' freight forwarding services to China. These new connections to and through Duisburg generated 'exponential' growth between 2014 and 2019, as Amelie Erxleben, Head of International Development at DIT, reveals in an interview with the *Financial Times* (2019), out of 90 trains arriving weekly in Duisburg originate from China, with the numbers expected to continue increasing. Such was the expansion in volume, she adds, DIT had to lease an additional 200,000 $m^2$ of land from Duisport to cope: 'It was the last available space. … We're really reaching the limits of our capacity here.' Elaborating on this situation to the authors, Erxleben added that because other operators[2] in the port imposed spatial limits, the only way to expand operations would be to improve operational efficiency (interview, December 2019).

Erxleben's comment is significant when assessed vis-à-vis the evolutionary context of Duisburg's economic restructuring: the introduction of logistics as a new growth pathway evolved incrementally and was not planned to cope with a sharp growth in freight volume. Territorial constraints therefore became apparent following this latest wave of infrastructure-led development and entail the repurposing or enhancement of existing infrastructure to create more scope for growth (see the box on 'existing infrastructure' in Figure 2). This said, the EU–China transcontinental rail connection clearly contributed to regional development through increasing employment within the logistics sector, including the re-training of formerly laid-off workers.[3] Lars Nennhaus (then of Duisport) offers specific insights on this development:

> Port dependent employment has doubled since the inauguration of the railway. The Logport built on the old steel plant terrain formerly employed 3000–4000 steel workers, now 5000 logistics employees are employed. Logistics replaces steel [as a major industry in Duisburg] although to different extents: many steel workers have now retired or left the region, while some former steel workers were retrained to fit the needs of the logistics sector. This has not been

> possible in every case, so new labour also migrated into the area.
>
> (authors' interview, August 2017)

This comment reinforces the previously mentioned observation that the move towards a logistics- and infrastructural-led pathway has become increasingly divergent from the manufacturing core of Duisburg. In spite of the commitment to retrain former skilled workers, extra-local workers have been required to fill positions in the logistics sector. Corresponding with the trend presented in Table 1, this workforce substitution again suggests path creation through infrastructure-led development as illustrated in Figure 2 is becoming more defined because local firms and institutions – Duisport, in this instance – are now able to match exogenous assets and investments in ways that are not constrained by the legacies of the steelmaking pathway. As Nennhaus adds, the growing rail links have grown *beyond* the industry to impact the wider city-regional economy in the form of new businesses and industries:

> More Chinese firms have set up subsidiaries in Duisburg in response to the new rail connection. China plans to … create a Hub-to-Hub network with Europe and in particular Germany, through joint ventures, investments, stakeholderships, and subsidiaries. Volume of rail freight is constantly increasing, extending capacities of the transport network in line with strategic interests of both sides of the railway. The presence of Chinese companies is to be increased among manufacturers and immediate trans-shipment providers.
>
> (authors' interview, August 2017)

Subsequent investment data affirmed Nennhaus' observation: the number of Chinese companies active in Duisburg tripled from 40 to more than 200 between 2014 and 2022 (*Xinhua*, 2019; *CGTN*, 2022). As these new opportunities emerged, it became apparent that the existing infrastructure-led developmental plan must be repurposed, if not also revised.

### 4.4. Repurposing and revising infrastructure-led developmental plans for Duisburg

To enhance Duisburg's attractiveness to incoming Chinese investors, the Duisburg city government established the Department for the Coordination of China Affairs (*Referat für Koordination von Chinaangelegenheiten*) to provide support for 'all China relevant matters' (Stadt Duisburg, 2022b, n.p.). One major initiative was its collaboration with Essen University to provide training for incoming Chinese investors to familiarize themselves with the local operational and institutional environment.[4] Two Chinese entrepreneurs recount their experiences:

> I came with a business plan, but I wasn't sure what aspects of the plan would meet the criteria required. This training programme highlighted areas I should work on. I am very sure my plan would have failed if I have not undergone training in Duisburg.
>
> (entrepreneur A, authors' interview, September 2019)

> My original goal was to operate as a trading company by buying goods across Europe and then transporting it by rail back to China. The training helped me understand how to source for the products, who to contact to arrange transport to Duisburg, payment methods and other related procedures. I am currently working to become a producer myself and the authority has continued to provide support.
>
> (entrepreneur B, authors' interview, September 2019)

The facilitation and consequent fast growth of Chinese investments in Duisburg strongly suggests that the logistics-focused new growth path has generated new flows. This outcome refines existing research that is first discussed in section 2: the success of infrastructure-led developmental plans is contingent on these plans' ability to engender revenue-generating flows, yet these flows need not be directly related to logistics (as reflected by the myriad types of Chinese businesses investing in Duisburg).

Indeed, while the introduction of entirely new industries to the Duisburg economy is occurring in tandem with the unresolved challenges of deindustrialization, these new businesses need not draw from inherited regional assets and labour competencies. What these new inflows represent, rather, are potentially short-term 'fixes' that only benefit specific sectors, as evidenced by the immediate boom in real estate and infrastructural investments. And even so, these benefits may transpose into new developmental challenges at multiple scales: apart from immediate local-level competition for land and labour to actualize these infrastructural investments, ongoing conversations with incoming businesses reveal a possible 'competitive' effect because some of the new firms are engaged in producing items in demand in China – such as furniture, chemicals and auto spare parts – that place them in direct competition with producers in Duisburg as well as those from Germany and the EU.

To ameliorate this effect, regional institutions and firms have been actively matching exogenous capacities (the transcontinental railway connections, a growing range of Chinese business operations, new operational techniques in logistics, and foreign human capital) to endogenous regional assets in a manner that reinforces long term adaptability to structural change. One key approach is to overcome the logistical capacity limits that Erxleben identifies in section 4.3. At the point of writing, the incoming opportunities have clearly led to the renewal and expansion of the pre-existing logistics industry (which include the businesses that support logistics operations) and city-regional labour market (which now comprises net inflows of foreign workers; Table 1). And further expansion is underway. As Erich Staake of Duisburger Hafen AG puts it, Duisport aims to invest €170 million (approximately US$202.91 million) between 2021 and 2024 after its continued growth during the COVID-19 pandemic in 2020 made it 'essential and targeted to expand the handling capacities in the Port of Duisburg for further growth' (*Port Technology*, 2021, n.p.). While these investments are not aimed at the entire

city-region, they enable Duisport to support growing logistical flows between the EU and China. And existing empirical data is reflecting a positive relationship between the transcontinental railway and trade in Duisburg.

According to Erxleben from the DIT, there is a fast-expanding integration between local logistics operators with incoming Chinese firms to coordinate their flows of goods (authors' interview, December 2019). Sustaining this integration and coordination is important due to the sharp growth in not just the volume of cargo flows but also in the range of products. According to Peng Qian, Director of Railway Logistics at Chongqing Port and Logistics Office, the overall types of freight carried on the EU–China transcontinental railway from Chongqing alone has expanded from exclusively information technology (IT)-related products in 2013 (stemming from the initiative by HP as discussed in section 4.1) to smart terminals, assembled automobiles, automobile spare parts, high-end medical products and equipment, light industrial goods and a range of around 1000 commodities that are cumulatively valued at more than 400 billion RMB (approximately US$57.5 billion) in 2022 (*Sina Finance, 2022*). At the same time, national-level statistics published by *Sina Finance (2022)* indicate the outbound–inbound ratio of China-to-EU transcontinental trains between 2016 and 2021 has increased by 30% to 81.5%, while the container load ratio has increased from 77.2% in 2016 to 98.1% in 2021.

These developments not only indicate the presence of increased trading flows in both directions (with more trains now returning to China; cf. the interview with Hans Reinhard of Interrail in section 4.3), but also reflect more efficient utilization of each train trip (which, at more than 98% capacity, is currently almost always full). Viewed in relation to Figure 2, this growing efficiency is a conjuncturally specific outcome (bottom box) that stimulates the repurposing and/or revision of infrastructure-led developmental plans (connections to the top box). With Duisburg now playing the role as a major hub in these flows, key actors are responding by implementing new plans to reinforce the city's new position as Germany's 'China city'.

## 5. CONCLUSIONS

> The Duisburg Port is maybe the single most successful story in what Germans call the Strukturwandel — the long, painful and as yet unfinished process of industrial conversion of the Ruhr region from coal and steel to a modern industrial and service-oriented economy. (Jacopo Maria Pepe, German Council on Foreign Relations; *Politico*, 2018)

Duisburg has been trying to recover from the rolling 'shocks' of deindustrialization for many years. Whether this recovery process – recently deemed to be a 'successful story' – is underpinned by short-term infrastructure-led development or is a manifestation of a 'long, painful and yet unfinished process of industrial conversion' in Duisburg (Pepe, cited in *Politico*, 2018) has not been explicitly considered. At one level, it may be quite apparent and even straightforward to term Duisburg's recent success as an outcome of what Schindler and Kanai (2021) term 'getting the territory right' for infrastructure-led development. Yet, as this paper has shown, the process is one that is conjuncturally specific: it involves the interaction of globally oriented infrastructural developmental plans with inherited growth pathways and infrastructural capacities. To build on Martin and Sunley's (2006) conceptualization of regional economic evolution that is first presented in section 2, whether a territory could become 'right' and benefit from infrastructure-led development is fundamentally underpinned by the 'interplay' between path creation and path dependence.

Specifically, this paper has demonstrated how the emergence of the logistics sector as a new growth pathway was *not* a strategic initiative to 'separate' from steelmaking. What ensued, rather, was a progressive weakening of one 'locked in' dominant path (steelmaking) and an emergence of an actually existing sector (logistics) as the primary source of growth. This growth did not appear suddenly; it also did not trigger a sharp turn away from Duisburg's 'depressed' status, as discussed in section 3. Rather, the inclusion of logistics within broader economic restructuring programmes generated the capacities to participate in new rounds of infrastructure-led development. And a breakthrough came in the form of transcontinental connections to China. This opportunity not only generated increased income for the logistics sector through growing freight volumes, but also led to the growth of a burgeoning cluster of Chinese businesses in Duisburg that seeks to build on access to rail connections by channelling European exports to China on what were initially empty eastbound trains. Herein lie two key points on infrastructure-led development that require further research.

First, the making of city-regions into major logistics hubs requires geographical–historical contextualization; they should not be taken a priori as one-off outcomes of spatial plans geared explicitly towards fulfilling neoliberal objectives. The focus on the interplay between path creation and path dependence in this paper's analytical framework therefore offers a conjunctural entry point for examining how the so-called getting territories 'right' maxim is more effectively about creating successful matches between endogenous and exogenous capacities in a *particular* time and region. The explanatory focal point is why these matches could (not) happen, namely whether economic evolution in a particular region has produced the 'right' structural and firm-level capacities to tap into opportunities that could emerge in/from other locations. Further studies on these conjunctures would be urgently required because infrastructure-led development could potentially trigger a competitive duplication of resources and an over-supply of similar infrastructure, just like 'entrepreneurial' urban regeneration policies generated uncritical replications across multiple cities without considering the constitutive effects of place-specific economic structures.

Second, this paper has demonstrated the importance of assessing how conjuncturally specific outcomes of

infrastructure-led developmental plans are not the be-all and end-all – these outcomes trigger dynamic and recurring changes to regional spatial planning that are of both conceptual and policy significance (Figure 2) (and see section 4.4). As this study has shown, key actors such as Duisport and the local authorities are proactively introducing new initiatives to enhance existing capacities to capture new growth opportunities generated by the transcontinental railway. At the same time, however, what is good for some actors (such as new Chinese business establishments in Duisburg) need not be positive for the region holistically. This is especially true for deindustrializing regions where the legacies of previously predominant pathways – steelmaking, in Duisburg's context – may continue to define the politics of resource allocation and the labour movement. The large-scale protests by steel workers as presented in the introductory section is a case in point. And here is where this paper's conjunctural analytical approach to evaluating infrastructure-led development could be highly pertinent for other deindustrializing contexts: it highlights whether, at a specific historical moment, new infrastructure-oriented spatial plans for path creation are truly able to circumvent or transcend the limitations of inherited developmental pathways.

## ACKNOWLEDGEMENTS

The authors thank Andy Pike, Danny MacKinnon, Lela Rekhviashvili, Fernanda Faria Silva, the anonymous reviewers and the editorial team at *Regional Studies* for constructive comments and suggestions on earlier versions of this manuscript. All errors and omissions remain the sole responsibility of the authors.

## DATA AVAILABILITY

Data from the Duisburg Intermodal Terminal (DIT) were kindly shared with the authors by one of the key interviewees, Amelie Erxleben, through her master's degree dissertation (Erxleben, 2017). Subsequent information has not been released by the DIT.

## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

## FUNDING

The research for this paper was funded by (1) a British Academy Small Research Grant, supported by the Sino-British Fellowship Trust [award number: SG160087]; and (2) Newcastle University's Faculty of Humanities and Social Sciences' Faculty Research Fund [award number OSR/0322/FRES/0022].

## NOTES

1. Six 'Logports' have been established at the time of writing in 2022, namely: Duisburg-Rheinhausen (Logport I, trimodal, established 1998), Duisburg-Wanheim (Logport II, trimodal, established 2006), Duisburg-Hohenbudberg (Logport III, bimodal, established 2013), Kamp-Lintfort (Logport IV, bimodal, established 2014), Oberhausen (Logport V, bimodal, established 2021) and Duisburg-Walsum (Logport VI, trimodal, established 2022). There is clear evidence of expansion during the past decade.
2. Duisport would rent its grounds to different terminal operating companies to operate eight to nine terminals. The overall territory is limited and, with further subdivision to the operating companies, this means expanding capacities through expanding operating space is very difficult.
3. Attempts were made to derive precise data on the retraining of formerly laid-off steelworkers, but these were not available as some workers left the city-region after leaving their jobs. For this reason, this paper looks at the impact on steelmaking by inferring from data on manufacturing employment and shifting sectoral compositions in the economic structure.
4. The term for this initiative is 'Public welfare programme for entrepreneurship in Germany by outstanding Chinese talents' (中国优秀人才在德创业公益项目).

## ORCID

*Kean Fan Lim* http://orcid.org/0000-0002-7979-2068
*Kristin Limbach* http://orcid.org/0000-0002-3365-9595

## REFERENCES

*21st Century Business Herald*. (2015). Tielu yu haiyun tongjia: Yuxinou kuaitie zheng zhongou maoyi xin tongdao [铁路与海运同价：渝新欧快铁争中欧贸易新通道]. *21st Century Business Herald*, 15 May. https://m.21jingji.com/article/20150515/b7be32b837fb355f51154c4222b6b379.html

Bensch, G. (1997). EU Strukturpolitik aus der Sicht Duisburgs: Duisburg im Strukturwandel. In Axt, H.-J. (Ed.), *Strukturwandel in Europa*. Südosteuropa, Ruhrgebiet und Reform der EUStrukturpolitik: Ergebnisse einer Internationalen Konferenz vom 5.–6- Mai 1997 im Rahmen des 25 jährigen Jubiläums der Gerhard-Mercator-Universität GH Duisburg (Südosteuropa aktuell 26) (pp.183–189), Südosteuropa-Ges.

Bosch, G. (1992). *Retraining – Not redundancy: Innovative approaches to industry restructuring in Germany and France*. International Institute for Labour Studies.

Casarini, N. (2006). *The evolution of the EU–China relationship: From constructive engagement to strategic partnership* (Occasional Paper No. 64). The European Union Institute for Security Studies https://www.iss.europa.eu/sites/default/files/EUISSFiles/occ64.pdf

CGTN. (2022). Increased trade with China helps reshape German city of Duisburg. 13 October. https://newseu.cgtn.com/news/2022-10-10/Increased-trade-with-China-helps-reshape-German-city-of-Duisburg-1dZp6k3PnUY/index.html

Coe, N. M. (2020). Logistical geographies. *Geography Compass*, *14* (10), e12506. https://doi.org/10.1111/gec3.12506

Crouch, C., Le Galès, P., Trigilia, C., & Voelzkow, H. (2004). *Challenges to economic governance. Responses to change in European local production systems*. Oxford University Press.

Danyluk, M. (2018). Capital's logistical fix: Accumulation, globalization, and the survival of capitalism. *Environment and Planning D: Society and Space*, *36*(4), 630–647. https://doi.org/10.1177/0263775817703663

Duisport. (2022). *The logport concept: From an industrial wasteland to one of Europe's leading logistics locations – A success story on 371 football fields*. https://www.duisport.de/kompetenzen/industrieflaechen-logisitkimmobilien/das-logport-konzept-logport/?lang=en

Erxleben, A. (2017). The New Silk Route from China to Germany via cargo train – An alternative or complement to air and ocean freight. (Unpublished master's thesis). Institute of East Asian Studies. University of Duisburg-Essen.

*Financial Times*. (2019). World's biggest inland port puts German rustbelt on China's map. *Financial Times*, 8 April. https://www.ft.com/content/58909b2e-56c0-11e9-91f9-b6515a54c5b1

Findeisen, S., & Suedekum, J. (2008). Industry churning and the evolution of cities: Evidence for Germany. *Journal of Urban Economics*, *64*(2), 326–339. https://doi.org/10.1016/j.jue.2008.02.003

Forbes. (2016). How those China–Europe 'Silk road trains' first began. Forbes, 29 June.

Friedrichs and Küppers. (1998). Revitalization strategies of cities in the Ruhr Area. In Wódz, K. (Ed.), *Social aspects of reconstruction of old industrial regions in Europe* (pp. 86–105). Uniwersytet Śląski.

Glass, M. R., Addie, J. P. D., & Nelles, J. (2019). Regional infrastructures, infrastructural regionalism. *Regional Studies*, *53* (12), 1651–1656. https://doi.org/10.1080/00343404.2019.1667968

Glassmann, U., & Voelzkow, H. (2004). Restructuring Duisburg: A new local production system substitutes an old steel plant. In *Changing governance of local economies: Responses of European local production systems* (pp. 139–160).

Grabher, G. (1993). The weakness of strong ties; the lock-in of regional development in Ruhr area. In G. Grabher (Ed.), *The embedded firm: On the socioeconomics of industrial networks* (pp. 255–277). Routledge.

Hassink, R. (2010). Locked in decline? On the role of regional lock-ins in old industrial areas. In R. Boschma, & R. Martin (Eds.), *Handbook of evolutionary economic geography*. (pp. 450–468) Edward Elgar.

Hesse, M. (2020). Logistics: Situating flows in a spatial context. *Geography Compass*, *14*(7), e12492. https://doi.org/10.1111/gec3.12492

Hospers, G. J. (2004). Restructuring Europe's rustbelt. *Intereconomics*, *39*(3), 147–156. https://doi.org/10.1007/BF02933582

IHK Niederrhein. (2016). *Der Niederrhein in Zahlen 2015/16*. Niederrheinische Industrie- und Handelskammer Duisburg.

Jakoby, V. H. (1997). Use of EU structural fund by NRW. In Axt, H.-J. (Ed.), *Strukturwandel in Europa*. Südosteuropa, Ruhrgebiet und Reform der EUStrukturpolitik: Ergebnisse einer Internationalen Konferenz vom 5.–6- Mai 1997 im Rahmen des 25jährigen Jubiläums der Gerhard-Mercator-Universität GH Duisburg (Südosteuropa aktuell 26) (pp. 141–148). Südosteuropa-Ges.

Keil, A., & Wetterau, B. (2013). Metropolis Ruhr. In *A regional study of the new Ruhr*. Regionalverband Ruhr.

Kopp, J. (2014). Vom Herz der deutschen Industrialisierung zum Kulturartefakt das Zechensterben im Ruhrgebiet. In Wehrs, N. (Ed.), *1964-das Jahr, mit dem '68' begann* (pp. 275–285). Robert Lorenz & Franz Walter.

Leitner, H., & Sheppard, E. (2020). Towards an epistemology for conjunctural inter-urban comparison. *Cambridge Journal of Regions*, *13*(3), 491–508. https://doi.org/10.1093/cjres/rsaa025

Lim, K. F. (2010). On China's growing geo-economic influence and the evolution of variegated capitalism. *Geoforum; Journal of Physical, Human, and Regional Geosciences*, *41*(5), 677–688. https://doi.org/10.1016/j.geoforum.2010.04.003

Lim, K. F. (2018). Strategic coupling, state capitalism, and the shifting dynamics of global production networks. *Geography Compass*, *12*(11), e12406. https://doi.org/10.1111/gec3.12406

MacKinnon, D. (2012). Beyond strategic coupling: Reassessing the firm–region nexus in global production networks. *Journal of Economic Geography*, *12*(1), 227–245. https://doi.org/10.1093/jeg/lbr009

MacKinnon, D., Dawley, S., Pike, A., & Cumbers, A. (2019). Rethinking path creation: A geographical political economy approach. *Economic Geography*, *95*(2), 113–135. https://doi.org/10.1080/00130095.2018.1498294

Martin, R., & Sunley, P. (2006). Path dependence and regional economic evolution. *Journal of Economic Geography*, *6*(4), 395–437. https://doi.org/10.1093/jeg/lbl012

Page, S. E. (2006). Path dependence. *Quarterly Journal of Political Science*, *1*(1), 87–115. http://dx.doi.org/10.1561/100.00000006

Peck, J. (2017). Transatlantic city, part 1: Conjunctural urbanism. *Urban Studies*, *54*(1), 4–30. https://doi.org/10.1177/0042098016679355

Pepe, J. M. (2018). *Beyond energy: Trade and transport in a reconnecting Eurasia*. Freie Universität Berlin.

Pike, A., Birch, K., Cumbers, A., MacKinnon, D., & McMaster, R. (2009). A geographical political economy of evolution in economic geography. *Economic Geography*, *85*(2), 175–182. https://doi.org/10.1111/j.1944-8287.2009.01021.x

*Politico*. (2018). How China put German rust-belt city on the map. *Politico*, 1 March. https://www.politico.eu/article/duisburg-looms-large-in-chinas-silk-road-vision/

Port Technology. (2021). Port of Duisburg cites investments and China trade for 2020 bounce. Port Technology, 13 April. https://www.porttechnology.org/news/port-of-duisburg-cites-investments-and-china-trade-for-2020-bounce/

Röhl, K. H. (2019). Das Ruhrgebiet: der anhaltende industrielle Strukturwandel im Spiegel der Regionalpolitik. *Wirtschaftsdienst*, *99*(1), 49–55. https://doi.org/10.1007/s10273-019-2432-x

Rommelspacher. (1998). Structural change of the Ruhr Area. In K. Wódz (Ed.), *Social aspects of reconstruction of old industrial regions in Europe* (pp. 80–85). Uniwersytet Śląski.

Schierenbeck, C. (2010). *On the governance of regional innovation systems. Case studies from four city-regions within the German federal state of North Rhine-Westphalia: Aachen, Dortmund, Duisburg and Düsseldorf* (Doctoral dissertation, University of Birmingham).

Schindler, S., & Kanai, J. M. (2021). Getting the territory right: Infrastructure-led development and the re-emergence of spatial planning strategies. *Regional Studies*, *55*(1), 40–51. https://doi.org/10.1080/00343404.2019.1661984

*Sina Finance*. (2022). Zhongou Banlie nishi er shangdongli zu [中欧班列逆势而上动力足]. *Sina Finance*, 19 July. https://finance.sina.com.cn/world/2022-07-19/doc-imizirav4279981.shtml

Stadt Duisburg. (2022a). Chinas Staatspräsident Xi Jinping besucht logport: OB Link: 'Ein starkes Signal für den Wirtschaftstandort Duisburg'. https://www.duisburg.de/rathaus/index.php?showpm=true&pmurl=http://www.duisburg.de/guiapplications/newsdesk/publications/Stadt_Duisburg/102010100000442169.php

Stadt Duisburg. (2022b). Referat für Koordination von Chinaangelegenheiten. https://www.duisburg.de/vv/oe/

dezernat-ob/ob-5/index.php?p=1406%2C2167%2C7625%2C2250%2C%2Fvv%2Forganigramm.php%2C123708
Statistik der Bundesagentur für Arbeit. (2017). *Statistisches JAhrbuch Nordrhein-Westfalen 1949–2016* (accessed April 2017).
*The Guardian*. (2018). Germany's 'China City': How Duisburg became Xi Jinping's gateway to Europe. *The Guardian*, 1 August. https://www.theguardian.com/cities/2018/aug/01/germanys-china-city-duisburg-became-xi-jinping-gateway-europe
Wódz, K. (1998). Social aspects of reconstruction of old industrial regions in Europe. In U. Śląski (Ed.). *Uniwersytet Śląski*.
World Bank. (2009). *World development report 2009: Reshaping economic geography*. https://openknowledge.worldbank.org/handle/10986/5991
World Port Source. (2017). Port of Duisburg: Port history. World Port Source. http://www.worldportsource.com/ports/review/DEU_Port_of_Duisburg_1258.php
Xinhua. (2019). BRI brings fresh opportunities to Germany's Duisburg: city official. Xinhua, 25 April. http://www.xinhuanet.com/english/2019-04/25/c_138009768.htm
Zimmermann, K., Hundt, C., Jütte, C., & Pofalla, C. (2017). Dortmund, Duisburg und die Rezession von 2008/2009–Warum zwei Städte derselben Region ökonomisch unterschiedlich resilient sind. *Raumforschung und Raumordnung*, *75*(5), 439–453. https://doi.org/10.1007/s13147-017-0483-2