Landscapes of Trade

Towards sustainable spatial planning for the logistics complex in the Netherlands

Merten Nefs

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TOC

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TOC

Landscapes of Trade

Towards sustainable spatial planning for the logistics complex in the Netherlands

Dissertation

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chair of the Board for Doctorates
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by

Merten Cornelis Angela NEFS
Master of Science, Delft University of Technology, The Netherlands
born in Roermond, The Netherlands

TOC

This dissertation has been approved by the promotors.

Composition of the doctoral committee:

Rector Magnificus,	chairperson
Prof.dr. W.A.M. Zonneveld	Delft University of Technology, promotor
Prof.dr. F.G. van Oort	Erasmus University Rotterdam, promotor
Dr.ir. T.A. Daamen	Delft University of Technology, copromotor

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Prof.dr. W.K. Korthals Altes	Delft University of Technology, reserve member

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“Then World was small / because Earth was big / Now World is very big / because Earth is small / The size of a parabolic antenna

Gilberto Gil (1991)
From the song Parabolicamará, phrase translated by the author of the thesis

“What [scientists and engineers] have done is visible in the machines we use and the landscape we look at. How they did it, we don’t know.”

Bruno Latour (1987)

Preface

The rise of the contemporary logistics complex, the topic of this thesis, has always been present in the background of my life. As a child, I used to watch containerships pass by on the Westerschelde on their route to the port of Antwerp in the 1980s. As a student, some of my side-jobs involved order-picking in wholesale or retail warehouses, fascinating environments ruled by barcodes, order lists and rack numbers. Today's XXL fulfilment centres are substantially larger and more automated, featuring robots, hand scanners and RFID wristbands, in the hands of a predominantly foreign workforce. As an architect and planner in São Paulo, I became aware of the impacting manifestation of global supply chains in the metropolitan territory. As a global hub in the coffee trade, soy, and other commodities, as well as automobile manufacturing, giant factory and warehouse complexes are cluttered along this region's heavy infrastructure. Some of these commodity chains, orange juice for example, flow through my current hometown Rotterdam. As a researcher at the Deltametropolis Association, based in Rotterdam, I investigated and discussed the relationship between land use and infrastructure, as well as the economic values of the metropolitan landscape. When landscape architects in our network, such as Adriaan Geuze and Berno Strootman, started pointing out the 'boxification' problem after the logistics real estate boom since 2014, I immediately knew that was a topic worth exploring. Not merely for its visual consequences—I always found that a rather narrow perspective—but because of the complex world of flows and economic actors that drives it. The issue cannot be ignored, because many environmental ambitions of today, such as a circular economy, will be facilitated in distribution centres (DCs).

In shaping the research project, I was inspired by the book Nature's Metropolis, in which William Cronon (1991) explains the growth of Chicago through the main supply chains that link it to its hinterland of the Great Plains and the urban centres at the East Coast: lumber, grain and meat. It is tempting to try and write such a history of the Netherlands too. However, such a book would take a long time to produce, while it could also not be sufficiently focused on the pressing discourse of the spatial planning of DCs in the Netherlands, to which this thesis aims to make a contribution. Thus, I decided from the start, to focus on the recent history of the logistics complex since 1980 instead.

During the PhD project the Covid-19 pandemic, Brexit and the war in Ukraine accelerated many logistical trends that were already underway, and the planning discourse entered a new phase—from signalling the problem towards understanding and attempting to solve it. The choice for such an urgent PhD topic clearly has its merits: never a dull day, attention from academia and the media, and many dynamic cases to study. At the same time, I needed to make efforts to separate the scientific work from more practical planning and consultancy projects on the topic, that emerged shortly after starting the PhD. I was studying an apparatus, which I was participating in at the same time, a situation I will reflect on in the concluding chapter of the thesis. I have attempted to maintain a neutral position by nuancing and building bridges in the debate between anxious policy makers, worried landscape activists, a defensive logistics (investment) sector, designers attempting to create impact and critical (sometimes sensationalist) journalists. In retrospect, it was never fully possible nor necessary to create a hard border between the activities. Instead, it became an important effort to be transparent about them at all times. The thesis itself and the list of activities undertaken in the same period should be a proof of this.

Acknowledgements

I am grateful to Paul Gerretsen and my colleagues at the Deltametropolis Association, who gave me the opportunity to start the PhD as an external researcher in 2019 and provided an inspiring and critical context over the years. I have been very lucky with my promotors Wil Zonneveld, Tom Daamen and Frank van Oort, who stimulated me in our many conversations to look beyond my own knowledge and explore their fields of spatial planning concepts, area development and regional economics. They kindly involved me in their academic work groups at the chairs of Spatial Planning & Strategy (SPS, including a discussion group of fellow PhDs) and Management of the Built Environment (MBE) in Delft, and the Erasmus Centre for Urban, Port & Transport Economics (UPT) in Rotterdam. At Erasmus UPT I had the possibility to finish the PhD during the year 2023, surrounded by skilled researchers. I highly appreciate the support of my paranymphs Alankrita Sarkar (Deltametropolis Association) and Jeroen van Haaren (Erasmus UPT).

Many organisations and individuals have supported and inspired my research efforts since 2019, including the Board of Government Advisors (CRa), Sophie Stravens and others at Architecture Centre Tilburg (CAST), Amsterdam Academy of Architecture, the Port City Futures Network, Stichting Kennis Gebiedsontwikkeling (SKG), Hans van Amsterdam and others at the Environmental Assessment Agency of the Netherlands (PBL), Raad voor de Leefomgeving & Infrastructuur (Rli), Eric Koomen and Apeksha Tare at Vrije Universiteit Amsterdam (VU), Stichting LISA, Cees-Jan Pen and others at Fontys Hogeschool, Breda University of Applied Sciences (BUAS), Hogeschool Rotterdam (HR), Hogeschool van Amsterdam (HvA), TIAS Business School; students of Erasmus School of Economics, The Delivery Society (TUDelft department of Architecture), Ferrara University (architecture and urban planning), Wuppertal University, the Association of European Schools of Planning (AESOP), Het Nieuwe Instituut, Tilburg Architecture Film Festival and Limburg Film Festival. As well as Archined, Gebiedsontwikkeling.nu, Financieel Dagblad, NRC, Investico & Groene Amsterdammer, De Architect, Logistiek.nl, Ruimte & Wonen, De Balie, NPO and other organisations.

I enjoyed the intense collaborations and discussions with the ministries of Internal Affairs & Kingdom Relations (BZK), Economic Affairs and Climate (EZK) and Infrastructure & Water (I&W), the twelve provinces of the Netherlands—especially the more logistics- and planning-minded staff members, Dutch cities including

Tilburg, Nijmegen, Roosendaal, Rotterdam, Utrecht and Venlo; design firms such as , Rademacher & de Vries, Urban Synergy, Defacto Urbanism, BURA urbanism, Bright, Studio Marco Vermeulen, Apto, Mulderblauw, DS landschapsarchitecten, Renzo Sgolacchia, Rufus de Vries, and consultants of Stec Group, TNO and Buck Consultants International. Without the great help of Christian Heerings, Hanneke Bruinsma and Tom Runhaar, I wouldn't have been able to get introduced so quickly in the world of logistics stakeholders, including Dilas, REWIN, Greenport Venlo, Midpoint Brabant, Logistics Community Brabant, DEKA Immobilien, Netherlands Distribution Council, Societeit Vastgoed, Topsector Logistiek and TKI Dinalog, CTP, Intospace, CEVA logistics, DSV, VGP, CBRE, and Cushman & Wakefield. The inspiring collaboration with Shera van den Wittenboer, Anne van Kuijk, Wouter Veldhuis and Charles Aangenendt, among others, kept me close to the spatial debate. I highly appreciate the dozens of photos of distribution centres that people have sent me while they were on a business trip or vacation.

Finally, the PhD would not have been possible without the love and patience of my friends and family. Special thanks go out to Lucia Dossin, who besides great love and patience also provided crucial frontend development for the online map of the Landscapes of Trade dataset, which turned out to be one of the first and most impacting outputs of the research.

Contents

List of Tables

List of Figures

List of abbreviations

CBS	Centraal Bureau voor de Statistiek [Statistics Netherlands]
CRa	College van Rijksadviseurs [Board of Government Advisors]
DC	Distribution centre
ESE corridor	East-Southeast corridor
EU	European Union
GIS	Geographical Information System
LQ	Location quotient
OLS	Ordinary least squares
PBL	Planbureau voor de Leefomgeving [Environmental Assessment Agency]
PI	Physical Internet
PM	Particulate matter
Rli	Raad voor de Leefomgeving en Infrastructuur [Council for the Environment and Infrastructure]
SBI	Standaard bedrijfsindeling [Dutch Standard Business Categories ~ NACE]
TEU container	Twenty-foot equivalent unit container
UK	United Kingdom
USA	United States of America
VAL	Value-added logistics
(X)XL	(Extra)Extra-large
3PL	Third-party logistics

TOC

Summary

At the time of writing, the logistics complex of the Netherlands has a building footprint of approximately 80 million square metres, within which a growing number of XXL distribution centres (DCs) exist. This footprint has increased fourfold since 1980, whilst the average size of a DC has more than tripled. Compared to other European countries, the DC footprint per capita is several times higher in the Netherlands. This particular use of the Dutch territory fits with the economic success story of the country as a 'gateway to Europe' and has generated a new large-scale landscape type: **Landscapes of Trade**. Up to the present, the planning system has generally facilitated DC development, whilst societal protests against such developments have increasingly influenced the planning discourse. Fierce debates on logistics have often reflected conflicting stakeholder interests and opposing views rather than a dialogue about strategic ways forward fuelled by the empirical evidence and insights required in planning discourse. Especially in the transition to a sustainable logistics complex, the latter are of great importance.

With insufficient publicly available knowledge, six aspects of the logistics complex have become key polemic issues in the planning discourse. These include the seemingly ubiquitous growth pattern of DCs in the Netherlands, the dominant and increasingly challenged policy narrative of the Netherlands as a 'gateway to Europe', and the public-private actor network that appears to fall short of adequate DC planning and development. Other issues are the claimed employment benefits of DCs, the balance of the benefits and burdens of logistics, and the provision of useful spatial planning information for logistics clusters in the emerging circular economy. The issues outlined here are observed both in research and practice and relevant in several parts of Europe and beyond.

By combining different perspectives and methods of empirical research, this thesis aims to shed light on and generate multi-disciplinary insights into the rise of the logistics complex and its planning discourse whilst focusing specifically on XXL DCs in the Netherlands. In doing so, its main goal is to provide an understanding of the evolving spatial pattern of logistics centres and its interaction with the co-evolving planning system. The Dutch logistics complex since 1980 offers a critical European case for the analysis, due to the clear shifts in its spatial pattern and planning system, as well as a fierce and well-documented planning discourse featuring various information sources and actor networks. It is a clear example of logistics sprawl and

port regionalisation processes, which have effectively turned the extensive hinterland of the Port of Rotterdam into Europe's largest and most fragmented *dryport*. This situation is characterised by a spatial pattern of expanding DCs—partly clustered and partly scattered—near urban agglomerations and infrastructure. Thus, the overarching question in the research is:

What historical, economic, and institutional dynamics shape the rampant expansion of the logistics complex in the Netherlands?

This thesis seeks to contribute to filling six specific knowledge gaps related to the aforementioned six issues and therefore addresses six sub-questions. **Chapter 2** addresses the question **How has the spatial pattern of DCs in the Netherlands changed over time?** It presents an atlas of the Dutch logistics complex, to show and discuss the spatial pattern of DCs and set the scene for the following analytical chapters. **Chapter 3** addresses the question **On what assumptions was the Gateway to Europe policy narrative (1980–2020) in the Netherlands based?** It seeks to answer this question by analysing the sources, advocacy coalitions and policy theories underlying the narrative, through a systematic literature review. **Chapter 4** addresses the question **What actor-institutional forces shape the spatial outcomes of local XXL DC transactions?** It analyses how spatial decisions are made in the actor-institutional dynamics behind the planning and development of DCs, through in-depth interviews and document analysis. **Chapter 5** addresses the question **What are the regional employment effects of XXL DCs?** It does so by analysing the effects of DCs by using company microdata in a threefold spatial-economic approach including direct, indirect and agglomeration effects. **Chapter 6** addresses the question **What role does spatial justice argumentation serve in the provincial and local planning discourse and decision-making on hinterland logistics?** It analyses the argumentation used in the planning discourse on DCs whilst focusing on the just distribution of the gains and pains of logistics. **Chapter 7** addresses the question **How are the validity and applicability of logistics cluster typologies and related information tools perceived by Dutch planners and policy makers?** It answers this question by analysing the outcomes of a Q-sort survey of the user experience of spatial typologies and data-driven maps in the recent policy process of planning logistics clusters.

Each chapter reaches detailed conclusions. When taken together, the results provide three answers to the overarching question. Historical trends and shocks have shaped the planning and development of the Dutch logistics complex. For example, several disruptive events (economic crises, COVID-19) and a general trend of trade internationalisation and market integration have boosted DC growth over time. Recently, geopolitical turmoil and emerging international sustainability

agreements have made various global value chains more uncertain, whilst shortages of land and personnel are increasingly posing concrete limits on the expansion of the logistics complex. Furthermore, economic processes and transformations have had a strong influence on the expansion of DCs; for example, the financialisation of DC development, the rise of e-commerce, and expectations about employment related to DCs. This thesis shows how monofunctional XXL DC clusters pressure the already overheated labour market, do not deliver the claimed indirect employment benefits in a region, and increase the risk of spatial-economic lock-in. Additionally, the transition to a circular economy will change the use of the logistics complex, either the management of reverse logistics flows or performance of remanufacturing activities in DCs in the future. Finally, institutional dynamics have been crucial in shaping the logistics complex. For example, a biased narrative that ignored critical reports, as well as unfounded claims, created a policy landscape that stimulated the expansion of logistics whilst assuming that the negative effects would be mitigated along the way through technological fixes and decentralised planning. The latter has introduced perverse incentives in the planning system and increased logistics sprawl. However, the regional and local planning discourse has been able to influence the quality of logistics developments using spatial justice arguments, whilst international corporate development standards and policy information tools have also proved to be valuable instruments used to improve spatial outcomes.

In summary, the dynamic conditions shaping the logistics complex in the 1980s were significantly different from the current situation. Therefore, a new logistics policy narrative—as a follow-up to the *Gateway to Europe* narrative, is necessarily grounded in these changed dynamics. However, for such a new narrative to be plausible and effective, it must be based on insights from further research regarding the dynamics discussed above, and on adapted planning practices that can effectively use them to pursue the new policy goals.

The outcomes of this thesis suggest three main angles for further research. First, a strategic international perspective on the scale of the Eurodelta. Second, more detailed insights into activities in DCs. Third, insights into the roles and dynamics of the fragmented actor network behind the planning and development of the logistics complex—especially semi-governmental organisations and intra-governmental dynamics. The thesis makes three main recommendations for public and private practitioners to further the interdisciplinary and sustainable development of the logistics complex. First, equal and open information provision based on research and practical experience in the actor network. Second, enhancing interdisciplinary planning and design competencies, focused on the spatial side of the *physical internet* (PI), and the logistics side of multifunctional urban developments. Third, collaborative attitudes among public and private actors in strategic spatial planning

and development, focusing on the environmental, economic, and social sustainability of the logistics complex. Commitment to such a research agenda and updated practice would enable a well-informed and broadly supported policy narrative on logistics—one that allows society to get the most out of each square metre in the **Landscapes of Trade**.

Samenvatting

Op het moment van schrijven omvat het logistiek complex van Nederland een bebouwde voetafdruk van ongeveer 80 miljoen vierkante meter, waarbinnen een groeiend aantal XXL-distributiecentra (DC's) bestaan. Deze voetafdruk is verviervoudigd sinds 1980, terwijl de maat van een gemiddeld DC meer dan verdrievoudigd is. In vergelijking met andere Europese landen is de DC-voetafdruk per capita in Nederland enkele malen groter. Dit bijzondere gebruik van het Nederlandse grondgebied hoort bij het succesverhaal van het land als 'Distributieland' of 'Gateway to Europe' en heeft een nieuw grootschalig landschapstype voortgebracht: Handelslandschappen of **Landscapes of Trade**. Tot nu toe heeft het planningsysteem DC-ontwikkeling doorgaans gefaciliteerd, terwijl maatschappelijke protesten tegen dergelijke ontwikkelingen in toenemende mate het planningsdiscours zijn gaan beïnvloeden. Verhitte debatten over logistiek weerspiegelen vaak conflicterende belangen van stakeholders en tegengestelde perspectieven, in plaats van een dialoog over strategische keuzes gevoed door de empirische bewijsvoering en inzichten die nodig zijn in een planningsdiscours. Vooral in de transitie naar een duurzaam logistiek complex zijn die laatste van groot belang.

Met onvoldoende publiek beschikbare kennis zijn zes aspecten van het logistiek complex polemische sleutelkwesties geworden in het planningsdiscours. Deze omvatten het schijnbaar overal voorkomende groeipatroon van DC's in Nederland, het dominante en steeds vaker in twijfel getrokken beleidsnarratief van Nederland Distributieland, en het publiek-private actornetwerk dat te kort lijkt te schieten in het adequaat plannen en ontwikkelen van DC's. Andere kwesties zijn de geclaimde werkgelegenheidsbaten van DC's, de balans tussen de baten en lasten van logistiek, en het leveren van bruikbare informatie voor de ruimtelijke planning van logistieke clusters in de opkomende circulaire economie. Deze kwesties worden waargenomen in zowel onderzoek als de praktijk en zijn relevant in verschillende delen van Europa en daarbuiten.

Door verschillende perspectieven en methoden van empirisch onderzoek te combineren beoogt dit proefschrift de opkomst van het logistiek complex en het bijbehorende planningsdiscours te verklaren en hier multidisciplinaire inzichten in te vergaren, met een speciale focus op XXL DC's in Nederland. Hiermee is het hoofddoel om het evoluerende ruimtelijke patroon van logistieke centra en zijn interactie met het co-evoluerende planningsysteem te begrijpen. Het logistiek complex van Nederland

sinds 1980 biedt een kritieke Europese casus voor de analyse, vanwege de duidelijke verschuivingen in het ruimtelijk patroon en het planningsysteem, en tevens een scherp en goed gedocumenteerd planningsdiscours in verschillende informatiebronnen en actornetwerken. Het is een helder voorbeeld van de processen van logistieke *sprawl* en haven-regionalisering, die het ruime achterland van de Rotterdamse haven effectief hebben getransformeerd in Europa's grootste en meest gefragmenteerde *dryport*. Deze situatie kenmerkt zich door een ruimtelijk patroon van uitbreidende DC's—deels geclusterd en deels versnipperd—nabij stedelijke agglomeraties en infrastructuur. De overkoepelende vraag in het onderzoek is daarom:

Welke historische, economische en institutionele dynamieken bepalen de ongebreidelde groei van het logistiek complex in Nederland?

Dit proefschrift beoogt bij te dragen aan het opvullen van zes specifieke lacunes in de kennis gerelateerd aan de eerdergenoemde kwesties, door de volgende zes deelvragen te beantwoorden. **Hoofdstuk 2** gaat in op de vraag **Hoe is het ruimtelijk patroon van DC's in Nederland veranderd in de tijd?** Dit hoofdstuk presenteert een atlas van het Nederlandse logistiek complex, om het ruimtelijk patroon van DC's te visualiseren en te bespreken, als voorbereiding voor de daarop volgende analytische hoofdstukken. **Hoofdstuk 3** behandelt de vraag **Op welke aannames was het beleidsnarratief Nederland Distributieland (1980–2020) gebaseerd?** Het hoofdstuk beantwoordt deze vraag door middel van een systematische tekstanalyse, die ingaat op de achterliggende bronnen van het narratief, coalities van belangenbehartiging en beleidstheorieën. **Hoofdstuk 4** draait om de vraag **Welke actor-institutionele krachten bepalen de ruimtelijke uitkomsten van lokale XXL DC transacties?** Het hoofdstuk analyseert hoe ruimtelijke beslissingen gemaakt worden in de actor-institutionele dynamieken van de planning en ontwikkeling van DC's, door diepte-interviews en documentanalyse. **Hoofdstuk 5** beantwoordt de vraag **Wat zijn de regionale werkgelegenheidseffecten van XXL DC's?** Dit gebeurt door de effecten van DC's te analyseren met behulp van bedrijfsmicrodata in een drievoudige aanpak van directe, indirecte en agglomeratie-effecten. **Hoofdstuk 6** richt zich op de vraag **Welke rol speelt argumentatie van ruimtelijke rechtvaardigheid in het provinciale en lokale planningsdiscours en de beslissingen over logistiek in het achterland?** Het hoofdstuk analyseert de argumenten die in het planningsdiscours worden gebruikt, met focus op de rechtvaardige verdeling van de lusten en lasten van logistiek. **Hoofdstuk 7** gaat in op de vraag **Hoe ervaren Nederlandse planners en beleidsmakers de validiteit en toepasbaarheid van logistieke cluster typologieën en daaraan verbonden informatie-instrumenten?** Het hoofdstuk beantwoordt deze vraag door de uitkomsten van een Q-sort enquête te analyseren, aangaande de gebruikerservaring van ruimtelijke typologieën en data gedreven kaarten in het recente beleidsproces rond het plannen van logistieke clusters.

Elk hoofdstuk trekt gedetailleerde conclusies. Tezamen geven de uitkomsten drie antwoorden op de overkoepelende vraag. Historische trends en schokken hebben de planning en ontwikkeling van het logistiek complex in Nederland mede bepaald. Verschillende disruptieve gebeurtenissen bijvoorbeeld (economische crises, COVID-19) en een algemene trend van internationalisering van de handel en marktintegratie hebben de toename van DC's aangejaagd. Recente geopolitieke onrust en opkomende internationale duurzaamheidsverdragen hebben verschillende mondiale waardeketens onzeker gemaakt, terwijl schaarse grond en personeel steeds tastbaarder de uitbreiding van het logistiek complex begrenzen. Daarnaast hebben economische processen en transformaties een sterke invloed gehad op de expansie van DC's; de financialisering van DC-ontwikkeling, de opkomst van e-commerce en verwachtingen omtrent werkgelegenheid gerelateerd aan DC's. Dit proefschrift laat zien hoe monofunctionele XXL DC clusters de reeds oververhitte arbeidsmarkt onder druk zet, niet de geclaimde indirecte werkgelegenheid oplevert in een regio, en het risico op een ruimtelijk-economische *lock-in* vergroot. Bovendien zal de transitie naar een circulaire economie het gebruik van het logistiek complex veranderen in de toekomst, ofwel op gebied van het managen van retourstromen dan wel het uitvoeren van taken voor *re-manufacturing* in DC's. Tot slot zijn ook institutionele dynamieken cruciaal geweest in de vorming van het logistiek complex. Een eenzijdig narratief dat kritische studies negeerde en zich baseert op niet-onderbouwde claims, heeft bijvoorbeeld een beleidslandschap gecreëerd dat de uitbreiding van het logistiek complex stimuleert en er tegelijkertijd op rekent dat de negatieve effecten vanzelf zouden worden gemitigeerd door technologische *fixes* en gedecentraliseerde ruimtelijke planning. Dat laatste heeft perverse prikkels geïntroduceerd in het planningsysteem en logistieke *sprawl* vergroot. Het regionale en lokale planningsdiscours is echter in staat gebleken om de kwaliteit van logistieke ontwikkelingen te beïnvloeden met behulp van argumenten van ruimtelijke rechtvaardigheid, terwijl internationale bedrijfsstandaarden van DC-ontwikkeling en informatie-tools voor beleidsmakers ook waardevolle instrumenten blijken te zijn om ruimtelijke resultaten te verbeteren.

Kort samengevat zijn de dynamische condities die het logistiek complex sinds de jaren 1980 hebben bepaald significant anders dan de huidige situatie. Daarom is een vernieuwd logistiek beleidsnarratief—als opvolger van het *Nederland Distributieland* narratief, noodzakelijkerwijs geworteld in deze veranderde dynamieken. Om zo'n nieuw narratief plausibel en effectief op te stellen, moet het echter worden gebaseerd op inzichten uit vervolgonderzoek naar de hierboven besproken dynamieken, en op aangepaste praktijken van ruimtelijke planning die zulke inzichten effectief kunnen inzetten bij het nastreven van de nieuwe beleidsdoelen.

De uitkomsten van dit proefschrift wijzen naar drie richtingen voor vervolgonderzoek. Ten eerste een strategisch internationaal perspectief op de schaal van de Eurodelta. Ten tweede een gedetailleerder inzicht in de activiteiten die plaatsvinden in DC's. Ten derde inzicht in de rollen en dynamieken van het gefragmenteerde actornetwerk achter de planning en ontwikkeling van het logistiek complex—vooral semi-overheidsorganisaties en intra-gouvernementele dynamieken. Het proefschrift doet drie hoofdaanbevelingen voor publieke en private actoren voor de bevordering van interdisciplinaire en duurzame ontwikkeling van het logistiek complex. Ten eerste gelijkwaardige en open informatievoorziening gebaseerd op onderzoek en praktijkkennis in het actornetwerk. Ten tweede versterking van de interdisciplinaire planning en ontwerppraktijk, gericht op de ruimtelijke facetten van het *physical internet* (PI), en de logistieke kant van multifunctionele gebiedsontwikkelingen. Ten derde effectievere attitudes voor samenwerking onder publieke en private actoren in strategische ruimtelijke planning en ontwikkeling, gericht op de ecologische, economische en sociale duurzaamheid van het logistiek complex. Toewijding aan een dergelijke onderzoeksagenda en vernieuwde praktijk zou een goedgeïnformeerd en breed gedragen beleidsnarratief voor ruimte en logistiek mogelijk maken—een die de maatschappij in staat stelt om het beste te halen uit elke vierkante meter in de **Landscapes of Trade**.

1 Introduction

At the time of writing, the logistics complex of the Netherlands has a building footprint of approximately 80 million square metres, within which a growing number of XXL distribution centres (DCs) exist. This footprint has increased fourfold since 1980, whilst the average size of a DC has more than tripled. Compared to other European countries, the DC footprint per capita is several times higher in the Netherlands, highlighting the special logistical role of the country for the continent. However, the rise of the logistics complex and XXL DCs is a global phenomenon associated with emerging global trade flows and the logistics revolution that has occurred over the last four decades (Rodrik, 2018; World Bank Group et al., 2017).

The influence of the logistics system is paramount. You may be reading this text from an electronic device or printed volume, both of which were produced in global production chains and possibly delivered to your doorstep. Some countries have a more central position in the trade network, such as the Netherlands. Fifteen million shipping container units (TEU) went through the port of Rotterdam[1] in 2022, largely filled with consumer goods on their way to the European hinterland. Six trains per week arrive in Tilburg over land, carrying electronics and other goods from Chengdu, China, to be distributed in Europe. Although most warehouses have historically contained semi-finished products for companies in value chains or retail inventory for physical shops, many of the recent XXL DCs serve the fast-growing web shops of e-commerce. Via Amazon,[2] a Dutch customer can order 600 million products, generally with a short delivery time. Therefore, many products are stored in abundance[3] within a truck drive's distance of major cities. Thus, the rapid and inexpensive comfort of e-fulfilment comes at a spatial price.

This logistical use of the Dutch territory fits with the economic success story of the country as a *Gateway to Europe* (in Dutch: 'Nederland Distributieland') and generates a new large-scale landscape type: **Landscapes of Trade**. The scale of recent XXL

1 https://www.porttechnology.org/news/port-of-rotterdam-achieves-highest-ever-container-throughput/

2 https://www.nrc.nl/nieuws/2023/08/02/amazon-breidt-uit-met-nieuw-distributiecentrum-in-almelo-a4171103

3 It is estimated that e-commerce requires up to three times the amount of storage when compared to traditional retail (see https://www.linkedin.com/pulse/why-e-commerce-needs-more-space-than-store-based-some-howells/).

TOC

DCs, reaching a footprint of over 150,000 square metres, makes it effectively impossible to 'fit' them into existing landscapes of the European hinterland. Waldheim and Berger (2008) described three emergent logistics landscapes: distribution and delivery, consumption and convenience, and accommodation and disposal. However, the planning guidelines for such landscapes remain largely absent in Europe. Economic use has been a major driver of Dutch landscape formation, including agrarian as well as industrial and port landscapes.[4] Although large Dutch land reclamation and consolidation projects have historically had an overarching landscape design effort (Blerck, 2022), this is not the case in the making of the logistics complex since the 1980s. It can be argued that given a strategically located and densely populated territory, a contemporary consumerist and entrepreneurial society can expect to see DCs from its windows. Nevertheless, since landscapes are 'the result of an accumulation of times' (Santos, 2012) and 'areas perceived by people',[5] the way they are shaped is a legitimate topic of democratic debate.

As this thesis seeks to demonstrate, the Dutch planning system facilitates DC development. Recently, societal protests against such developments have increasingly started to influence the planning discourse. The fierce debate on logistics often reflects conflicting stakeholder interests and opposing views, rather than a dialogue about strategic ways forward fuelled by the empirical evidence and insights required in a planning discourse. Especially in the effort of planning for a sustainable logistics complex, the latter are of great importance. Here, sustainability is understood as the ability of the logistics complex to fulfil (inter)national policy goals regarding the circular economy by 2050 (IenW & EZK, 2016), and to maintain a *licence to operate* regarding its social and environmental impacts (BZK, 2020).

4 https://kennis.cultureelerfgoed.nl/index.php/Ontginningen_in_de_twintigste_eeuw

5 Landscape definition by the EU Landscape Convention (2000, ratified in 2005, see https://www.coe.int/en/web/conventions/).

1.1 Aim and structure of the thesis

By combining different perspectives and methods of empirical research, this thesis aims to shed light on and generate multi-disciplinary insights into the rise of the logistics complex and its planning discourse whilst focusing specifically on XXL DCs in the Netherlands as a critical case in northwest Europe (see also Section 1.4). In doing so, its main goal is to provide an understanding of the evolving spatial pattern of logistics centres and its interaction with the co-evolving planning system. Thus, the overarching question behind the research is:

What historical, economic, and institutional dynamics shape the rampant expansion of the logistics complex in the Netherlands?

With insufficient publicly available knowledge, six aspects of the logistics complex have become key polemic issues in the planning discourse. These include the seemingly ubiquitous growth pattern of DCs in the Netherlands, the dominant and increasingly challenged policy narrative of the Netherlands as a 'gateway to Europe', and the public-private actor network that appears to fall short of adequate DC planning and development. Other issues are the claimed employment benefits of DCs, the balance of the benefits and burdens of logistics, and the provision of useful spatial planning information for logistics clusters in the emerging circular economy.

The issues outlined here are observed both in research and practice (see Sections 1.2 and 1.3) and relevant in several areas in Europe and beyond. This thesis seeks to contribute to filling six specific knowledge gaps related to these six issues and therefore addresses six sub-questions.

Chapter 2 addresses the question **How has the spatial pattern of DCs in the Netherlands changed over time?** It presents an atlas of the Dutch logistics complex, to show and discuss the spatial pattern of DCs and set the scene for the following analytical chapters. **Chapter 3** addresses the question **On what assumptions was the Gateway to Europe policy narrative (1980–2020) in the Netherlands based?** It seeks to answer this question by analysing the sources, advocacy coalitions and policy theories underlying the narrative, through a systematic literature review. **Chapter 4** addresses the question **What actor-institutional forces shape the spatial outcomes of local XXL DC transactions?** It analyses how spatial decisions are made in the actor-institutional dynamics behind the planning and development of DCs, through in-depth interviews and document analysis. **Chapter 5** addresses the question **What are the regional employment effects of XXL DCs?** It does so

by analysing the effects of DCs by using company microdata in a threefold spatial-economic approach including direct, indirect and agglomeration effects. **Chapter 6** addresses the question **What role does spatial justice argumentation serve in the provincial and local planning discourse and decision-making on hinterland logistics?** It analyses the argumentation used in the planning discourse on DCs whilst focusing on the just distribution of the gains and pains of logistics. **Chapter 7** addresses the question **How are the validity and applicability of logistics cluster typologies and related information tools perceived by Dutch planners and policy makers?** It answers this question by analysing the outcomes of a Q-sort survey of the user experience of spatial typologies and data-driven maps in the recent policy process of planning logistics clusters.

In the following sections, the research object of the logistics complex is described in more detail as a multi-faceted apparatus, the societal and scientific relevance of the research are demonstrated, the Dutch case is introduced, and the following chapters of this thesis are outlined.

1.2 The apparatus of the logistics complex

The logistics complex has many definitions depending on the disciplinary perspective one chooses. Similar to the *corridor* concept—which largely focuses on the spatial and economic effects of a linear chain of transport nodes in the territory—the logistics complex is multi-scalar and multi-dimensional (Witte, 2014, p. 21).

The macroeconomic and supply chain perspectives define the logistics complex as a topological network that facilitates global value chains (World Bank Group et al., 2017). In such a network, individual DCs—unlike transport hubs—are relatively flexible and fungible nodes with limited spatial context that can be interchanged and redefined according to markets needs (Danyluk, 2019). From this perspective, the growth of the logistics complex is limited by the state of the world economy, sustainability goals, and geopolitical crises.

A transport perspective (Notteboom et al., 2022; Rodrigue, 2020) considers the logistics complex as a combination of publicly owned infrastructure (e.g. waterways, railways and roads) and largely privately owned (multimodal) terminals and DCs. In this physical network, transportation, energy, and infrastructure maintenance costs are a limiting factor, as well as the supply of warehouse capacity and personnel.

A regional economics perspective observes logistics as an economic activity, part of a regional business ecosystem and community (McCann, 2013; Sheffi, 2012; Stimson et al., 2006, p. 9) where the activity generates spatial agglomeration, spillover, and network effects. It can also create spatial mismatches (Diodato et al., 2018; Marshall, 1890; Neumark & Simpson, 2015) or act as a relatively footloose activity using first-nature advantages of local infrastructure (e.g. a port) whilst contributing little local value (Danyluk, 2019; Geerlings et al., 2018). The logistics sector participates in regional land, real estate, and labour markets (Bertaud, 2018), whilst the price mechanisms in these markets limit logistics growth.

A spatial planning systems perspective according to Nadin et al. (2018, p. 8) focuses on 'the ensemble of institutions that are used to mediate competition over the use of land and property, to allocate rights of development, to regulate change and to promote preferred spatial and urban form'. Therefore, the spatial planning perspective acknowledges the logistics complex as one of many functions that must be combined in an area, seeking a positive trade-off between the impacts (known as externalities in the economics perspective). Like the regional economics perspective, spatial planning attempts to balance the benefits of logistics facilities for local

economic activities against the nuisance of, for example, road congestion (Aljohani & Thompson, 2016; Van den Berghe et al., 2018). To promote plans, investments, and interventions, spatial planning in the Netherlands uses *images, concepts, and tools* (Stead, 2021; Van Duinen, 2004; Zonneveld & Verwest, 2005). National, regional, and local spatial planning perspectives are not always aligned in their goals and processes, and each has different competencies (Balz, 2019; Faludi, 2016; Boelens & Jacobs in Zonneveld & Nadin, 2021, Chapter 8). Typically, a national planning perspective aims to provide the infrastructure required for overall economic development, whilst local and regional governments seek to optimise the spatial use of the available infrastructure without destroying the living environment.

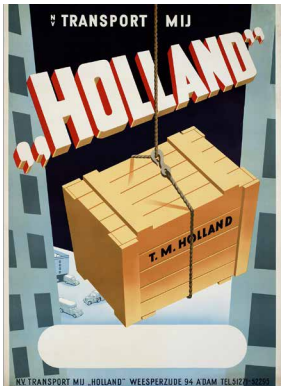
Although relevant knowledge can be produced within the scope of each of these perspectives, the inherent gaps and overlaps between the perspectives make a multi-disciplinary approach to understanding spatial planning efforts in the evolving logistics complex worthwhile, and even needed. The logistics complex is so extensive, and its underlying decision-making processes so dispersed and volatile, that it cannot be understood and planned merely as a technological artefact. It also cannot be seen as an effort of social systems engineering, as explained by Ramo (1969): 'Cities do not constitute a good systems design […] Redesign to make them into a better overall system is not taking place at a sufficiently high rate'. A clear example is the *Physical Internet* (PI) concept (Ballot et al., 2014; Montreuil, 2011), which—since around2010—has aimed to make logistics more efficient and sustainable through the standardisation of boxes, containers and protocolised *white label* warehouses, handling goods from and to any organisation. Although there is no technological barrier to achieving this, many institutional and behavioural aspects—such as the reluctance of companies to share commercial data—prevent it being adopted.

More holistic or comprehensive approaches can also be found in the literature. For instance, Martin's (2016) concept of the *urban apparatus* allows for a multi-dimensional understanding of a phenomenon such as the logistics complex, decomposing it into infrastructural, physical, political, socio-economic, and cultural components that interact. Furthermore, landscape researcher Bélanger (2017) analysed the *technological apparatus* of infrastructural landscapes. Frejlachová et al. (2020) and Orenstein (2019, p. 30) also defined the warehouse system as respectively a 'spatial apparatus' and a 'spatio-temporal apparatus for modulating flows of capital'. LeCavallier (2016, p. 101) defined DCs as 'not isolated objects but local manifestations of a dispersed communications network'. Similarly, Hein (2018) used a multi-dimensional cultural approach to investigate the PetroleumScape and PortCityScape. The choice of title for the present research, **Landscapes of Trade**, was inspired by these multi-disciplinary approaches, even though this research primarily views the logistics complex and XXL DCs as spatial-economic systems rather than cultural ones, albeit shaped by a multitude of forces.

1.3 Societal discourse on logistics

Trade and logistics are integral parts of human society, even over larger timeframes. According to anthropologist Graeber and archaeologist Wengrow (2021, p. 23) '… different groups may take on specialities—one is famous for its feather-work, another provides salt, in a third all women are potters—to acquire things they cannot produce themselves. Sometimes one group will specialize in the very business of moving people and things around.' As commodity chains, 'silkroads' may stretch across continents over long periods, representing central elements in world history (Frankopan, 2015). Rooted in the military principle of reducing friction in an army's supply chains, modern logistics is obviously of a new nature and scope (LeCavallier, 2016, p. 4). In the Netherlands, the trade and logistics sector has become part of national identity and narratives (Figures 1.1, 1.2, 1.3 and 1.4). There is a large field of critical geography research regarding logistics, which places the topic of logistics in broader global debates regarding capitalism, tax evasion, warfare, and labour exploitation (Angélil & Siress, 2011; Campling & Colas, 2021; Cowen, 2014; Easterling, 2014; Khalili, 2021; McCalla, 1990; Tsing, 2009; Verzier, 2023). After all, 'the movement of goods is a substitute for the movement of people' in the production chain (Stiglitz, 2013, p. 77). However, this thesis specifically focuses on spatial planning around logistics.

Even before the so-called *logistical revolution* in the 1970s, the impact of logistics systems on the urban environment was already a discomforting topic for at least some historians, geographers, and architects. Mumford (1961, p. 563) stated that 'many of the original functions in a city demanding physical presence of participants, are now transposed into forms capable of swift transportation, mechanical manifolding, electronic transmission and worldwide distribution.' Castells (1996) later affirmed that in the globalised world, being connected through networks of information and goods has become more important than many other characteristics of a city. More recently, Mitchell (2007) observed that 'architecturally, the most striking consequence of "teleservice" is transformation of the traditional relationship between facade and back room. Many organisations are beginning to acquire electronic fronts and architectural backs'. The current planning discourse on the landscape 'boxification' and nuisance caused by *darkstores* is arguably just a next chapter in a history of evolving views on the effects of logistics innovations on our living environment.



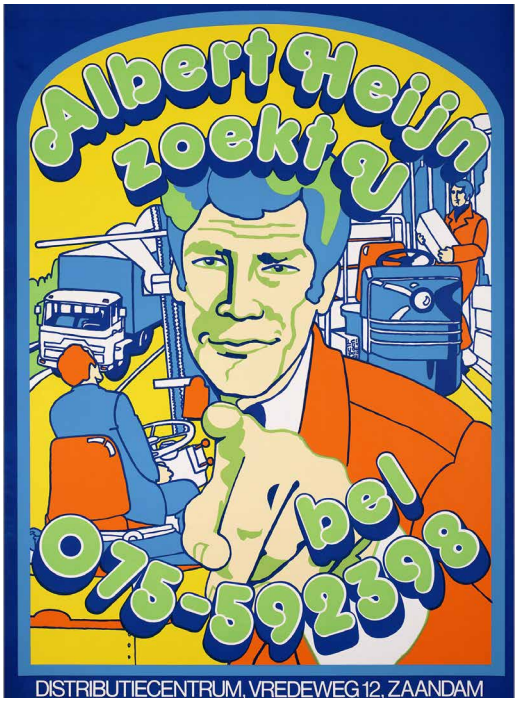


FIG. 1.1 Top left: Poster Transportmij Holland, 1950. Source: GeheugenNL.
FIG. 1.2 Top right: Poster '15.000 transport companies are helping the Netherlands back on track', 1945. By Martin Paulissen, Vliegenthart Company. Source: GeheugenNL.
FIG. 1.3 Bottom left: Poster 'Collect, Move, Deliver. Faster, Cheaper', 1931. By the Van Gend en Loos Company. Source: GeheugenNL.
FIG. 1.4 Bottom right: Poster 'Albert Heijn is looking for you', to work in its distribution centre, 1974. Source: Reclame Arsenaal.

TOC

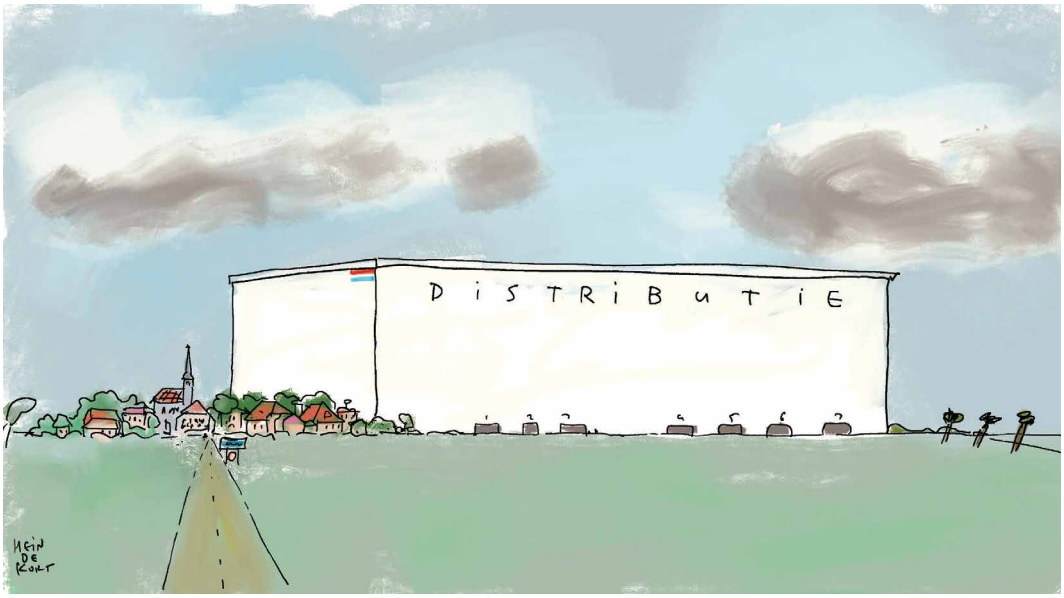


FIG. 1.5 Cartoon: 'Boxification' of the landscape. By Hein de Kort in Financieel Dagblad, 2021-10-17.

FIG. 1.6 Mural: the spatial scarcity and logistics debate visualized for a broad audience in Gent (www.oost-vlaanderen.be/ruimte2050). Photo: Merten Nefs.

TOC

From a societal perspective, there are two major reasons to strive for a *sustainable* logistics complex. First, the transition towards a circular economy in 2050—standing Dutch and EU policy[6] (IenW & EZK, 2016)—highly depends on logistics to manage the flows of reusable materials and repairable goods. Although it remains quite uncertain what this transition entails exactly, the available scenarios (Rood & Evenhuis, 2023) suggest that more products and materials will have to be handled and treated near the consumer, which contrasts with the current linear model in which many activities of the value chain occur on other continents (Ekins et al., 2019; PBL, 2022; Van Buren et al., 2016). When this occurs, it will likely increase the demand for logistics and DC-like buildings. These new value chains are also required to be more resilient. The recent de-risking of supply chains due to the COVID-19 pandemic, Brexit, and the war in Ukraine, have also increased the demand for warehouse space. Spatial decisions on logistics developments will become significantly more difficult when another EU policy regarding 'No-Net Landtake' (Decoville & Feltgen, 2023; Evers et al., 2023) takes effect, practically limiting the expansion of the built-up area to its footprint in 2030.

Second, the logistics complex is causing several negative environmental impacts and socio-economic effects. Although such concerns have existed for a long time (NEI, 1983), they have only recently become pivotal issues in the planning discourse. Researchers have pointed to the limited benefits and high burdens of unlimited freight transhipment and reexport in densely populated territories in both Europe and the US, such as the Netherlands and California (Aljohani & Thompson, 2016; Coe & Hess, 2013; Hesse, 2020; Kuipers et al., 2018; Yuan, 2019, 2021). The regularly debated environmental and socio-economic effects of DC development include the deterioration of landscapes and biodiversity by logistics sprawl (Aljohani & Thompson, 2016; Cra et al., 2019; Hesse, 2020; Krzysztofik et al., 2019; Kuipers et al., 2018; Rli, 2016; RPB, 2006b, 2006a). In the Netherlands, Flanders, and North-Rhine Westphalia, the visual impact and land take have become quite important in the public debate (Figures 1.5 and 1.6). The effects include forms of nuisance, such as emissions of CO_2, NO_x and $PM_{10}/PM_{2.5}$, noise, light pollution, and road congestion (Frejlachová et al., 2020; Geerlings et al., 2018; McKinnon, 2018, p. 15; Teo et al., 2019). They also include an increased scarcity of space on business estates, resulting in the expulsion of small- and medium-sized enterprises (SMEs) by large logistics real estate developers with deeper pockets (Provinciale Staten Noord-Brabant, 2023; Stec Group, 2020). Finally, there is an increased scarcity of labour in logistics and by consequence in other sectors as well, despite DC automation, along with housing and exploitation issues related to the many labour migrants working

6 https://www.europarl.europa.eu/news/en/headlines/society/20210128STO96607/how-the-eu-wants-to-achieve-a-circular-economy-by-2050

in DCs (H. Bakker et al., 2019; Bergeijk, 2019; Coe & Hess, 2013). For varying combinations of these reasons, local citizens have increasingly protested new logistics developments and the expansion of existing sites.

In the Netherlands, the current national spatial planning policy (BZK, 2020) reflects the friction between two ambitions: facilitating the (circular) economy by supplying land within an increasingly scarce space, and simultaneously mitigating the environmental and socio-economic effects of logistics. Logistics is considered an important growth sector and one that needs spatial steering and location restrictions. Increasingly, the following societal question is being raised: To what extent is this growth necessary to keep up with population growth alone, or population growth along with increased consumption and new consumption models, sustainability, trade volumes and developer profits (see growth numbers in Figure 1.7)?

The public 'boxification' debate, as it is called in The Netherlands, started in the realm of landscape experts. Since the late 2010s, it has become more mainstream and antagonistic (Klumpenaar, 2022; RPB, 2006b). DC working conditions and the role of DCs in the circular economy have more recently become part of the discourse (Bergeijk, 2019; Rood & Evenhuis, 2023). Besides companies, consumers are often blamed for XXL DCs and other logistics issues, since 'all resistance to "boxification" begins with one's own laziness' (Donkers, 2020). Many, however, refuse to be a scapegoat for XXL DCs and logistics nuisance, such as journalist Koen Haegens (2022, p. 9; translation by author): 'I don't remember signing a form to agree with package delivery by exploited, sleep drunk drivers in dirty white diesel vans.' Another focal point of criticism is the national, provincial, and local policies that have either ignored or failed to get a grip on logistics developments.

Although increased consumption and a growing population are frequently mentioned in the discourse, the growth of DCs does not match the growth curve of the population, unlike offices and houses (Figure 1.7). On top of this expected growth, there appear to be other structural trends in the economy and international trade that drive the expansion of the logistics complex.

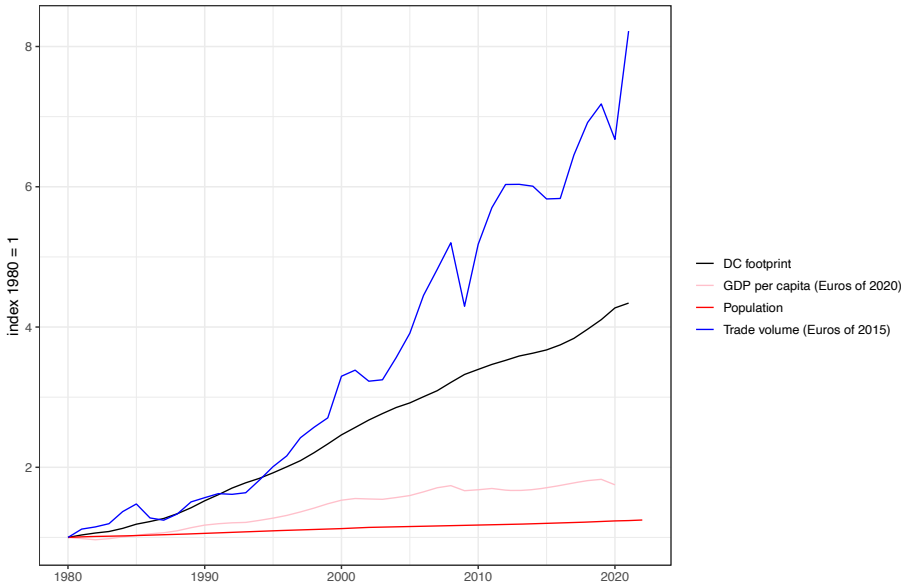


FIG. 1.7 Indexed growth in the Netherlands between 1980 and 2020: population, GDP/capita, trade, and DC footprint. Source: CBS and Dutch Distribution Centres 2021 Geodata (Nefs, 2022).

The logistics (real estate) sector positions itself in the debate by emphasising its importance and ubiquity, for example in the common slogan[7] 'everything is logistics', as well as its massive scope: 'unifying the planet through supply chains' (Orenstein, 2019, p. 225). Nevertheless, such claims deny agency in the economic system since the sector sees itself as merely a flexible facilitator between powerful producers and consumers, with limited responsibility to make important choices. In contrast, a more receptive part of the sector generally points to the government for adequate regulation, whilst a more traditional part emphasises that the existing economic system must be maintained and strong regulation of the logistics complex is dangerous. A multinational DC developer based in the Czech Republic[8] called for 'higher governmental requirements in European countries for DC developments, in a level playing field. Because we fill in all free space for entrepreneurship like everyone else. Public tenders should not only select on maximum land revenue, but also on how SMEs and ecology are handled in the proposal'.

7 See https://everythingislogistics.com/ and https://brabantinbusiness.nl/nieuws/alles-is-logistiek

8 Informal interview February 2023, translation author.

TOC

Undoubtedly, changing a highly complex and financialised system like logistics is also difficult to achieve from the inside, or, as a DC investment banker[9] based in Germany put it: 'Crisis or not, hundreds of billions of investor capital are still searching for a way out. […] This month we invested, by coincidence, in a large DC behind my own house. […] What we are all doing right now, unconstrained construction of one large grey "cigar box" after another, is not really my vision of the future either.'

Furthermore, making spatial policies for logistics is difficult due to the many knowledge gaps that have appeared in the process. This research aims to contribute to filling some of these gaps, especially by analysing the actual physical and economic patterns of the logistics complex in detail, as well as the role of long-term policies and actor networks in its development since the 1980s. Besides the need for concrete policies, societal stakeholders on the side of government as well as the private sector and NGOs have emphasised the need for a new spatial-economic narrative as a follow-up to the dominant **Gateway to Europe** mantra already mentioned. Although such a new narrative cannot be the result of a scientific project, the present research has contributed to this societal discussion on several occasions (see Appendices).

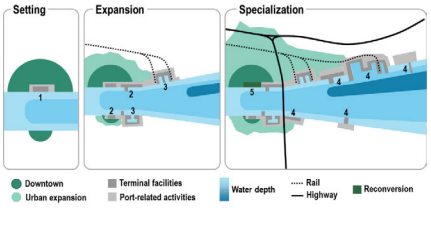
9 Informal interview November 2022, translation author.

1.4 Knowledge gaps in the spatial planning of logistics

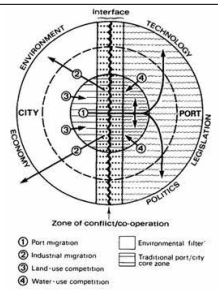
The research structure, as introduced in Section 1.1, seeks to address several knowledge gaps that appear in the literature and the available data sources, as well as in the recent planning discourse. Thus, the research aims to generate both scientific and societal contributions. The six gaps presented directly below limit the understanding of the spatial planning and development of the logistics complex, as well as the possibilities for its sustainable planning moving forward. By choosing these lenses, other valuable approaches on the topic inevitably had to be put aside, such as long-term historical approaches, as well as analyses of supply chain management and real estate economics.

The assessment of the **spatial pattern of the logistics complex** is clearly a key element in the discourse on expanding DCs (Flämig & Hesse, 2011; Hein & Mil, 2019; Raimbault, 2019). Logistics sprawl and the rise of hinterland *dryports* are the main examples of changes in the spatial pattern (Aljohani & Thompson, 2016; Heitz et al., 2017; Notteboom et al., 2022; Strale, 2020; Woudsma et al., 2016). The changing pattern has typically been illustrated with either anecdotical evidence of particular DC projects, or aggregated data with little detail (Bak, 2021; BCI, 2019a; Stec Group, 2020). A basic and rather surprising knowledge gap in the Netherlands is the lack of a comprehensive and detailed map of the Dutch logistics complex. Some partial datasets can only be purchased from consultants and are not open-access or reproducible. The situation where large corporations do have this type of information and small public entities do not, creates an information advantage. The compilation of a comprehensive longitudinal spatial dataset requires the combination of various sources and extensive validation. This—possibly along with stakeholder interests—explains the absence of such a map or dataset until recently (this does not count only for the Netherlands). The limited availability of proprietary company microdata poses a barrier to disclosing and updating this type of information.

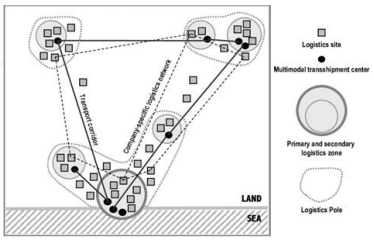
Port expansion



Anyport model (Bird, 1963)

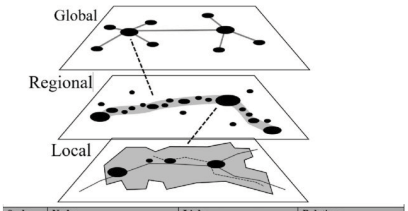


Port-city interface (Hoyle, 1989)



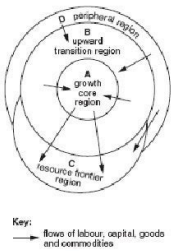
Port regionalisation (Notteboom & Rodrigue, 2005)

Corridor-forming and zoning

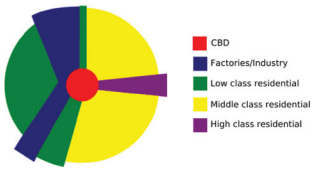


Scale	Nodes	Links	Relations
Local	Employment and commercial activities	Roads and transit systems	Commuting and distribution
Regional	Cities	Corridors (rail lines, highways, canals)	Urban system
Global	Gateways (airports and ports)	Air and maritime lanes	Investment, trade and production

Scales of spatial organisation (Rodrigue, 2016)



Core-periphery model (Friedmann, 1966)



Urban sector model (Hoyt, 1939)

FIG. 1.8 Models explaining part of the spatial pattern of logistics.

Several urban, regional, and port development models (Hein & Mil, 2019; Van den Berghe, 2018) can explain the growth pattern of the logistics complex (Figure 1.8). Two types of geographical models appear to be relevant to explaining the pattern, focusing either on port expansion and regionalisation, or on corridor forming and other types of zoning. From 1980 to 2010, the *anyport model* (Bird, 1963, pp. 29–33) predicted the growth of port complexes towards the sea and explained the spatial pattern in the gathered data on DCs quite well—especially in the ports of Rotterdam and Amsterdam. The *port-city interface dynamics model* explains why port cities experience spatial dynamics through, for example, competition (Hoyle, 2000, p. 405). Since the 1990s, the *port regionalisation model* (Meyer, 1999, p. 23; Notteboom & Rodrigue, 2005) including hinterland logistics corridor forming can be recognised in the data pattern, particularly in the south of the country (e.g. Dordrecht, Moerdijk, Venlo and Tilburg). The different scales of spatial organisation in a corridor were demonstrated by Rodrigue et al. (2016) and (P. A. Witte, 2014), explaining the influence of global networks on regional corridors and local areas. The development of such corridors from transport to economic development corridors,

TOC

as is often desired by policy makers, was described by Galvez (2014, p. 9). Upon zooming in on urban regions in such corridors, new infrastructure and DCs are located increasingly far from highly-priced sites in urban cores, as predicted by the related *standard urban model* from the 1960s. The pattern of logistics appears to follow transport infrastructure and increasingly avoid certain population centres, which are sensitive to nuisance and more influential in spatial planning, as shown in the *core-periphery* model developed by Friedmann (1966) and the *sector model* created by Hoyt (1939).

The main push and pull factors behind these models are arguably economic and transport volume growth initially, as well as increased land prices near major hubs and the attempt to segregate nuisance from urban and residential areas. More recently, e-commerce and otherwise changing supply chains stimulating DCs in the proximity of population centres have become the main factors, in tandem with primarily national-scale incentives and regulation by the planning system (Rodrigue, 2020). Although these models explain some of the heterogeneity, such as hinterland corridors and hotspots, they do not sufficiently explain the more recent fragmentation in the pattern that can be observed especially since the 2000s (see **Chapter 2**). This thesis assumes diverse decentralised land policies and other factors in the planning system, as well as development actor networks being responsible for this pattern of logistics sprawl. These policies and actor networks will be analysed in **Chapters 3–7**.

Especially in The Netherlands, the trade and logistics industry is first and foremost a story; in the eyes of many it is a historical and economic success story. The merchant history of the Netherlands and Europe's number-one port in Rotterdam is widely known (see, for instance De Klerk, 2019). In 1654, Johan de Witt already promoted a tax deduction to keep the Baltic grain trade flowing through Amsterdam (Van Tielhof, 2002, pp. 4–5). Large infrastructure investments from the 19th century until recently have enabled the port of Rotterdam and its hinterland connections to reach their current positions. Therefore, the gateway mantra is more than a cultivated marketing plot, or a booster story to attract investors (Cronon, 1991; Orenstein, 2019); instead, it has been a rather dominant **policy narrative** since the 1980s, selectively building on this history. This narrative has provided the context for large influence in infrastructure investments as well as fiscal and other legislation (Kuipers et al., 2018; Kuipers & Manshanden, 2010; Rli, 2016; Zande & Kreukels, 2000), and it has functioned as a slogan to attract exporting and logistics businesses to the Netherlands (Veenstra, 2022) via the governmental Netherlands Foreign Investment Agency (NFIA). However, it remains unclear how this narrative developed in detail, by which exogenous shocks and research documents it was influenced (or not), and what its underlying assumptions were for various phases of spatial-economic

policy making (P. A. Hall, 1993; Hoogerwerf, 1990). A better understanding of how such policy narratives come about is crucial for the development of new narratives that can—when combined with economic stimulus or fiscal measures—lead to a sustainable logistics complex (Throgmorton, 1996).

In many media items and research papers, the construction of an XXL DC is discussed as a singular decision made by one investor or developer (Combes, 2019; A. Onstein et al., 2019; Sakai et al., 2020; Verhetsel et al., 2015). However, the spatial decisions regarding a DC—including its location, geometry, and landscape integration—are usually taken in a **complex network of actors** ranging from the public to the private side of the spectrum, with hybrid organisations in between. Many of these do not have a spatial planning role to begin with, and act, for example from a risk management or financial portfolio perspective (Hesse, 2004). Each actor has their own interests, power, and modus operandi. Moreover, the dynamics of path dependency, historical institutionalism, principal agent theory and multi-level planning are usually at work in such actor networks (Healey, 1999, 2006; Higgs, 2018; Salet, 2018; Sorensen, 2015). Insights into this institutionalised actor network, as well as how it has recently influenced the location choice, geometry, and landscape integration of DCs, can help to identify success factors for sustainable logistics planning.

Regional employment benefits have been an important and continuous argument behind DC developments since the 1980s. For decades, the creation of jobs in logistics was claimed by both public and private stakeholders, referring to direct employment in the DC, as well as indirect employment in the supply chains, and business ecosystem in the region. As obvious as this may indeed sound, there are very few empirical studies that have structurally measured such employment effects in DCs and their regions, particularly in spatial detail and over a long timeframe. This information is becoming more relevant now that direct employment no longer seems to be a valid argument for DC development—since tasks in DCs are increasingly automated or performed by migrant labour—with only the indirect and business ecosystem effects remaining as plausible employment benefits. Therefore, it is crucial to gain structural insights into these various regional effects and the role of place-based policy (Ellison et al., 2010; Faggio et al., 2017; Kline & Moretti, 2013; Neumark & Simpson, 2015; Rivera et al., 2014; Steijn et al., 2022; Warffemius, 2007).

While the negative spatial impacts of logistics are hardly visible on a national planning level, this is increasingly the case regionally and locally. Trade-offs are made in local policy decisions—sometimes explicitly and often implicitly—between the **benefits and burdens of DC developments**. This arguably makes DC

development a case of spatial justice (Bret, 2018; Moroni, 2020; Rawls, 1971; Soja, 2010; Yuan, 2021). Despite the stories of aldermen making a deal with a DC real estate developer over lunch—which is a global phenomenon (LeCavallier, 2016; Stein, 2019)—it can be assumed that local politicians also attempt to balance the benefits and burdens of DCs for the local population, with varying success. From a spatial policy perspective, it would be relevant to know what kinds of spatial justice arguments play a role in the policy discussion and how these arguments influence various trade-offs in local decision-making. Such knowledge would enhance the opportunities for a better-informed and balanced policymaking process.

Finally, logistics has been a black box and one-size-fits-all element in spatial planning, for lack of an applicable **typology of logistics area types** (Heitz et al., 2019). There are several useful distinctions in terms of types of logistics companies focusing on, for example, different functions in the transport chain or their (sub)urban context (Diziain et al., 2012; Ekins et al., 2019; Gravagnuolo et al., 2019; Heitz et al., 2019; Meza-Peralta et al., 2020; Sakai et al., 2020; Strale, 2020; Van Buren et al., 2016; Van Oort et al., 2017). However, the recycling and remanufacturing environments of the circular economy are lacking in most typologies. A comprehensive combination of logistics functions and spatial location factors is also lacking. Furthermore, it remains unclear how such a typology may influence and support the spatial planning process at the various policy levels. This is understandable since one would typically require a real-world experimental setting and lots of time to study this.

1.5 The Dutch case

Although the growth of the logistics complex and the spatial planning issues described above occur in many parts of the world, this thesis addresses them in the European context by focusing on the critical case of the Netherlands as a research object. The changing spatial planning paradigm in the Netherlands during the 1990s perfectly mirrored the emerging economic globalisation paradigm from the 1980s. One of the leading Dutch planners of that time, Dirk Frieling, stated in 1998 that with the existence of the EU, planners should stop comparing the Randstad area to other Dutch cities, but rather see its significance in a European network of metropolises. According to him, policy makers were 'constantly frustrated by local and provincial considerations' (Berkers in BNA Onderzoek, 2019; translation by author). This European outlook in spatial planning remains visible in spatial planning memoranda today (BZK, 2020; IenM, 2012), especially with regard to transport corridors.

Most chapters in the thesis examine key parts of the Dutch logistics complex by zooming in on the East-Southeast Freight Corridor (ESE corridor), which includes the busiest trade and transport routes of the country and a large part of Dutch DCs (Figure 1.9). Two chapters zoom in to local DC development cases within the ESE corridor for more detail. The scope of the research is geographically determined by the Dutch territory and chronologically begins from 1980. The main physical entities studied are Dutch DCs, with a specific focus on (X)XL DCs in the hinterland of the Port of Rotterdam.

The apparatus of the Dutch logistics complex since 1980 offers a critical case for analysis (Flyvbjerg, 2011), since its development and planning discourse is more intense than those of other nearby European countries. The Netherlands has had strong policies and a policy narrative, to position the country as a key logistics hub or gateway to Europe. Since the 1980s, the country has developed the densest transport networks and the highest amount of logistics floorspace per capita in Europe, with the former being fuelled by national and the latter by foreign investments (see **Chapters 2 and 3**). It is adopting critical and conflicting policies to become a circular economy in 2050 as part of EU legislation and simultaneously to steer and restrict the development of DCs in the short term. The Netherlands has experienced a strong port regionalisation process, practically turning the southern half of the country—the hinterland of the Port of Rotterdam—into Europe's largest and most fragmented *dryport*. It has also experienced fierce public discourse on DC developments involving a broad actor network, including protests influencing the political debate from the local to the national level. This discourse

has been quite well documented in the media and professional press. Several other European countries have experienced similar trends, but none as pronounced as the Netherlands and with the same availability of data sources.[10] The insights into the historical, economic, and actor-institutional dynamics that can be drawn from studying the Dutch logistics complex—whilst making use of specific cases within it to analyse the aforementioned aspects can thus also be relevant for other countries. The data on the Dutch logistics complex, required for the various parts of the research, are introduced in the next chapter.

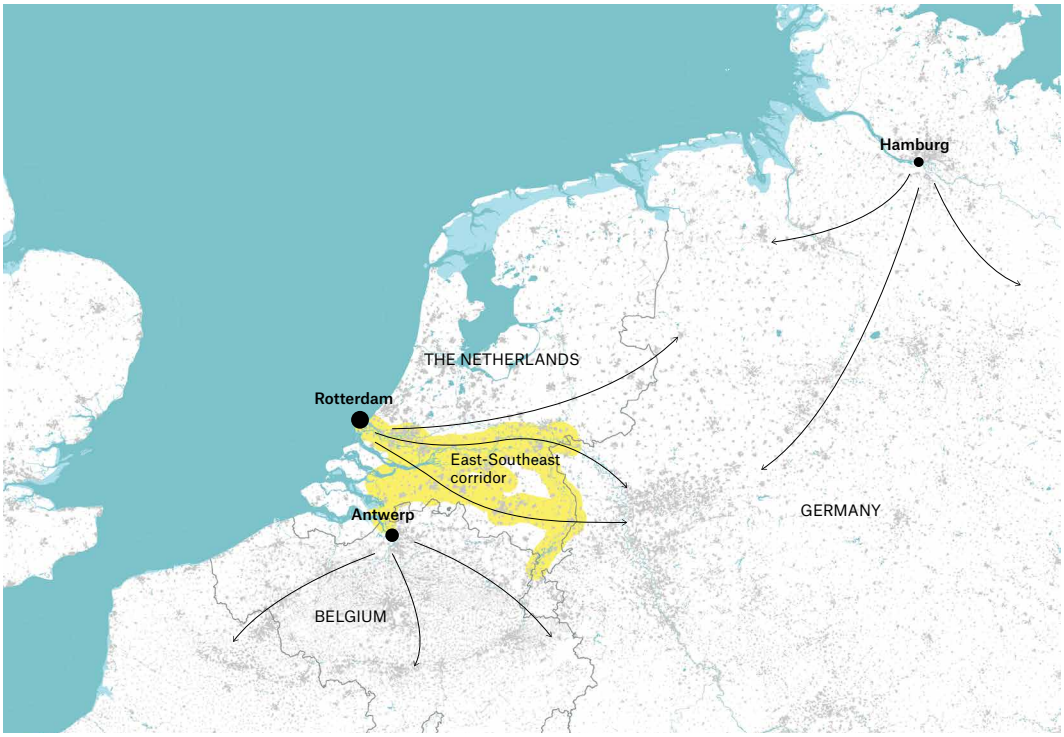


FIG. 1.9 Top three European ports, an indication of their hinterlands, and the Dutch East-Southeast freight corridor.

10 As an exception, detailed data on trade flows appears to be more available in France, the USA and Canada.

TOC

1.6 Thesis outline

The following chapters of the research address six sub-questions pertaining to the aforementioned aspects. Although disciplinary knowledge is of great importance to the understanding of each of these aspects, the apparatus of the logistics complex is highly multi-dimensional in nature. Therefore, this thesis employs a mixed approach (Clark et al., 2021; Tashakkori & Creswell, 2007) combining qualitative and quantitative methods and insights from multiple disciplines, as described in detail in each of the respective chapters (see Table 1.1). As stated by Bertaud (2018, p. 2), collaboration between the disciplines is fruitful and necessary because 'planners are blind; they act without seeing. The economists are paralyzed; they see but do not act.' One could also say that both disciplines have different perspectives on the issue and use different instruments to act. The final chapter reflects on the use of the mixed approach (Section 9.2).

Works of critical geography and architectural research, such as Out of Stock (Orenstein, 2019), The Rule of Logistics (LeCavallier, 2016) and Learning from Logistics (Lyster, 2017), have each provided an in-depth account of a specific case in the logistics complex: the histories of the bonded warehouse, Walmart, and FedEx, respectively. This technique of focusing on a specific issue in a critical or instrumental case study (Flyvbjerg, 2011; Stake, 2005) is also applied in several of the chapters (see Table 1.1).

TABLE 1.1 Research issues and methods by chapter.

Chapter	Key issue	Main methods (besides literature review)
2	Spatial pattern of DCs	Geographical Information System (GIS) data compilation, validation, and visualisation
3	Policy narrative of logistics	Systematic review of policy documents
4	Actor-institutional network behind DC development	Case study and semi-structured in-depth stakeholder interviews
5	Regional employment effects of DCs	Employment density mapping (GIS), co-agglomeration index (Stata) and shift-share analysis (R)
6	Use of spatial justice arguments in the logistics debate and decision-making	Document analysis, data analysis, and visualisation (R)
7	Applicability and validity of logistics cluster typology and information tool	Multicriteria analysis, Q-sort survey and Q-method factor analysis (R)

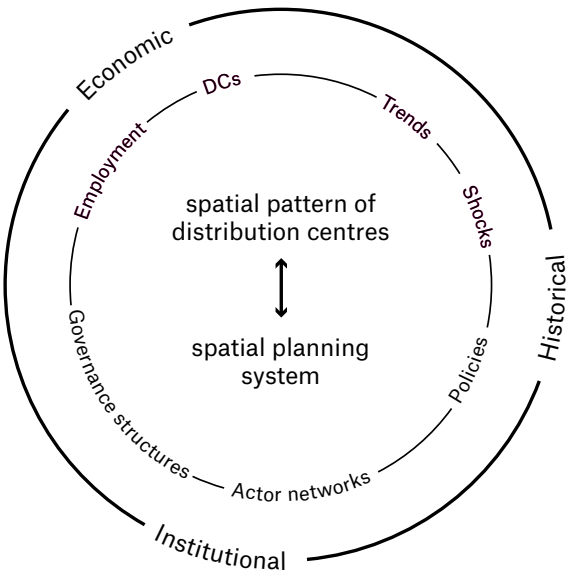


FIG. 1.10 Conceptual scope of the research. From the inside out: main issue, measurable elements, and dynamics.

The overall research approach separates various elements in the logistics complex that could be observed: physical artefacts (DCs) and experienced landscapes, arguments and narratives for decision-making (policy theories, counternarratives), economic patterns (regional, national) and effects (employment, agglomeration), as well as governance structures (see Figure 1.10). The choice of elements to be analysed in detail, the focus on particular variables, data collection and processing, as well as specific outputs, are further elaborated in each chapter.

Most chapters are written as academic journal articles. Chapter 6 is an adaptation of a conference paper and Chapter 2 offers a concise atlas of the logistics complex, built up from maps and diagrams produced and gathered throughout the research and partly published in interactive web viewers as well. The data and scripts underlying each chapter, as far as it is permitted, are shared open-access in an online data collection on the 4TU repository.[11] The images used in the thesis are produced by the author unless otherwise stated.

11 DOI: 10.4121/b39208e8-3d54-421d-b453-ef0831e3b913

TOC

Chapter 2 is an *atlas* to present and discuss the spatial pattern of DC in the Dutch logistics complex since 1980. In a GIS more than 20,000 datapoints of logistics buildings are compiled and validated, distinguishing different logistics functions, and ranging in size from small to extra-extra-large (XXL). Cartographic and numerical visualisations, performed with the statistically treated data, provide insights into several concrete facets pertaining to the development of the logistics complex between 1980 and 2021. One is the growth, spatial clustering, and fragmentation of DC developments (Flämig & Hesse, 2011; Hesse, 2004). Another is the shifting of the gravity point of the logistics complex (Kuipers, 2016; Van de Ven, 2020). Furthermore, the changing size classes and functions of DCs (Hines, 2013; Leinbach & Capineri, 2007), as well as employment in these categories, are documented in the 40-year timeframe since 1980. Regional differences are also shown. DC floorspace per capita is high in the Netherlands when compared to other countries. Infographics and an Ordinary Least Squares (OLS) model provide insights into the main factors' correlations with this variance. Furthermore, a few environmental impacts of the logistics complex are mapped. By illustrating several spatial trends and aspects of the logistics complex, the chapter sets the scene for the following analytical chapters.

Chapter 3 analyses the evolution of the Gateway to Europe policy narrative whilst focusing on the key exogenous shocks (P. A. Hall, 1993), advocacy coalitions, and research (Sabatier, 1998) that influenced the policy theories (Hoogerwerf, 1990), which were instrumental in the policies made within the context of the narrative. Since 40 years of documentation and policy discussions on this topic amount to many thousands of pages, a systematic literature review method (Liberati et al., 2009) was used to select, process, and analyse the information. The findings are chronologically presented in a policy timeline with related exogenous shocks, in a diagram linking spatial policy memoranda to influential reports, and in a list of main causal policy theories underlying the policies. The chapter reflects on the suboptimal use of research and the imbalance of advocacy coalitions found, as well as on the use of the potential that policy narratives (Throgmorton, 1996) generally provide.

Chapter 4 analyses how spatial decisions are made in the institutionalised actor networks behind the planning and development of DCs, through in-depth interviews and document analysis. The assumption is that actor behaviour in the public-private planning-development dialectic can explain the observed logistics sprawl (Heitz et al., 2017; Krzysztofik et al., 2019; Strale, 2020). In the analysis, the spatial outcome of a DC transaction (North, 1987; Williamson, 1998) is deconstructed into location choice, geometry, and landscape integration, supported by a literature review. Semi-structured interviews shed light on the different roles stakeholders performed in four case studies on DC developments in the ESE corridor, as well as how their diverging

objectives and information positions influence DC transactions. The stakeholder selection included government officials at different levels, their semi-public entities that are used as land development organisations, as well as foreign investors, brokers, and consultants. The chapter reflects on two possible influences: the involved tiers of government planning and internationalisation of the DC developer, as well as the legal-financial arrangements influencing DC transactions. Based on this discussion, a typology of DC developments is proposed.

Chapter 5 analyses the employment effects of DCs in a threefold spatial-economic approach in regions of the ESE corridor, distinguishing direct employment in DCs (Coe & Hess, 2013; Hesse, 2020; Yuan, 2019), indirect employment in the supply chain (Chhetri et al., 2014; Sheffi, 2012) and employment in the regional business ecosystem—known as the agglomeration effects (Diodato et al., 2018; Faggio et al., 2017; Van den Heuvel et al., 2014). For this purpose, three methods are used in sequence: job density mapping and the summarising of key sectoral employment figures for regions in GIS; a co-agglomeration index to assess whether logistics structurally—above random levels—occurs jointly with other sectors in the same municipality; and a shift-share analysis to assess the agglomeration effect of DCs in a region. All three parts of the analysis use the same company microdata between the years 2000 and 2020. The chapter reflects on the observed heterogeneous spatial pattern of logistics employment (Heitz et al., 2019), on the claimed and realised employment benefits in regions that stimulate the development of DCs compared to regions without such stimulating policies in the ESE corridor, and on the decline of other key sectors in these regions.

Chapter 6 analyses the argumentation used in the planning discourse on DCs whilst focusing on the just distribution of the gains and pains of DC developments (Yuan, 2021). This is done by analysing the position of political parties towards regional DC development, assessed through data obtained from an official information website made to help voters choose in the provincial elections of 2023. Additionally, 2 years of newspaper articles in regional outlets from two case study regions are screened for the use of spatial justice arguments related to DC developments. These listed arguments are compared to the local political decision-making process regarding two specific DC development sites. The chapter reflects on the dominance of certain arguments, the large spread of political positioning (by party and region), the different trade-offs being made by the authorities, and the possibility of the public debate to effectively increase spatial justice in local decision-making regarding DC developments.

Chapter 7 analyses the validity and applicability of spatial typologies and information tools such as data-driven maps in the policy process of planning logistics clusters. First it proposes a new typology of logistics cluster areas for spatial planning in the circular economy, based on existing examples gathered in a literature review. The applicability and validity of the typology, represented in suitability maps, is tested in a Dutch *policy lab* (Lee & Ma, 2020; Whicher, 2021) during the 2022–2023 period—a government programme[12] in which national and regional government officials participate to make and test spatial policies for logistics. Results from a Q-sort survey (Coogan & Herrington, 2011) completed by participants of the lab, are analysed with Q-method statistics (Zabala, 2014) yielding two main views on the typology and maps. The different views are explained through qualitative remarks gathered in the survey, as well as group statistics on the participants' role and knowledge level regarding the typology and map.

Chapter 8 draws conclusions from the combined outcomes of the research parts introduced above to answer the overarching question of the research. Based on the empirical research, recommendations for spatial policy makers are summarised here, as well as possible directions for further research.

Due to the lively debate on the planning of the logistics complex in the Netherlands, it was possible to discuss the topic with several audiences and elaborate on it in various design and consultancy projects in parallel to the PhD research. While there is a sharp distinction between academic and practice-oriented work, there has been cross-fertilisation between the two. **Chapter 9** reflects on this way of working in the research process of the PhD project. For reasons of transparency, a list of these parallel activities—academic and non-academic—is added to the Appendices.

12 This programme is called 'Grip on large-scale company buildings' (in Dutch 'Grip op Grootschalige Bedrijfsvestigingen')

TOC

2 Atlas of the Dutch logistics complex

The scientific and societal debate on the spatial effects and planning of the logistics complex depends highly on the quality of the available information. Even after 40 years of Gateway to Europe policies, there is still not a detailed open-access overview of the building stock of logistics. Certainly, there are consultancy firms and brokers who gather these data for their own use and occasionally publish selections and reports on an aggregated level[13], some of which have been used in this thesis. This is not enough, however, to sustain independent research on the topic and to enable governments to make policies from a more similar information position as the market.

This chapter introduces an **open-access** dataset of the logistics complex of the Netherlands in 2021 (Nefs, 2022b). Considering the available sources at that moment as well as the academic standards, it may be considered the best possible dataset at the time of writing: (i) documented and shared according to the FAIR[14] principles—findable, accessible, interoperable and reusable; (ii) consistently gathered from sources that will be available in the foreseeable future; (iii) dating back to before 1980 when the phenomenon of distribution centres emerged; (iv) featuring high detail across the Dutch territory usable for publication and analysis. The data are gathered from open sources (OpenStreetMap, BAG, IBIS) and a closed source (LISA company microdata), the latter obtained with the help of Stichting LISA, Frank van Oort (Erasmus School of Economics) and Hans van Amsterdam (Netherlands Environmental Assessment Agency, PBL). The data are compiled by the author, validated in collaboration with Thomas Bonte and Carlijn Ligterink (Vrije Universiteit Amsterdam), Vera Loefs and Ana Luisa Moura (Deltametropolis Association). The data have been used for research, media articles and academic work (see Appendices). The sources, compilation, **treatment and validation** methods of the data are described in **Appendix 1**. Simplified versions of the data have been published on interactive maps and infographics online[15] since 2019 to contribute to the public discourse.

13 For example, international broker CBRE, Dutch broker's association NVM or consults BCI and Stec Group.

14 https://www.go-fair.org/fair-principles/

15 https://mertennefs.eu/landscapes-of-trade/ and https://mertennefs.shinyapps.io/distributioncentres_geodata_app/

To get an overview of the logistics complex of the Netherlands at the start of this thesis, the next section uses the dataset to describe its development since 1980, by demonstrating key parameters which appear in the discourse such as size, growth pattern, functionality, scale and employment of the logistics complex, on different scales.[16] The following section shows and discusses the relatively large spatial logistics footprint in The Netherlands compared to other countries. The third section of this chapter describes some of the spatial impacts, and section 2.4 provides insight into the suitability of Dutch areas for certain types of logistics. The final section illustrates relevant aspects of DCs via individual examples, which cannot be understood completely from the data.

2.1 The spatial development of the logistics complex

The geodataset includes 26.951 logistics buildings in the Netherlands, built before November 2021, as well as the business estates they are in, and the outline of the East-Southeast freight corridor of the Netherlands—the busiest logistics area of the country. The definition of the logistics sector elaborated and used in this research includes trade, import, export, wholesale, transportation, and warehousing activities, as well as e-commerce. Definitions of what a DC is are quite broad in the literature, usually including any building in which goods are (temporarily) stored for commercial purposes in value- and supply chains (Keshavarz-Ghorabaee, 2021). Many real-estate surveys focus on so-called XXL warehouses for logistics service providers, larger than 40 or 50 thousand square meters in ground floor space (Bak, 2021; BCI, 2019a), for the purpose of market analysis.

This research, however, aims to assess the growth of the entire logistics complex, including medium and small storage buildings. To avoid irrelevant buildings such as small, dedicated office buildings and electrical installations, only logistics buildings larger than 500 sqm were considered in the data collection. Additionally, 4.533 large buildings with retail centres on industrial sites were included, where consumers 'pick their own orders', such as construction materials stores. As well as 782 buildings

16 R scripts of the quantitative data visualizations are available in the repository.
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TOC

with logistics co-activity, for example a hospital with a logistics entity for medical materials. Manufacturing and recycling facilities, which often include logistics activities, are not included unless a separate logistics company is registered in the building. Several of the analyses presented in the next chapters are exclusively focused on XL (> 20.000 sqm) and XXL DCs (>40.000 sqm), used by traders and logistics service providers. Depending on the analysis, therefore, subsets of certain functions and size classes of DCs are used.

FIG. 2.1 Lacking logistics establishment data. Left: Tesla Motors Tilburg. Right: agrobusiness in Barendrecht. Source: Google Earth.

The data still underestimates the logistics spatial footprint, since often agricultural or manufacturing companies own logistics-style buildings and perform logistical tasks, without being registered as such (see examples in Figure 2.1). Researcher René de Koster (Erasmus University, RSM) estimates the existence of about 50.000 logistical locations, including raw materials and product storage of manufacturers[17]. The actual use or vacancy of DCs at a certain moment, in terms of volume and market orientation of the goods, cannot be derived structurally from public nor proprietary data. This makes urgent public discussions on the scarcity of DC space more difficult, and the question which part of the logistics complex is needed to supply the Netherlands difficult to answer.

17 In an informal interview in 2022.

2.1.1 Physical growth of the logistics complex

An often-cited aspect of the logistics complex is its growth rate (Flämig & Hesse, 2011; Hesse, 2004; Kuiper et al., 2023), while figures tend to diverge according to the definition of DCs. Additionally, emerging EU regulations[18] on 'No-net Landtake' in 2050 (Decoville & Feltgen, 2023; European Commission, 2021; Evers et al., 2023), as well as persisting growth trends of logistics service providers make a breakdown of functional and size classes of DCs insightful. The total logistics complex of the Netherlands, including trade and logistics companies—somewhat underestimated as mentioned above—measures 77 million square meters of building footprint in 2021, 15 million of which fall in the fast-growing and often debated category of XL and XXL DCs pertaining to logistics service providers (Figures 2.2 and 2.3). When the aforementioned XL retail and logistics co-location facilities are added, the footprint increases to almost 100 million sqm. Most logistics buildings are small or medium-sized. Since 1980, the size of the logistics complex increased fourfold—an annual rate of about 4%—while the average size of an individual DC increased three times (Figure 2.12). The data maps (Figures 2.4 - 4.8) show growth occurs on various spatial scales.[19] The recent growth figures of about 2 million sqm per year, from small to XXL, in the last decade are compatible with other research, which can vary in terms of definitions.[20]

18 At the time of writing, the government of the Netherlands is deliberating on a position in the European land scarcity debate. The Flemish government has started an initiative to study how landtake can be net-zero in 2040 (Flanders Bouwshift 2040 policy is in the making). The No-Net Land Take policy process is part of the EU Soil Strategy for 2030 (https://environment.ec.europa.eu/publications/eu-soil-strategy-2030_ena.eu)

19 For an interactive view, see https://mertennefs.eu/landscapes-of-trade/

20 CBRE, Stec, BCI and NVM generally focus on subsets of the total logistics real-estate, for example larger than 2.500 or 25.000 sqm.

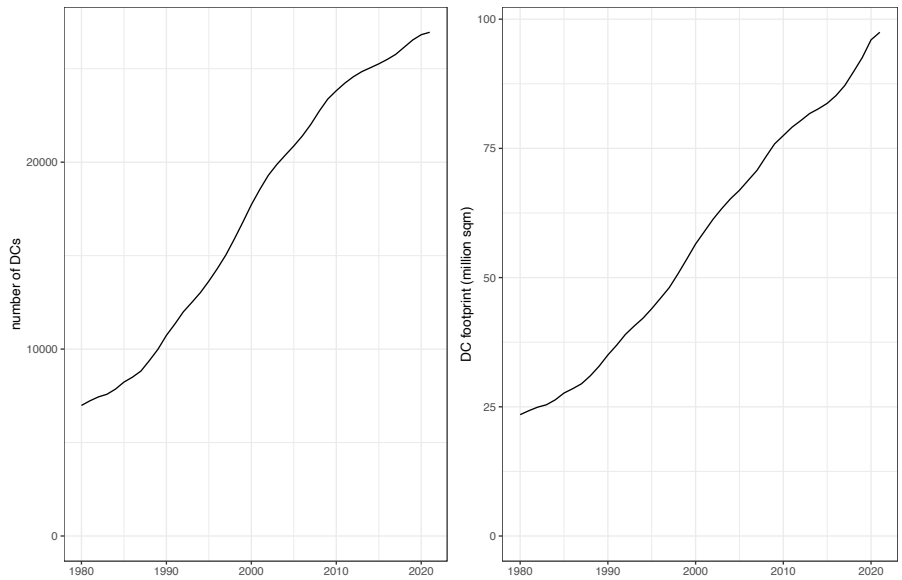


FIG. 2.2 Absolute growth in number and footprint of DCs in the Netherlands. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022). See interactive dashboard at https://mertennefs.shinyapps.io/distributioncentres_geodata_app/

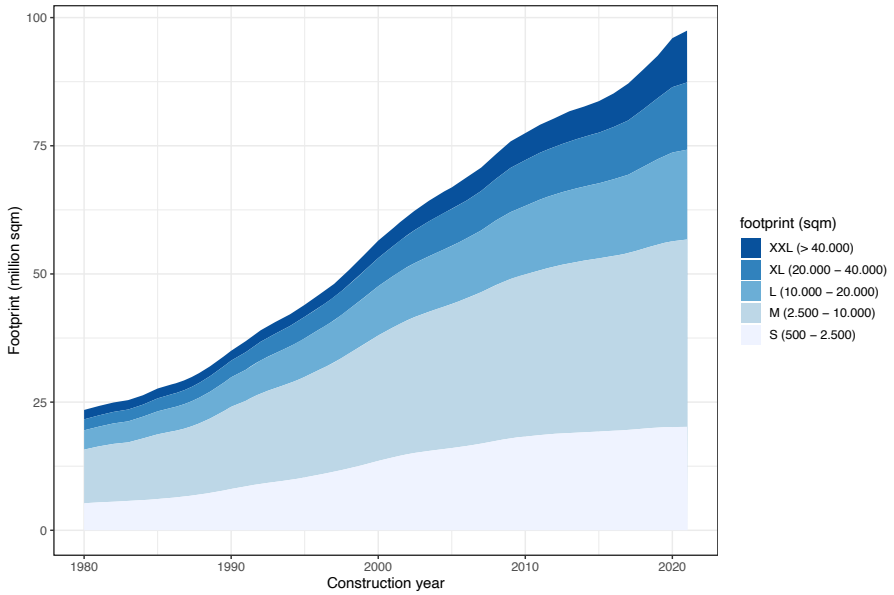


FIG. 2.3 Cumulative growth of DC size classes. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022). See interactive dashboard at https://mertennefs.shinyapps.io/distributioncentres_geodata_app/

TOC

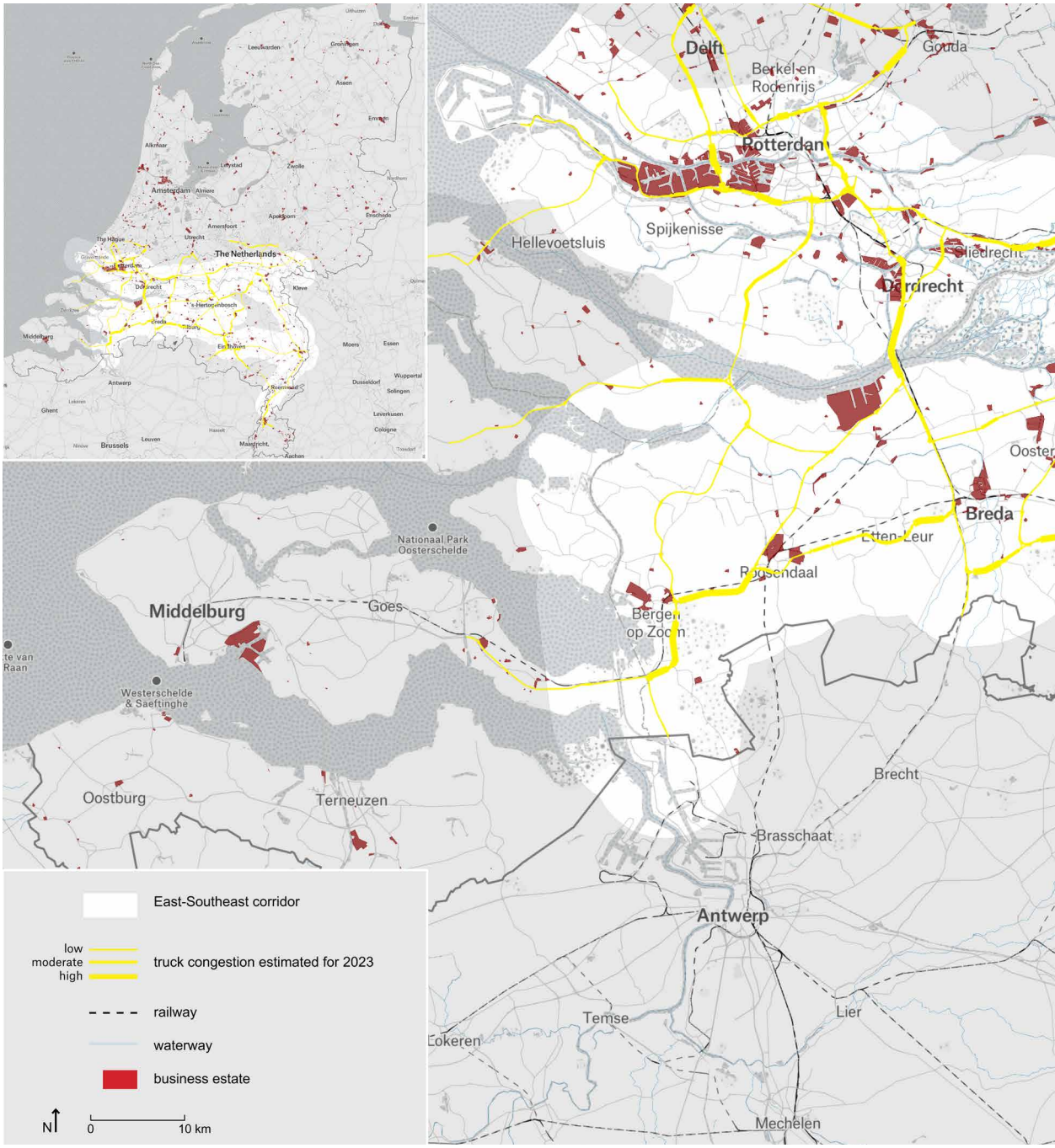
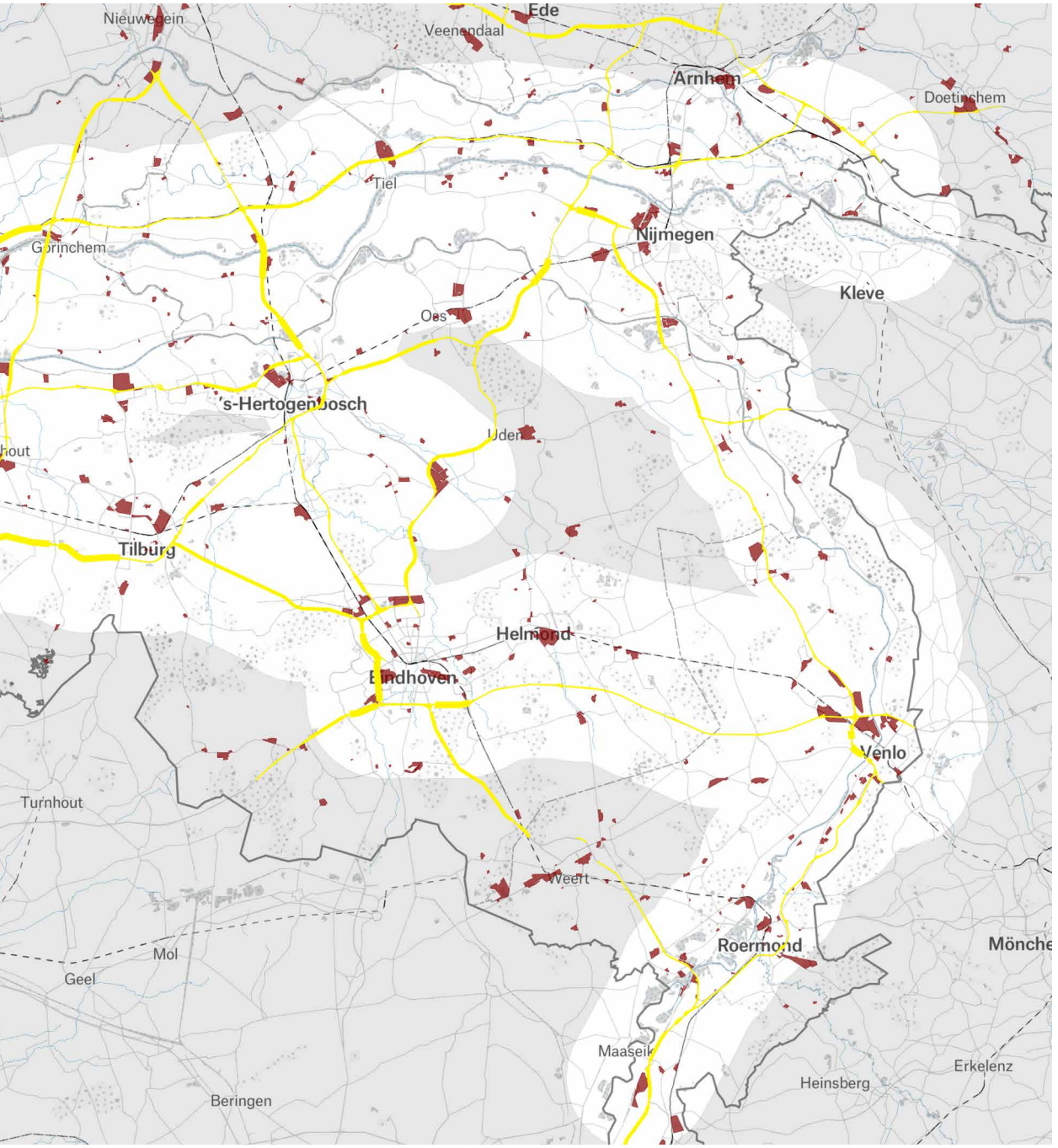


FIG. 2.4 Map of the logistics complex in 1980. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

TOC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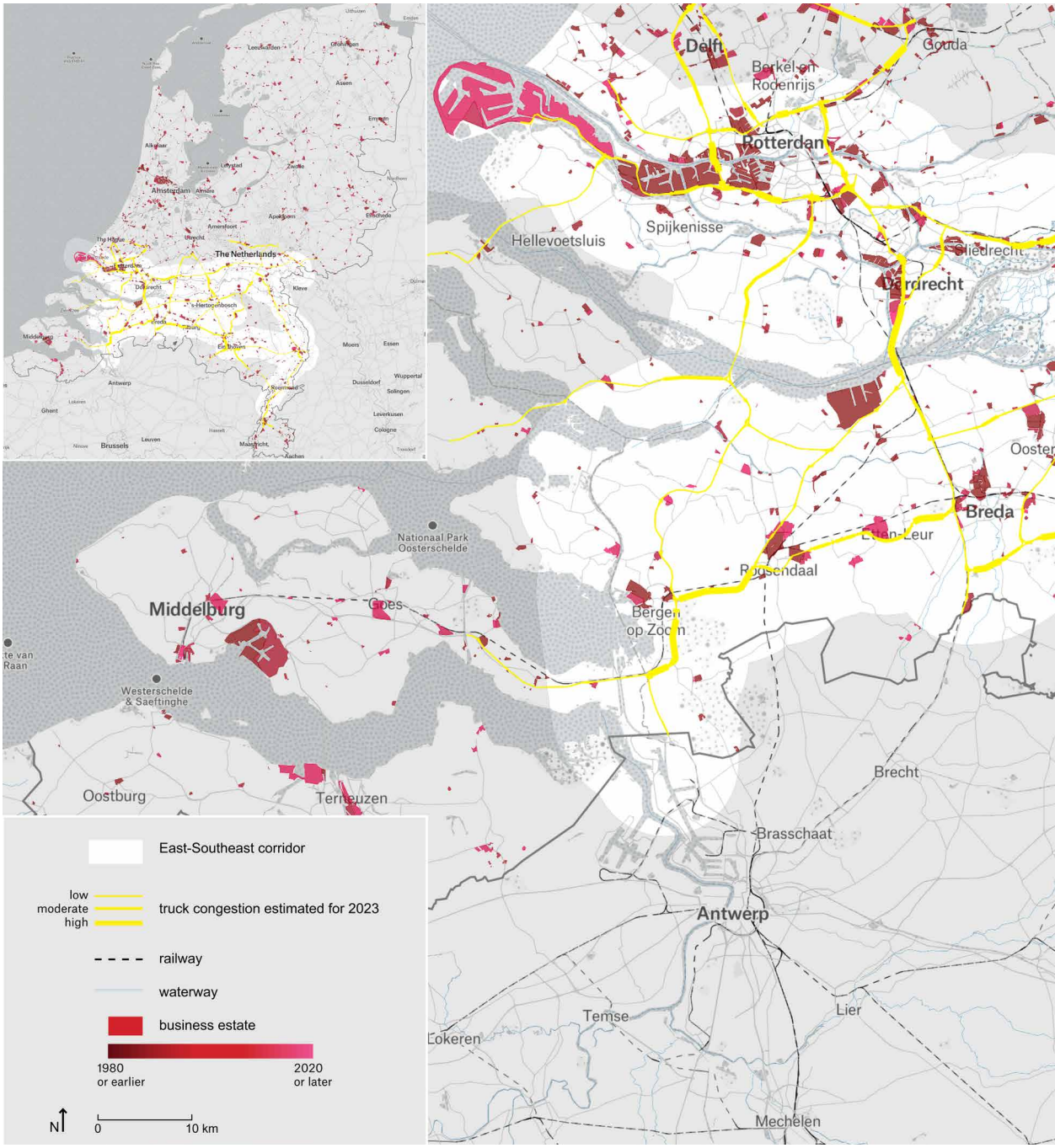
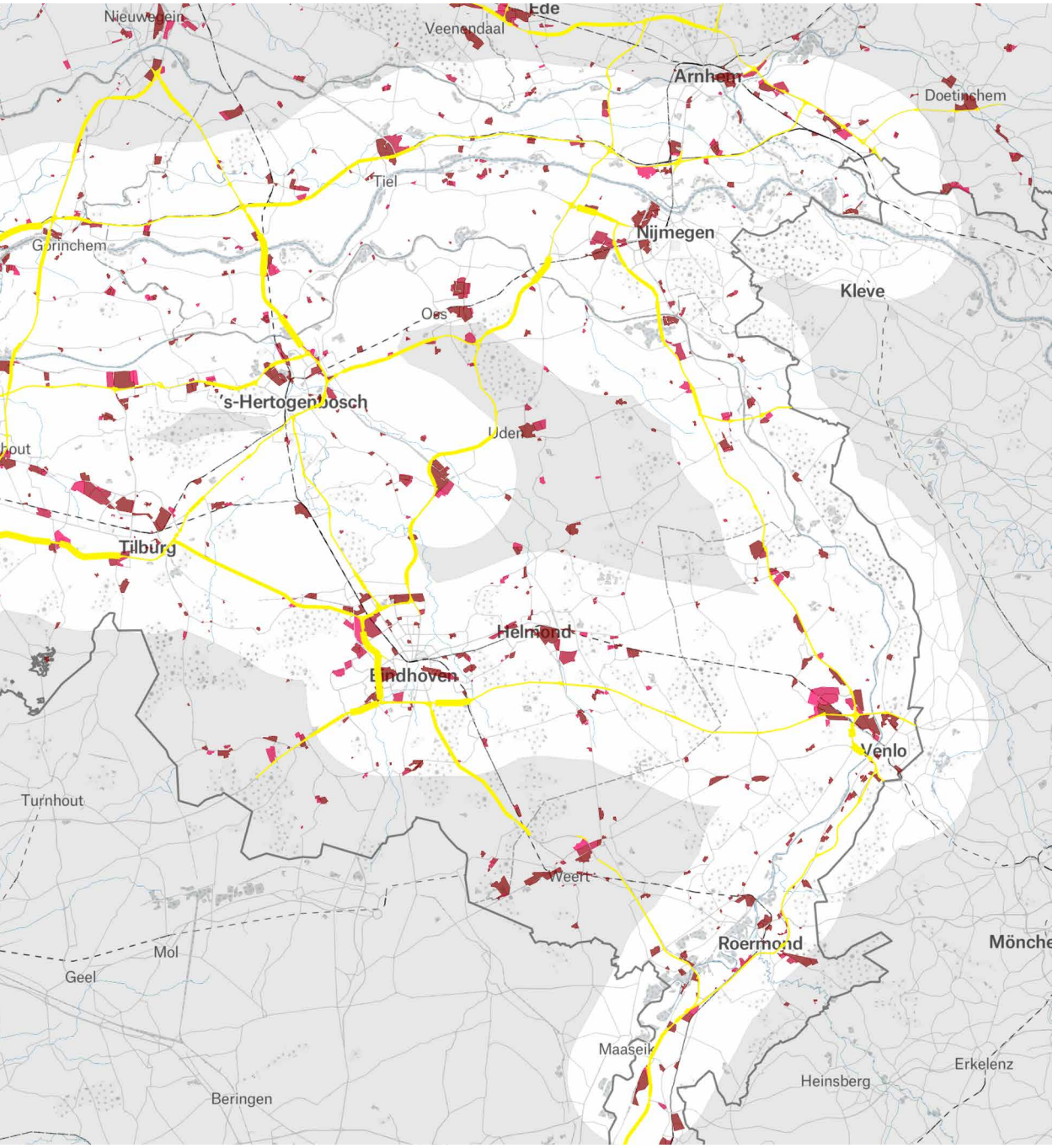


FIG. 2.5 Map of the logistics complex in 2021. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

TOC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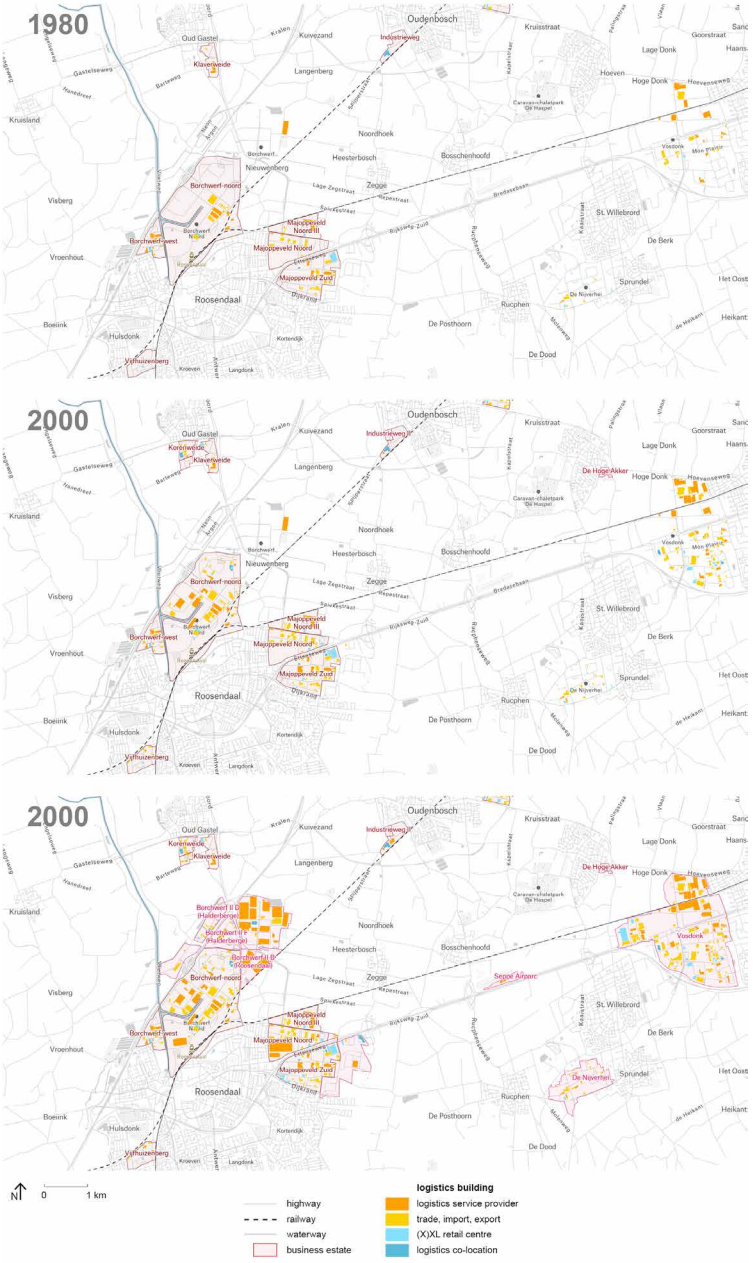

FIG. 2.6 Detailed panel map of Roosendaal 1980-2000-2021. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022). See interactive map at https://mertennefs.eu/landscapes-of-trade/

TOC

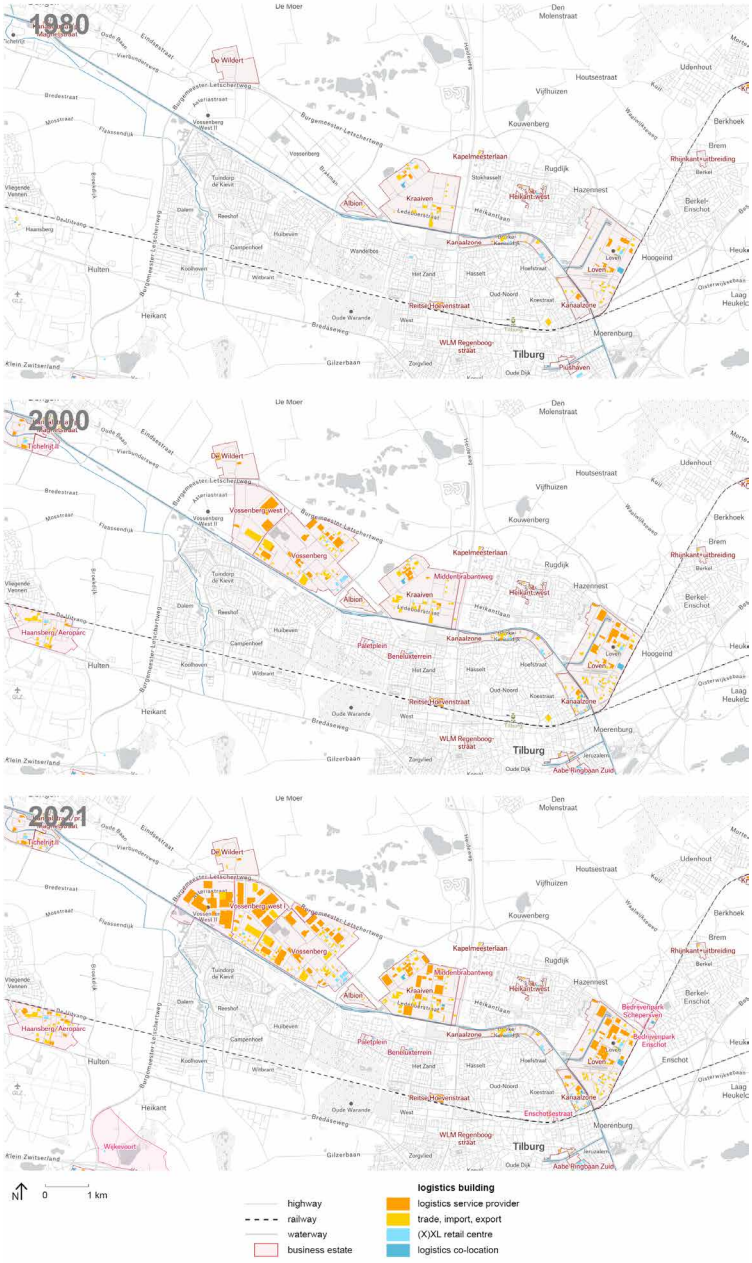

FIG. 2.7 Detailed panel map of Tilburg 1980-2000-2021. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022). See interactive map at https://mertennefs.eu/landscapes-of-trade/

TOC

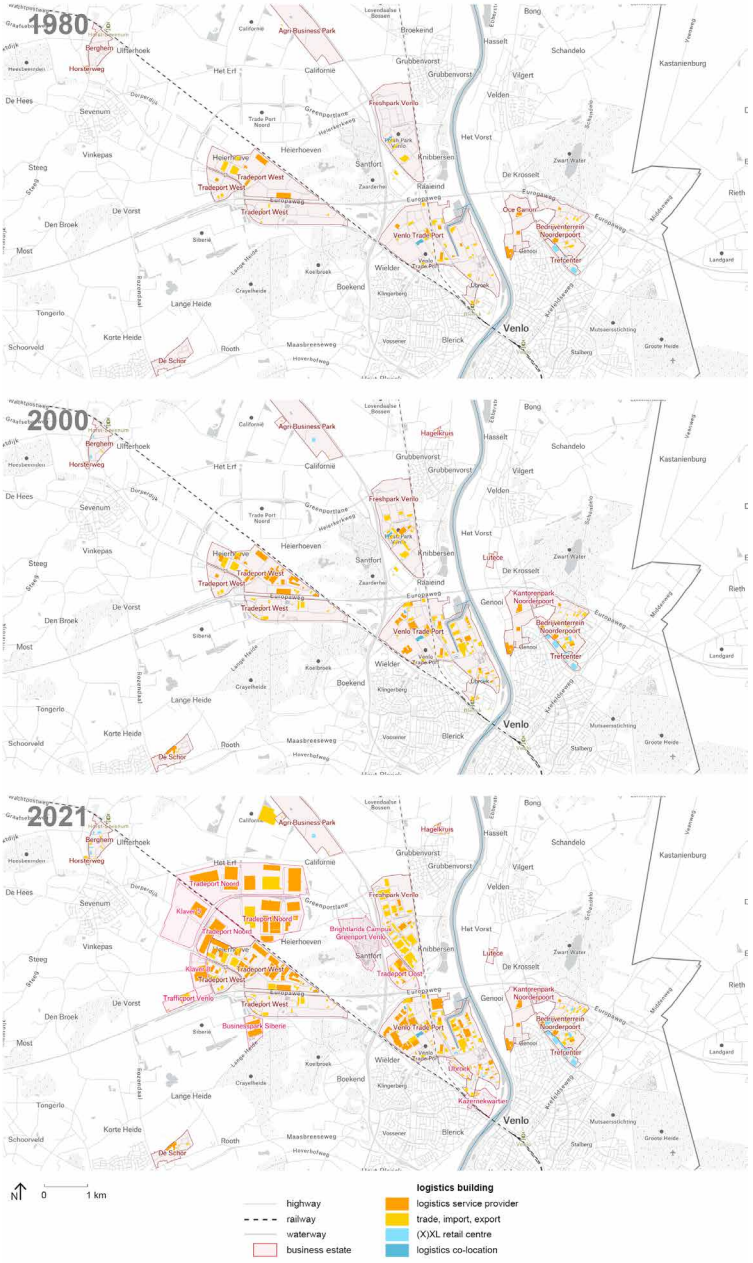

FIG. 2.8 Detailed panel map of Venlo 1980-2000-2021. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022). See interactive map at https://mertennefs.eu/landscapes-of-trade/

TOC

2.1.2 Shifting of the logistics complex in the East-Southeast corridor

Another aspect which is often discussed is the heterogeneous growth pattern of logistics, showing hotspots and growth vectors towards the foreland or hinterland, as well as the phenomenon of logistics sprawl (Aljohani & Thompson, 2016; Heitz et al., 2017; Strale, 2020; Woudsma et al., 2016).

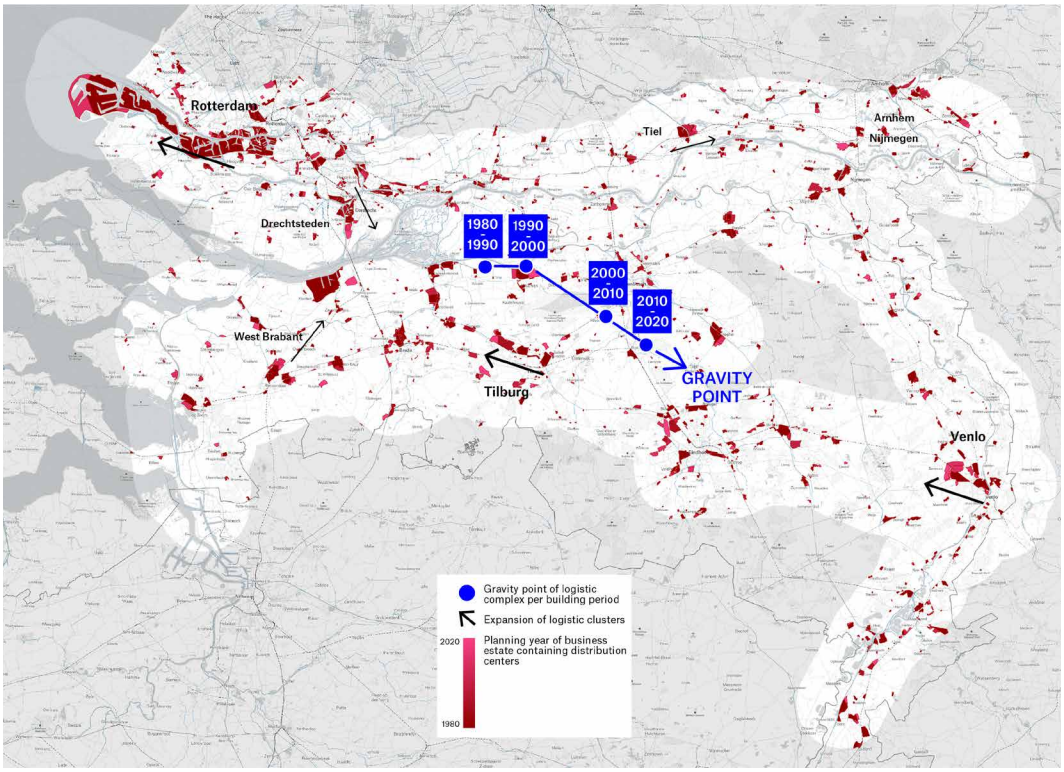

FIG. 2.9 The logistics complex shifting east. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

On a local level, many logistics clusters such as Port of Rotterdam, Tilburg and Venlo, shift to the west. On the level of the ESE corridor, however, new developments show a shift of logistics—slowly but surely—to the east. This can be shown by plotting the gravity point of DC developments per decade in GIS, weighted by the size of the DC (here the Weighted Centroids function in QGIS was used). As shown in Figure 2.9, in 40 years' time the gravity point of developments in a given decade has moved 30 km to the east (Nefs, 2021a). Possible explanations for this shift,

TOC

besides the high land price and scarcity near the ports and growing population in the hinterland mentioned above, are the increasing importance of transcontinental rail transport from Eastern Europe and Central Asia as part of the Chinese Belt and Road Initiative (Kuipers, 2016; Van de Ven, 2020).

2.1.3 Evolving of DC types

Since the 1980s, new DCs have changed shape to accommodate different logistical functions and economies of scale. Whereas the logistics complex around 1980 consisted for a large part of smaller and medium-sized warehouses used for dedicated products by wholesalers, retailers and importers/exporters, as well as transportation companies. Over time, logistics became increasingly an outsourced activity for many businesses, which explains the rise of so-called third (and fourth) party logistics (3PL) firms. Especially from the 2010s onwards, these firms have scaled up their buildings for reasons of flexibility, automation, and dynamics in the real-estate business. While in the USA, construction of XXL warehousing has already peaked, also in Europe the first signs are appearing of a shift to smaller buildings.[21]

The activities inside a DC can be very diverse. A comparison between two e-commerce DCs in the same region of Midden-Brabant, one for home appliances and the other for fashion, illustrate this.[22] Per 1.000 sqm of floor space, the number of loading docks is similar: one. The number of product locations per square meter varies between 2 and 15, the number of daily truck loads per dock from 2 to 3, and the number of employees per 1.000 sqm from 2 to 25. Both deal with about 20% of returned products every day, requiring 20% of personnel. Of total personnel, around 30% tends to be contracted and 70% flexible via agencies.

21 See https://www.welingelichtekringen.nl/anp/grote-distributiecentra-hebben-langste-tijd-gehad and https://www.abnamro.nl/nl/zakelijk/insights/sectoren-en-trends/real-estate/klein-heeft-de-toekomst-in-het-vastgoed.html

22 Mediamarkt home appliances Etten-Leur, fashion XPO Tilburg. Numbers compiled from site visits, media articles and presentations.

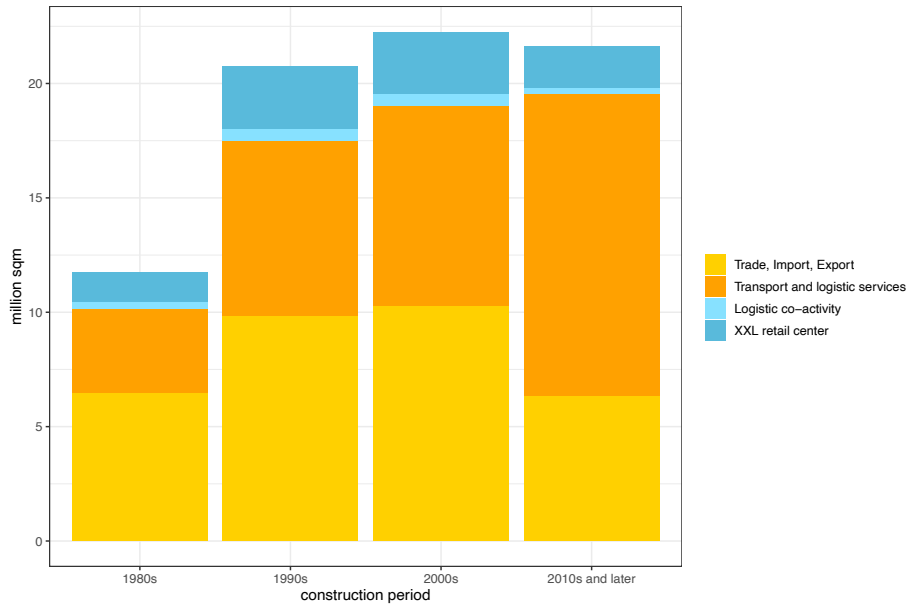

FIG. 2.10 Changing DC function types since 1980. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

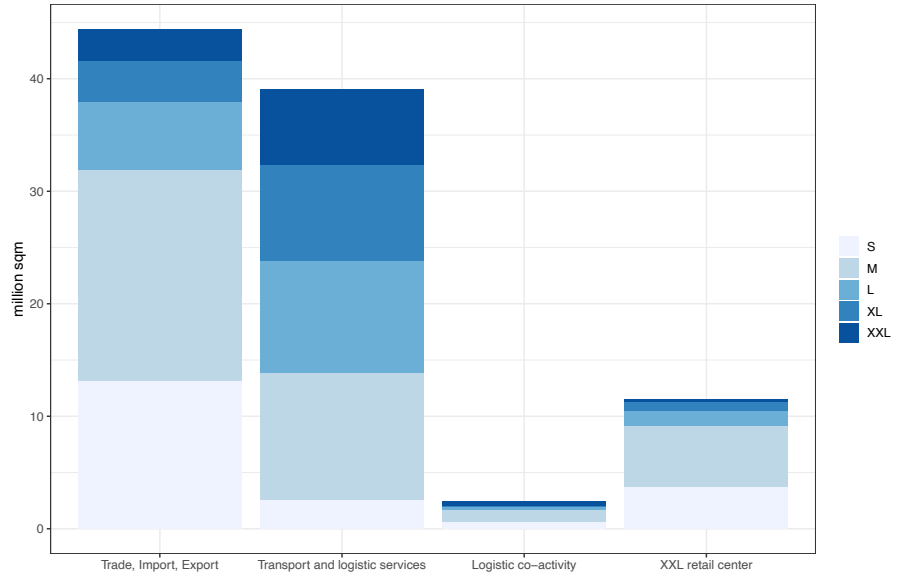

FIG. 2.11 DC function per size class. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

TOC

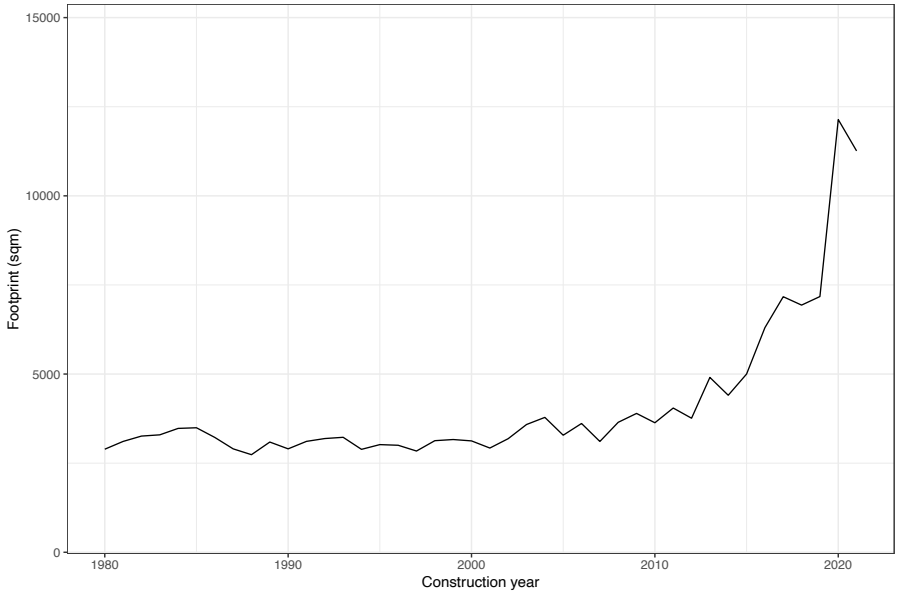

FIG. 2.12 Increasing size of the average DC since 1980. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

2.1.4 Employment in DCs

Employment has been a central argument in the policies facilitating logistics developments. Transport infrastructure and DCs have often been promoted by claiming the creation of jobs. The building boom of DCs since 2014 in combination with a tight labour market have led to permanent shortage of personnel and attempts to improve the productivity of the existing workforce through technology. Between 2015 and 2018 a Dutch employment agency observed increases in logistics job offers in six logistics regions of between 300 and 400% (ManpowerGroup, 2018).

In total, 896912 people were employed in the sector in 2017 following this thesis' broad definition of logistics and calculated from the LISA microdata, or 11% of total Dutch jobs in that year. 70% of these jobs were performed inside a logistics building in a business estate as mapped above—the rest is arguably registered in office buildings of logistics companies and residential units of small entrepreneurs. Of total workers in the sector, 73% are men. Parttime workers, here defined as less than 12 hours per week, amount to 8% of men and 18% of women (source: LISA and Dutch Distribution Centres 2021, filtered for the year 2017).

TOC

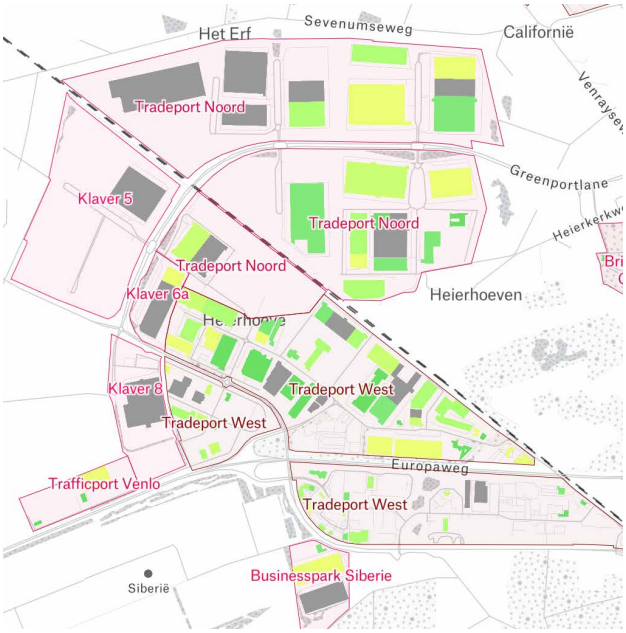

FIG. 2.13 Lacking employment data of DCs (in grey). Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

Employment numbers on logistics, although quite usable on the higher levels of scale (municipal or higher), have several blind spots on the level of individual buildings. As discussed above and shown in Figure 2.13, many recent XXL warehouses are not (yet) part of the LISA microdata. For analyses in this research, these had to be either excluded or provided with average employment numbers per function and size class. Another blind spot pertains to the highly fluctuating and unavailable numbers of migrant labour, a considerable part of the labour force. The microdata should include workers from Dutch employment agencies, but it is unclear to what extent migrant labour is covered. The number of migrant workers in the Netherlands is estimated around 735 thousand in 2023, while research shows that the number of migrant workers can grow until 1.2 million in 2030 (SEO, 2022). Especially in the ESE corridor, a large share of migrants works in DCs (Roemer, 2022). A third blind spot concerns the activities performed in DCs, the quality rather than the quantity of work. Often, besides logistical handling of goods, assembly and service tasks take place, which are not distinguished in the microdata, since the whole company falls under a single subsector (SBI).

Despite the image of logistics as a global growth sector, employment numbers develop quite differently across regions and areas. In the Netherlands as a whole,

the logistics sector—rather broadly defined in the dataset of this research—has grown slower than the total economy, in terms of employment. In some regions, especially in the East-Southeast (ESE) corridor, logistics employment has boomed and is becoming a heavy pilar of the regional economy. Also, on the local level there is much variation. Figure 2.14 shows the heterogeneous patterns in 2020 in the ESE corridor reflecting relocation effects and emerging hotspots.

Despite the continuing growth in direct employment in logistics in the ESE corridor, this growth is characterised by a declining space quote: each newly built square meter of DC generates on average 25-30% less jobs (see **Chapter 5** and Figure 2.15). This effect is strongest in DC hotspot regions.

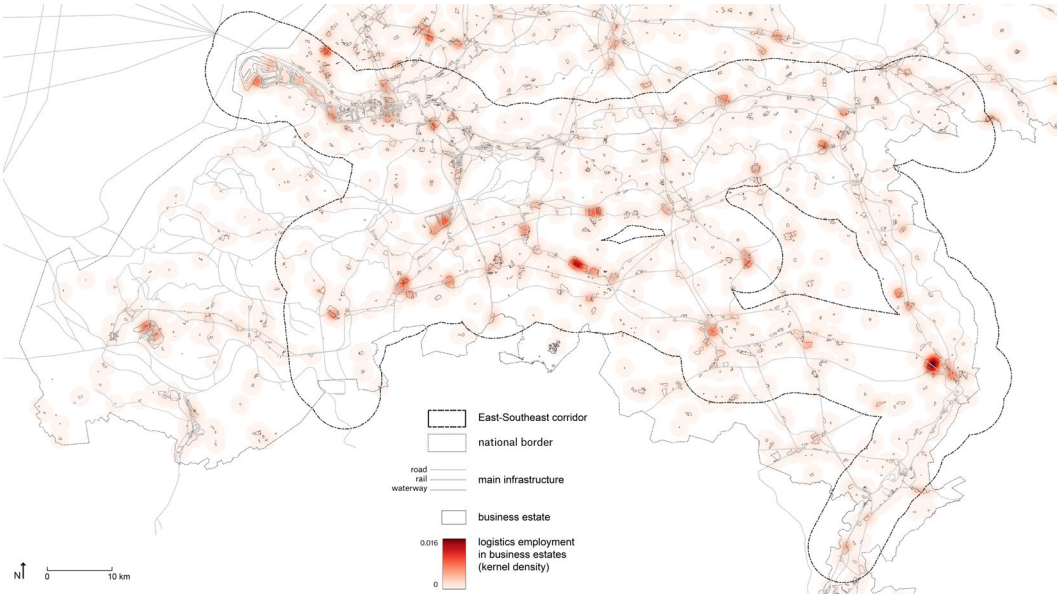

FIG. 2.14 DC employment density map ESE corridor 2020. Source: LISA microdata and Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

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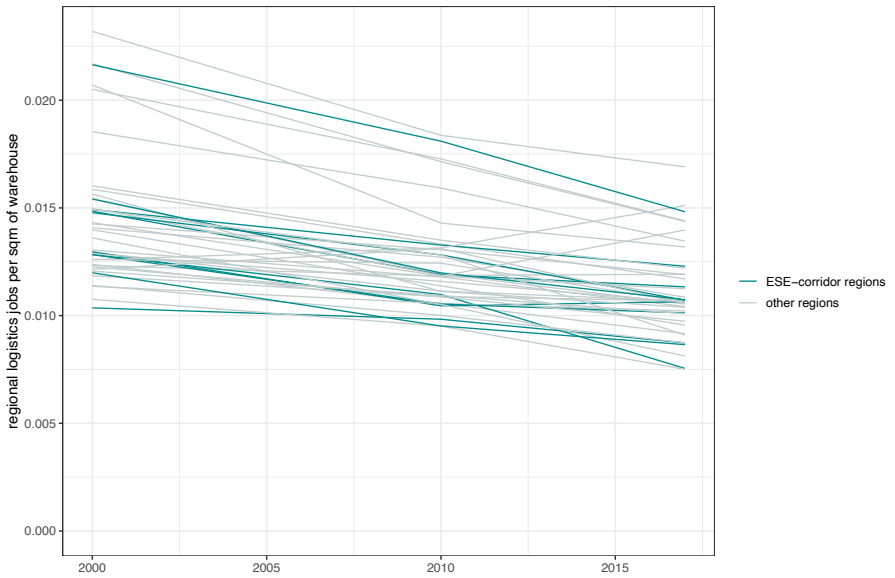

FIG. 2.15 DC employment space quote, dropping in ESE corridor and other regions. Source: LISA microdata and Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

2.1.5 Regional differences

As mentioned above, the spatial-economic pattern of logistics varies strongly per region. DC growth for example has traditionally concentrated in the western and southern part of the Netherlands (Figure 2.16). More recently, Flevoland[23] and other regions more to the north and east are catching up, arguably due to a 'waterbed' effect that pushes developments away from the south and west, where land for DC development has become scarce and expensive. Regional specialisation in logistics, measured as location quotient (LQ, Figure 2.17) follows the spatial footprint. The LQ is calculated as the share of logistics in the total economy of a region, compared to the average of all Dutch regions. The resulting DC building stock per capita in Dutch regions in 2021 is shown in Figure 2.18.

23 In Flevoland, subsidies also appear to have played a role in the attraction of large DCs (https://www.destentor.nl/lelystad/flevoland-lokt-zara-met-2-9-miljoen-euro~a3993b84/?cb=003b0f5983dafd4abba6d48271eaf014&auth_rd=1)

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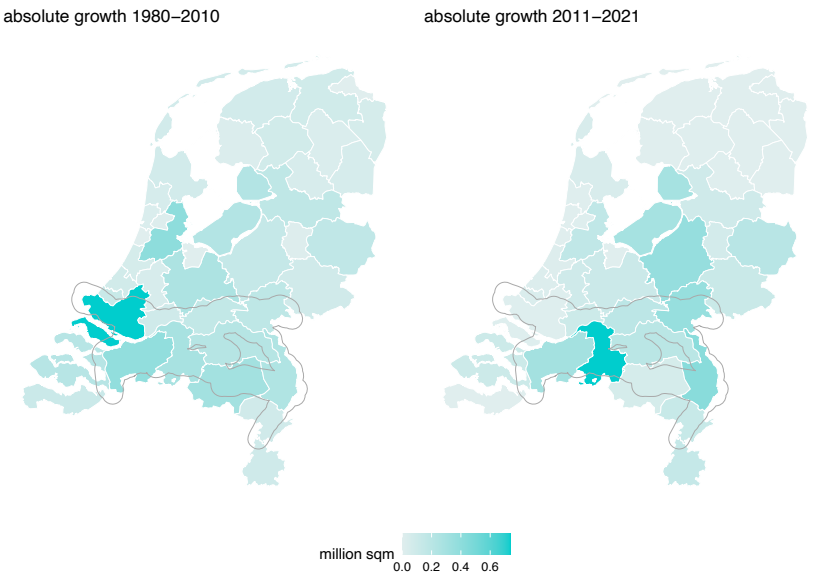

FIG. 2.16 DC footprint growth per region in the earlier period 1980-2010 and more recently (2011-2021). Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

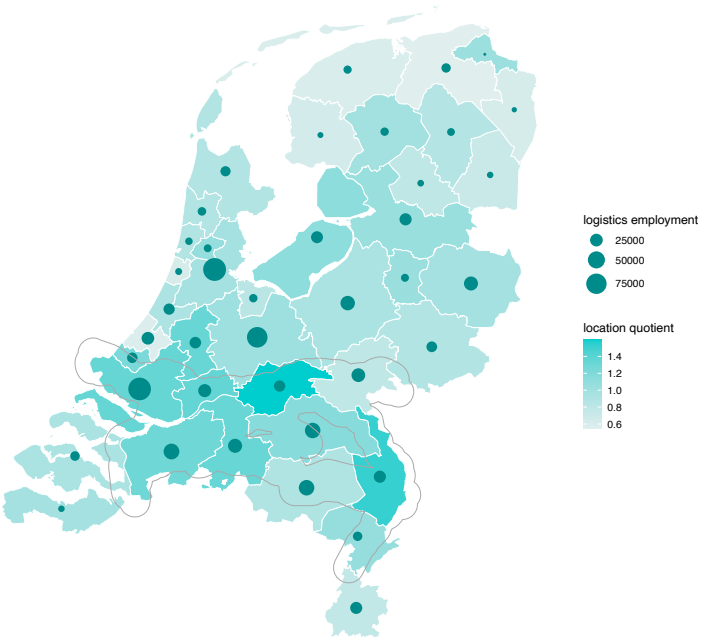

FIG. 2.17 Logistics specialization rate (location quotient) per region in 2017. Source: LISA microdata

TOC

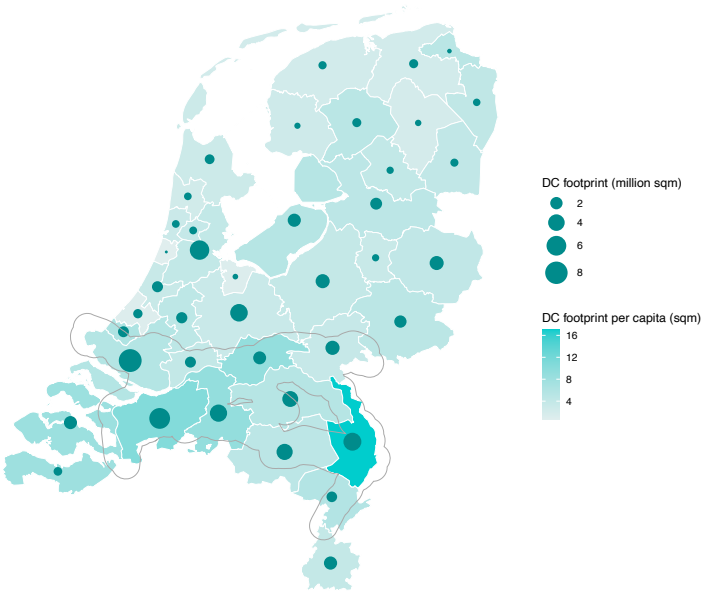

FIG. 2.18 Map of total DC area and area per capita, per region in 2020. Source: CBS and Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

2.2 The Gateway factor of the Netherlands

In the planning debate on logistics, proponents often emphasize the importance of DC developments for the Dutch economy and society—such as domestic consumption and export of Dutch products. Opponents often highlight the role that DCs in The Netherlands play in distributing goods that are not produced or consumed in the Netherlands, but rather reexported to other (European) countries. The first category is understood as an essential activity to maintain the vitality of the Dutch economy, the second is often considered a spatial-economic choice. Instead of catering for international distribution of foreign goods, the DC's land, labour and other resources could also be used for other purposes, such as production of goods. It remains unclear, however, what part of the logistics complex belongs to these categories. An estimate, extrapolated from interviews

TOC

and website analysis by Stec (Dubbeld, 2022; Stec Group & Denc, 2022), suggests that as much as 75% of Dutch DCs cater to the Dutch market.[24]

Real estate research demonstrates that large DCs in The Netherlands are almost entirely financed by foreign capital (Bak, 2021), suggesting that serving Dutch consumers and exporters is only an indirect objective of those investments, after the purpose of receiving rents. Real estate market numbers show that the amount of class A[25] DC area per capita in The Netherlands is the highest in Europe in 2023.

The concise regression analysis below aims to shed more light on the proportion of domestic logistics versus the 'Gateway factor' of The Netherlands, defined as the share of Dutch DCs that is dedicated to international trade and distribution on top of domestic consumption and production. In the analysis, DC area (sqm) in European countries[26] is estimated by two models, the first including trade[27] (the sum of imports and exports per capita, in million Euro) along with domestic factors that might explain DC development: e-commerce penetration (%); manufacturing share of economy; logistics, wholesale and retail share of economy; and real expenditure per capita (Euro). Model 2 excludes trade and the logistics sector from this list.[28]

24 This number varies significantly per region: in the southern provinces of the Netherlands, where most large warehouses are located, the Dutch market orientation found by Stec is around 50-60%. The study considers warehouses larger than 5000 sqm and necessarily made assumptions about multitenant facilities and thresholds of orientation.

25 Top rate DCs in the market, by the current standards of floorspace, ceiling height, loading docks and load bearing capacity of the floor. Data received from CBRE and CTP in 2023.

26 The number of European countries with DC footprint area data is very limited (12), as is the number of countries in the EU. This decreases the precision of the analysis, but the goal of this analysis is rather to get a rough idea of the importance of the variables.

27 Particularly important in this analysis would be the amount of re-export, which is known to be an important DC intensive activity in The Netherlands. The country is the world's third re-exporter, after the US and Hong Kong (Jones e.a., 2020). Consistent re-export numbers for all EU countries, however, is not available. Trade volume as the sum of imports and exports, is therefore used in this analysis instead.

28 Relevant variables with high inter-correlation (> 0.7) are also excluded. Trade is taken as a proxy of added value and income per capita, and container throughput (TEU) per capita. Real expenditure per capita correlates highly with population size, the first is taken as a proxy for the latter since it correlates higher with DC area per capita.

TABLE 2.1 OLS model output with dependent variable DC area per capita. Source: CBRE & CTP, CBS and Eurostat.

	Linear regression model	
	Dependent variable:	
	Logistics footprint per capita	
	(1)	(2)
Trade volume per capita	16.622*** (2.061)	
E-commerce penetration	0.004 (0.004)	0.016 (0.009)
Manufacturing share of economy	1.585 (0.839)	1.782 (2.831)
Logistics, wholesale and retail share of economy	3.791 (2.005)	
Real expenditure per capita	0.0001*** (0.00001)	0.0001 (0.00004)
Constant	-2.225** (0.714)	-2.217* (1.182)
Observations	12	12
R^2	0.973	0.578
Adjusted R^2	0.951	0.420
Residual Std. Error	0.117	0.404
F Statistic	43.736***	3.656*

*p<0.1; **p<0.05; ***p<0.01

The results show that the model including trade is much more successful in estimating the DC area per capita in European countries than model 2. Especially the adjusted R-square in model 2 is quite low. Reverse causality and endogeneity are potentially important in the observed correlation between DC area and trade per capita, since higher trade may explain larger DC area just as DCs may explain trade. For the estimation of the Gateway factor this is not necessarily a problem since both are part of the gateway (non-domestic) concept. Considering only the domestic use of the logistics complex, the variable of real expenditure per capita (in Euros) is the most explaining. The amount of underprediction of DC area per capita in model 2 is especially high in the Netherlands (Figure 2.19), about 0.9 square meter per capita or 40% of the total 2.2 sqm. Based on this result, the 'Gateway factor' of the Netherlands—the share of DC space dedicated to the international trade and logistics function of the country[29], could be estimated at 40%, more than the estimated 25% by Stec (but close to their estimate for the south of the Netherlands). Ongoing research at Tilburg University aims to shed light on this issue through company surveys (Acocella et al., 2024). A preliminary estimate, also focusing on the south, suggests a 50-50% division between foreign and domestic orientation.

29 One could argue that the sector of logistics, wholesale and retail would pertain in large part to the domestic economy in advanced economies. While that could be case, other countries in the graph do not show the same negative residual in modal 2 when this sector is excluded. A bias still present in the model is the absence of real re-export numbers.

From the most significant variables in model 1, the Class A DC area per capita in other European countries is predicted (Figure 2.20 and Figure 2.21).

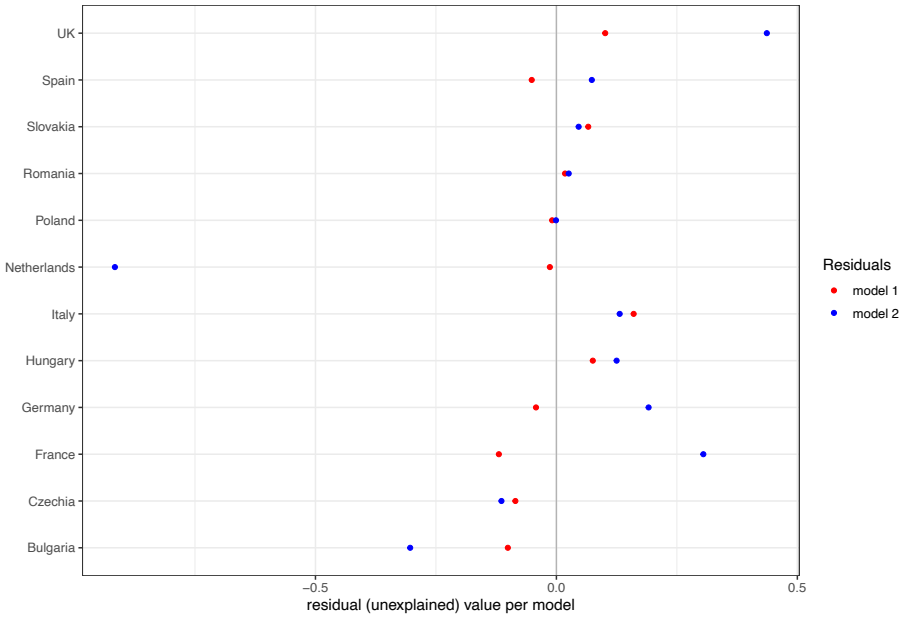

FIG. 2.19 Comparison of the model including and excluding trade. Source: CBRE & CTP, CBS and Eurostat.

TOC

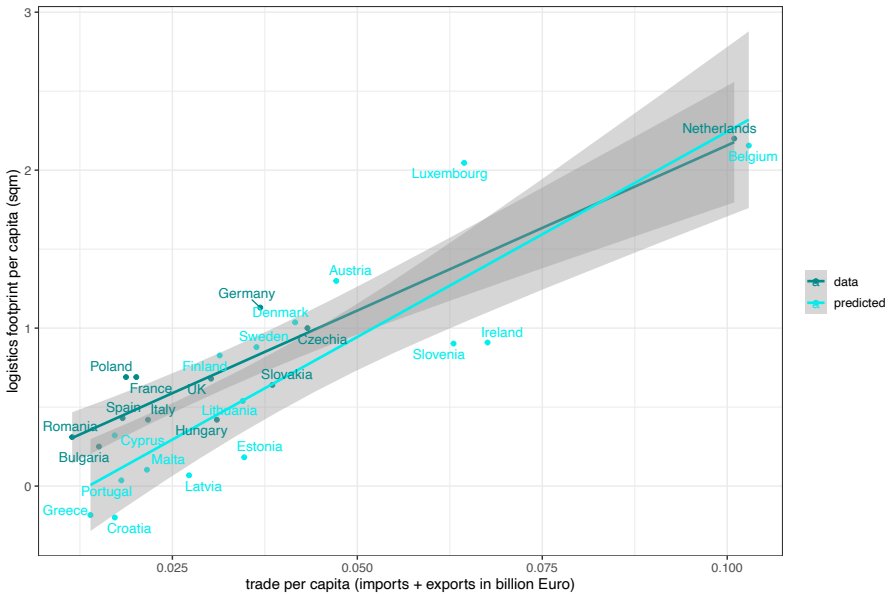

FIG. 2.20 Class A DC area per capita in Europe, related to trade volume. Source: CBRE & CTP, CBS and Eurostat.

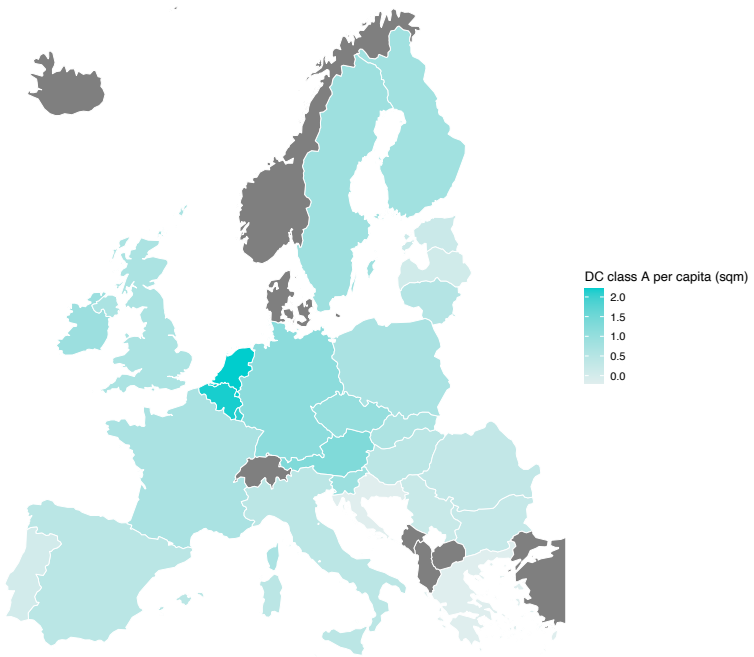

FIG. 2.21 Map of EU countries of measured (or predicted) DC area per capita. Source: CBRE & CTP, CBS and Eurostat.

TOC

2.3 Spatial impacts

The spatial impacts of DC developments occur in various dimensions. In the section above, the most important land use and employment impacts were introduced. The planning of logistics involves more spatial and environmental effects such as noise, congestion, light, NOx and other emissions (Maronier, Véronique, Grote Beverborg, 2019; Pinchasik et al., 2019). Measuring nuisance is not part of this research, but as nuisance is part of the policy discourse on DCs it is important to have a basic understanding of the types and scales of nuisance associated with DC development. In the Dutch discourse on DCs much emphasis is laid on the visual impact of landscape 'boxification' (Bontenbal, 2022; CRa et al., 2019; Slabbers, 2021). Most DCs are experienced from linear infrastructure such as highways or passenger railways. It is an interesting question whether the automobile perspective should be the focal point in landscape conservation (see the discussion on the Landscape Panorama policy in **Chapter 3**). As shown in Figure 2.22, DCs of larger size classes are located more often in business estates with a high environmental category (permitting more nuisance). These are usually not located in urban areas but rather outside the city along heavy infrastructure.

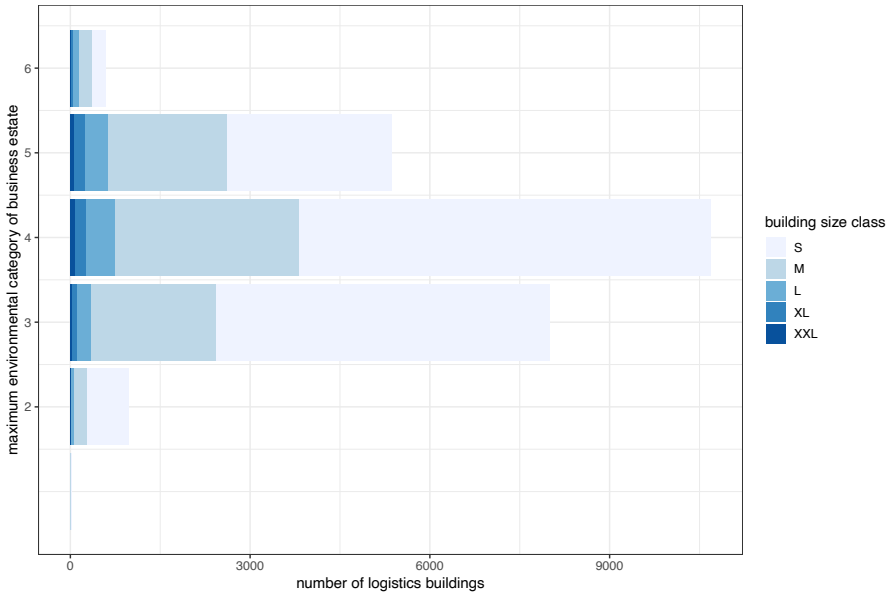

FIG. 2.22 Number of logistics buildings in business estates of a certain (maximum) environmental category, organised per building size class. Source: Dutch Distribution Centres 2021 Geodata (Nefs, 2022)

TOC

Some of the spatial effects are shown in Figure 2.23. The visual impact is estimated by selecting DCs within 1000 meters of the road axis. For a more accurate impact assessment, a viewshed analysis could be made, in which a detailed map is drawn of all possible lines of sight from the road, and how these are visually blocked by either buildings, relief or vegetation. Congestion, measured per day, can be partly attributed to trucks moving to and from DCs along the highway.[30] Light pollution is a relevant phenomenon near highways, caused by public lighting, vehicles and buildings. The Netherlands is Europe's 'lightest' country.[31] Nitrogen (NO_x) emissions[32] associated with freight transport are linked to biodiversity problems, particulate matter (PM) to health issues.

Figure 2.23 shows the spatial impacts of DCs in two major traffic corridors in The Netherlands: the A15 and the southern half of the A2. The first is considered by planners a typical hinterland corridor for large volumes of freight, while the second is known as a 'knowledge corridor' with high-end campuses and recreation facilities and attractive landscapes (Luttik & Veer, 2010). The latter corridor would arguably suffer more from increased nuisance and would therefore ideally be planned to have less impact from DCs. The outcome in Figure 2.23, however, shows a highly heterogeneous nuisance level on both corridors, featuring areas of more congestion, light and nitrogen compounds, correlating with more densely urbanized zones of the corridor. The port and southern ring road of the agglomeration of Rotterdam (A15) present a more extreme level of all kinds of nuisance mapped. The western ring road of Eindhoven (A2) has a similar but smaller effect.

30 RWS 2021

31 https://www.atlasleefomgeving.nl/nieuws/lichtemissie

32 https://data.rivm.nl/apps/gcn/

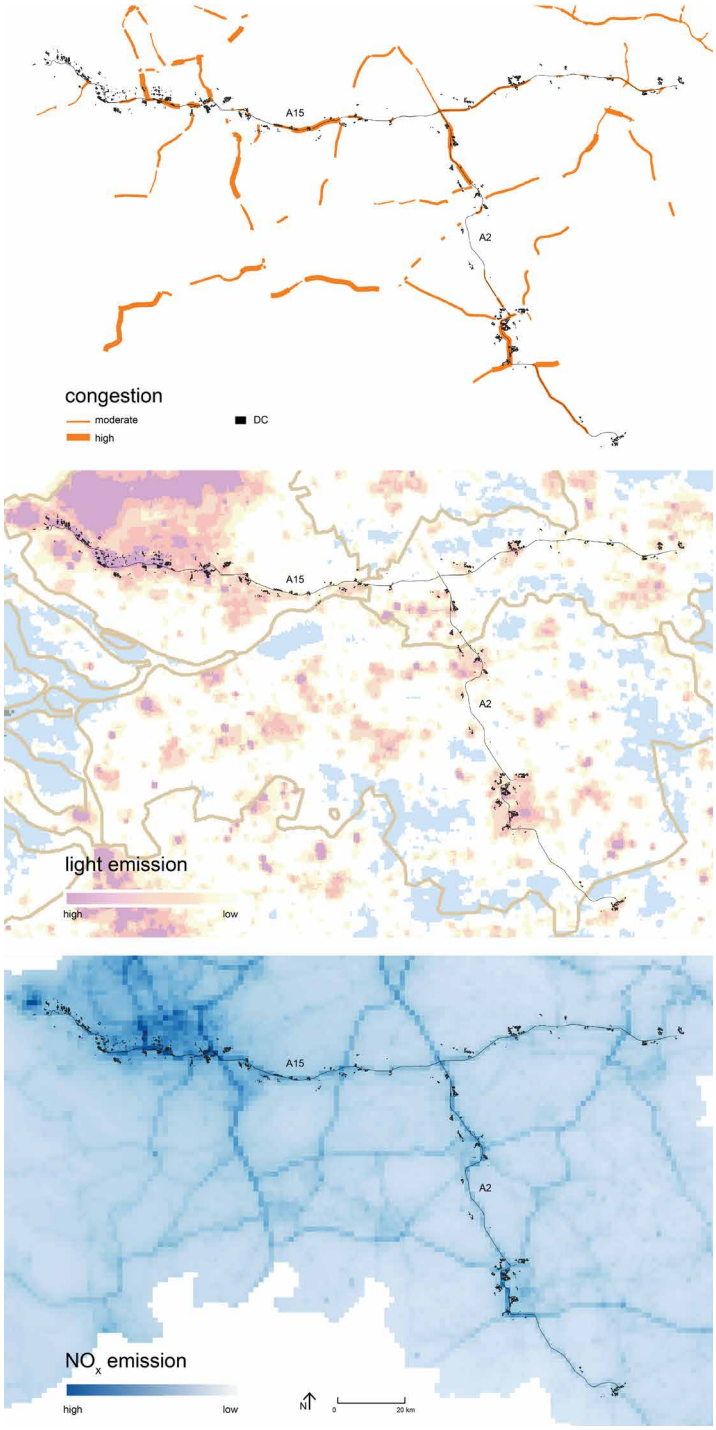

FIG. 2.23 DCs and nuisance impacts along the A15 and A2 south corridors. Source: Rijkswaterstaat (RWS), Atlas Leefomgeving and RIVM

TOC

2.4 Location suitability for logistics cluster types

For the planning discourse of logistics, not only the historical development and current pattern of DCs is relevant, but also the suitability of areas for new DC developments, in greenfield or existing (brownfield) areas. As different logistics activities have different spatial impacts and requirements, the maps below (Figures 2.26 to 2.29) separate the logistics complex in four realms as shown in Figure 2.24, weighted differently as per Figure 2.25. A good suitability is by no means a license to build, it is merely one of the arguments in the national and regional policy discourse on whether and where various kinds of DC clusters should be facilitated in the future. Suitability can also apply to already built-up areas, in case there is a redevelopment or densification project. No-go areas—white on the map—include Natura2000, UNESCO world heritage sites and national (rural) monuments. The weighted multicriteria method, validity and applicability of these maps are discussed in **Chapter 7**. Background information and data are available in the repository.[33]

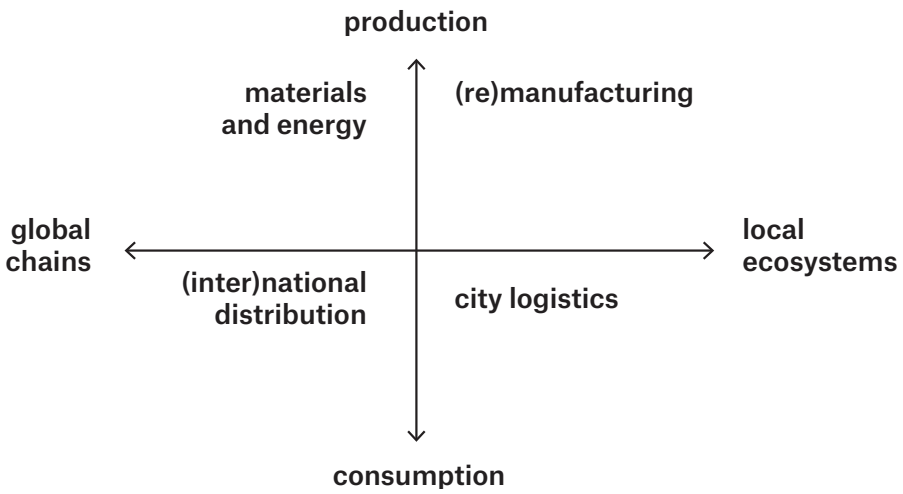

FIG. 2.24 Typology of logistics types.

33 DOI: 10.4121/9fc68331-a857-4775-8cd0-cb562a64fc51

TOC

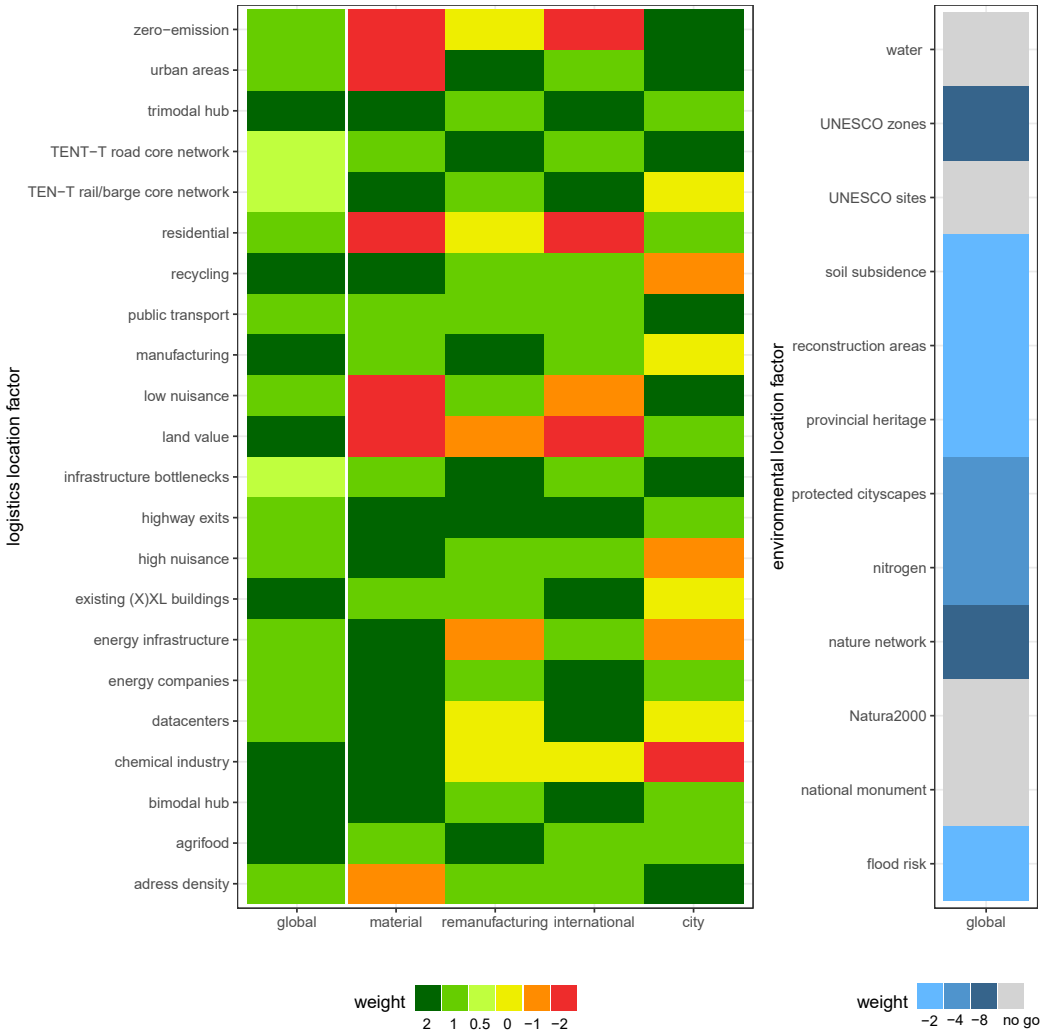

FIG. 2.25 Multicriteria heatmap, showing weights per logistics cluster type. Source: Data underlying the publication 'Applying a logistics cluster typology in spatial planning for circularity: lessons from a Dutch policy lab'. DOI: 10.4121/9fc68331-a857-4775-8cd0-cb562a64fc51

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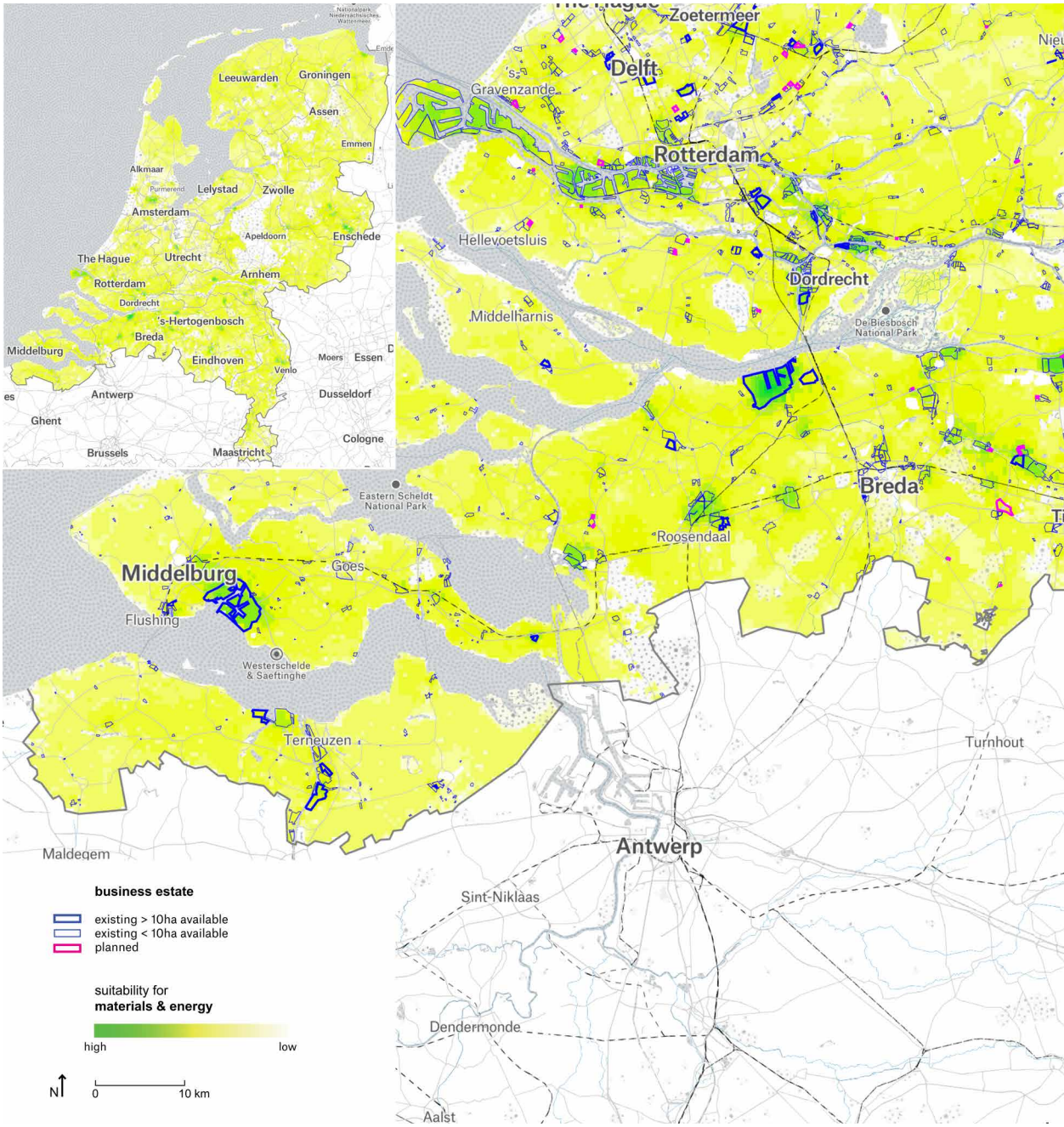
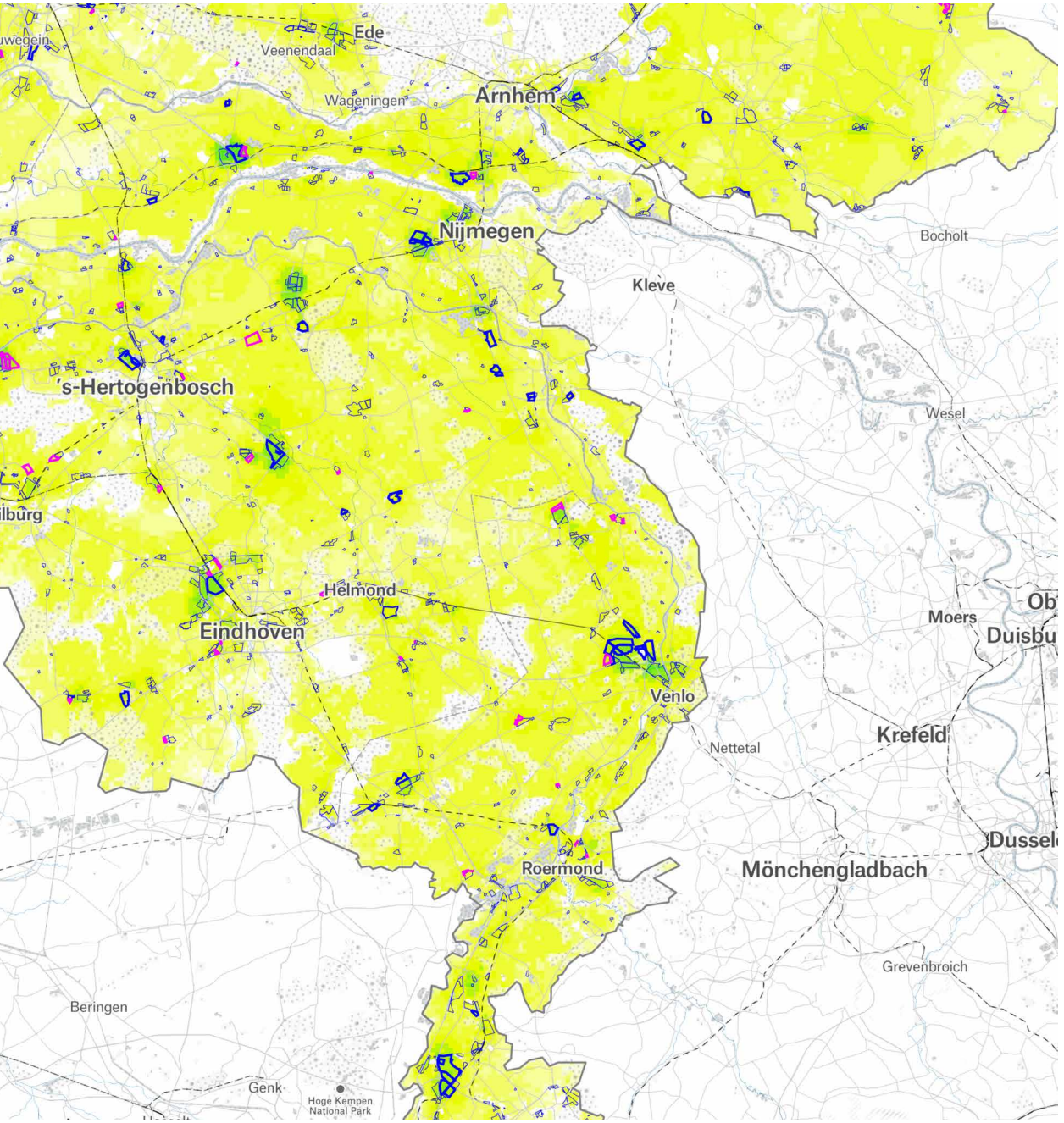


FIG. 2.26 Suitability map Materials & Energy. Source: same as Figure 2.25.
See interactive map at https://mertennefs.eu/landscapes-of-trade/grip/

TOC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Beringen
Genk
Hoge Kempen
National Park

TOC

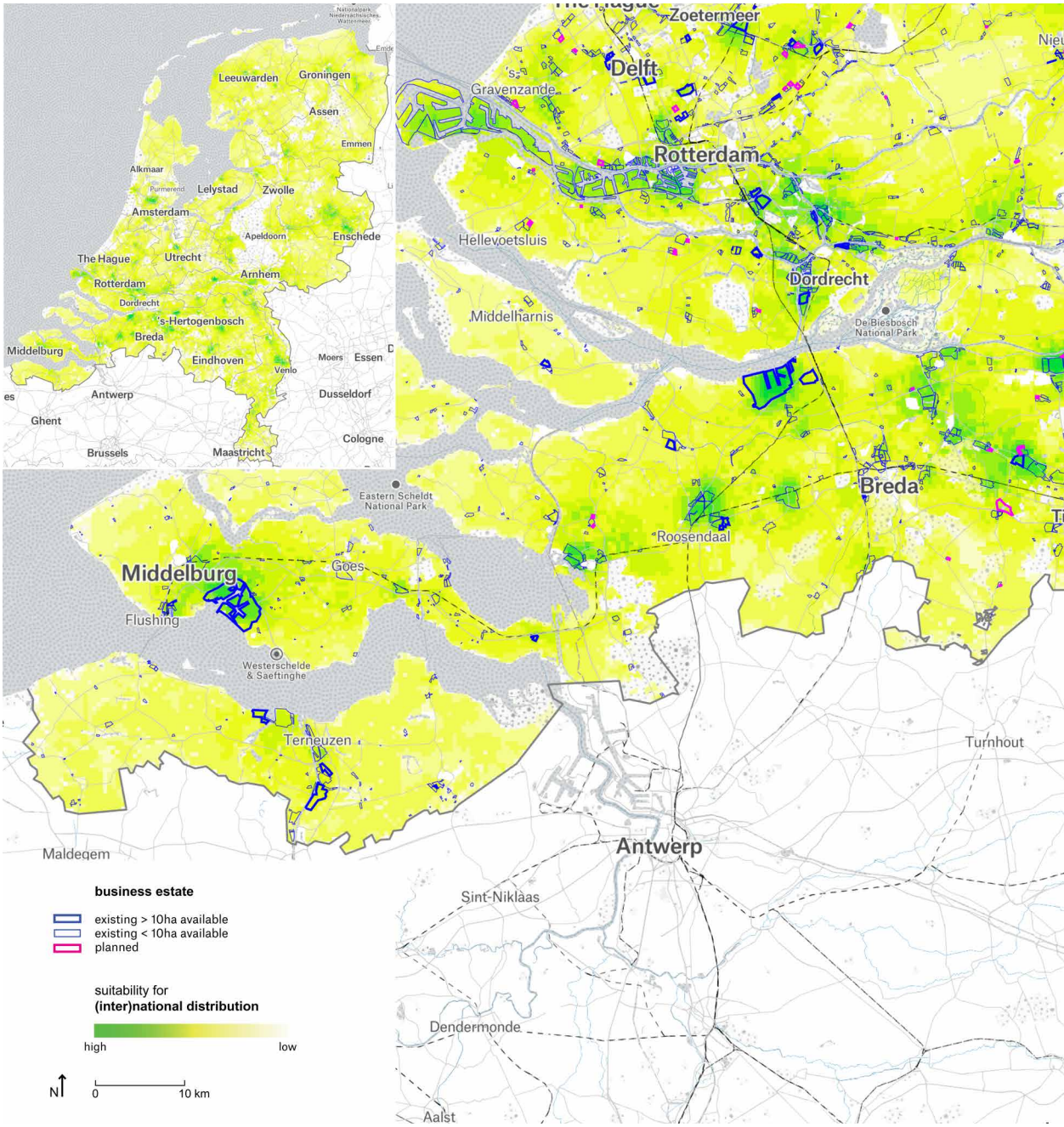

FIG. 2.27 Suitability map (inter)National distribution. Source: same as Figure 2.25.
See interactive map at https://mertennefs.eu/landscapes-of-trade/grip/

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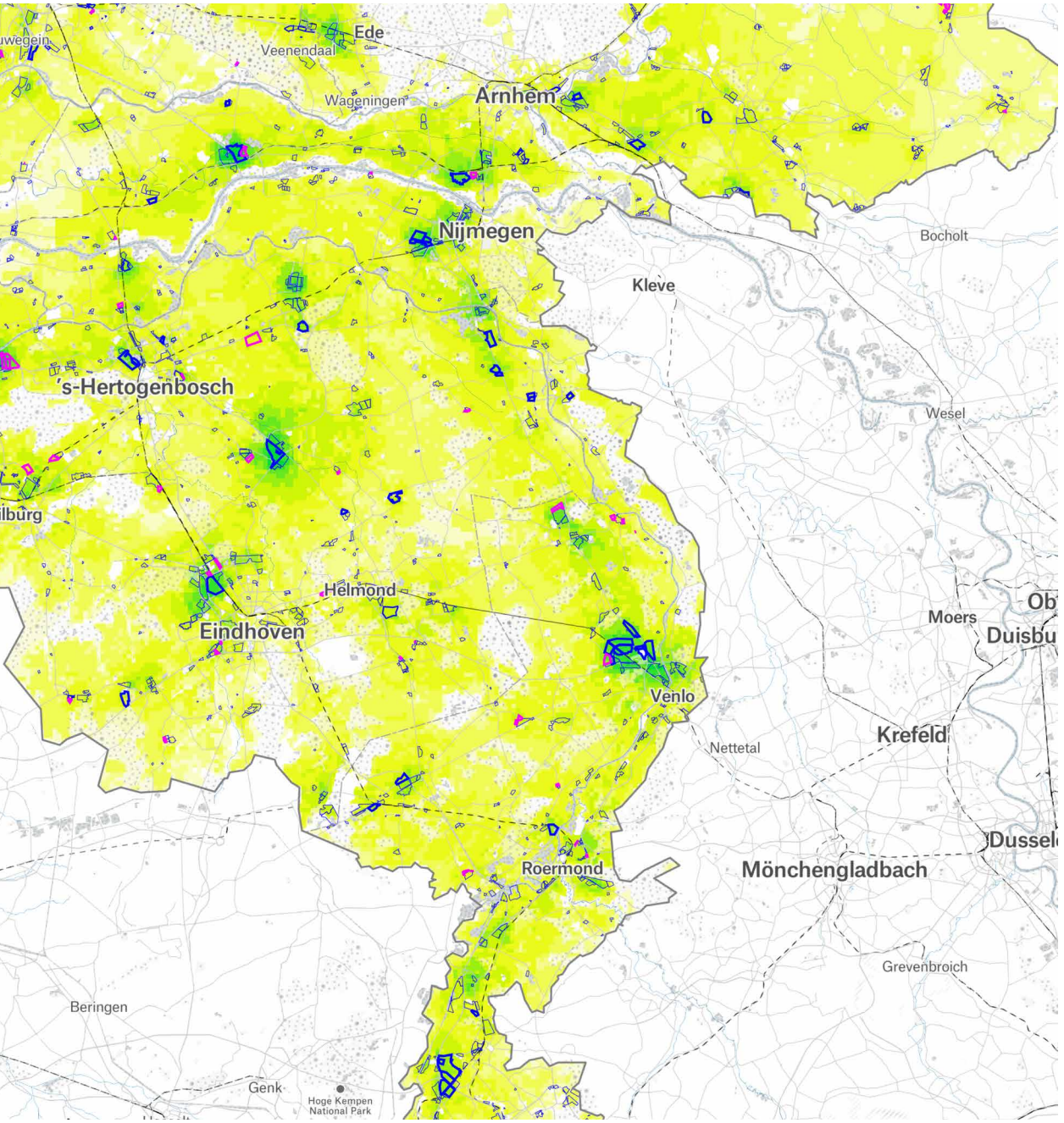
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Roermond
Mönchengladbach
Grevenbroich
Beringen
Genk
Hoge Kempen
National Park

TOC

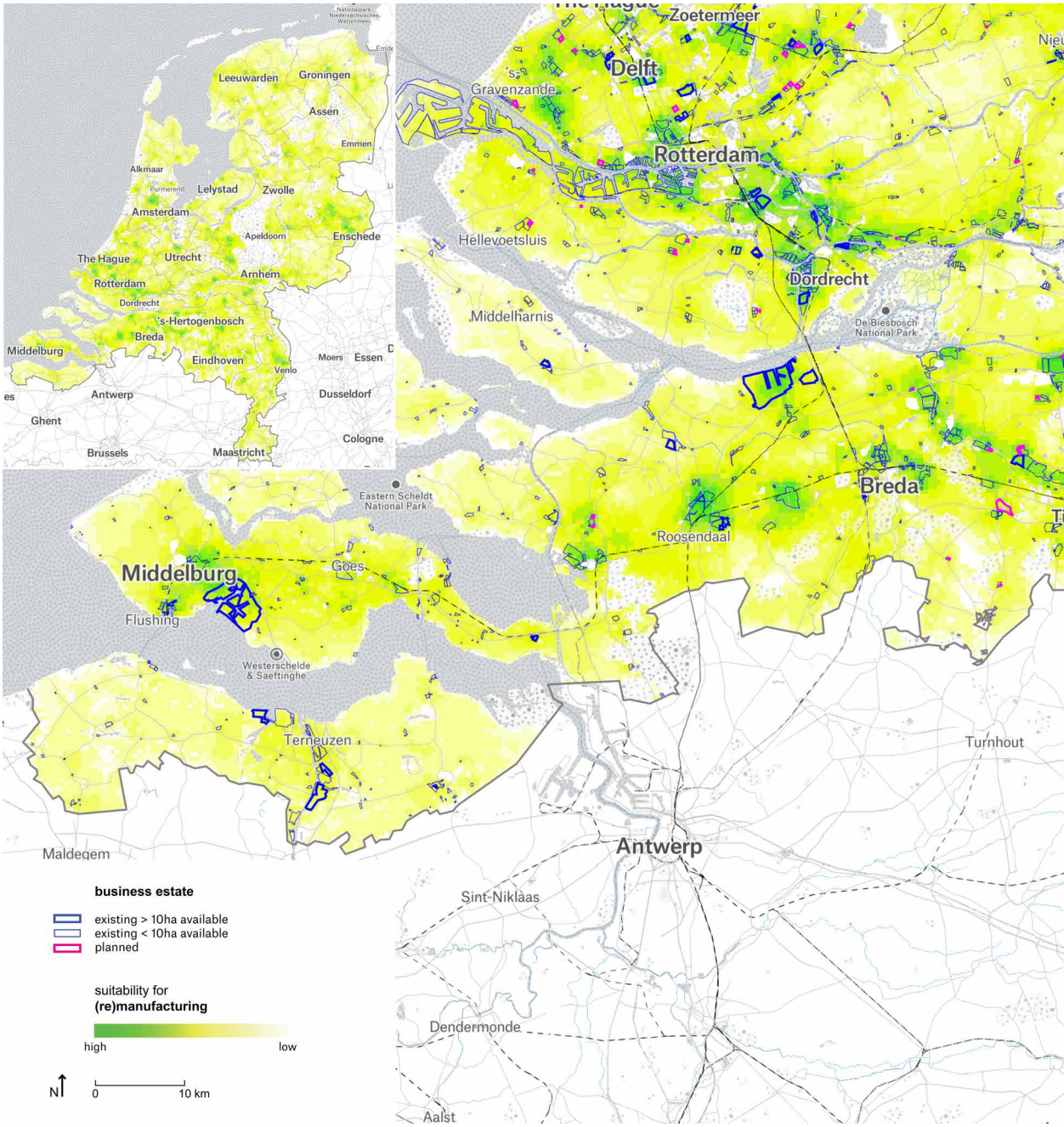

FIG. 2.28 Suitability map (re)Manufacturing. Source: same as Figure 2.25.
See interactive map at https://mertennefs.eu/landscapes-of-trade/grip/

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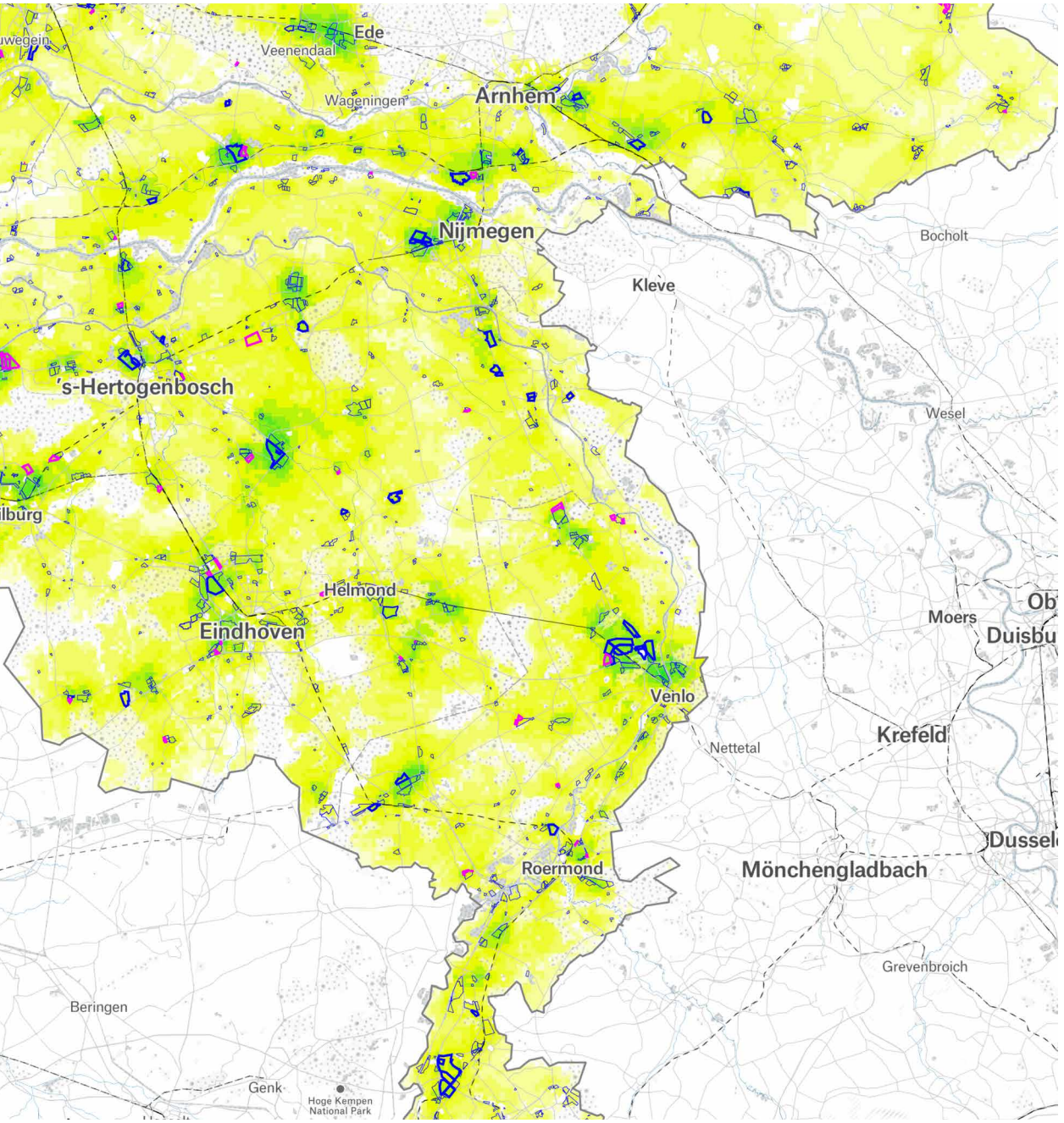
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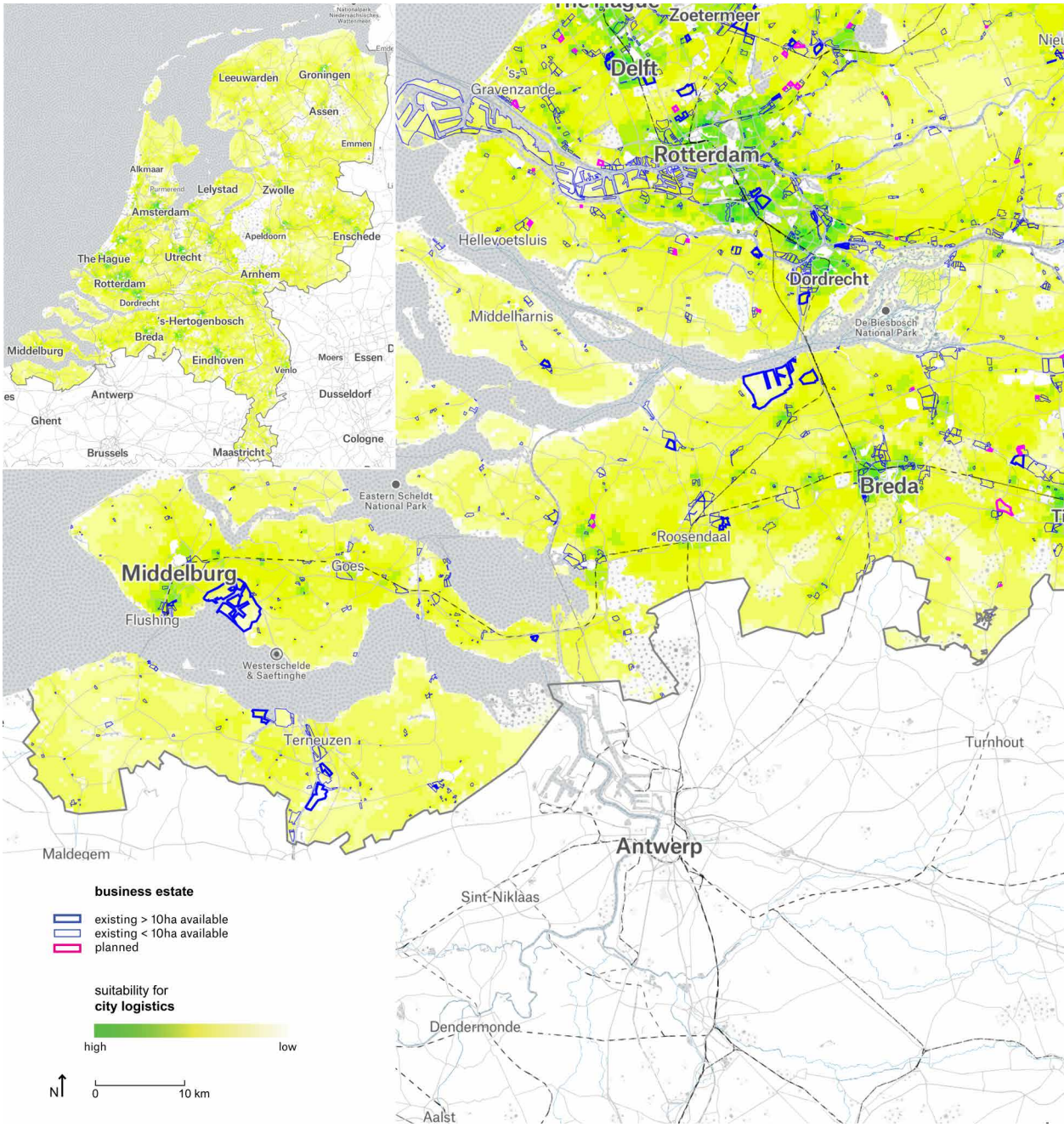

FIG. 2.29 Suitability map City logistics. Source: same as Figure 2.25.
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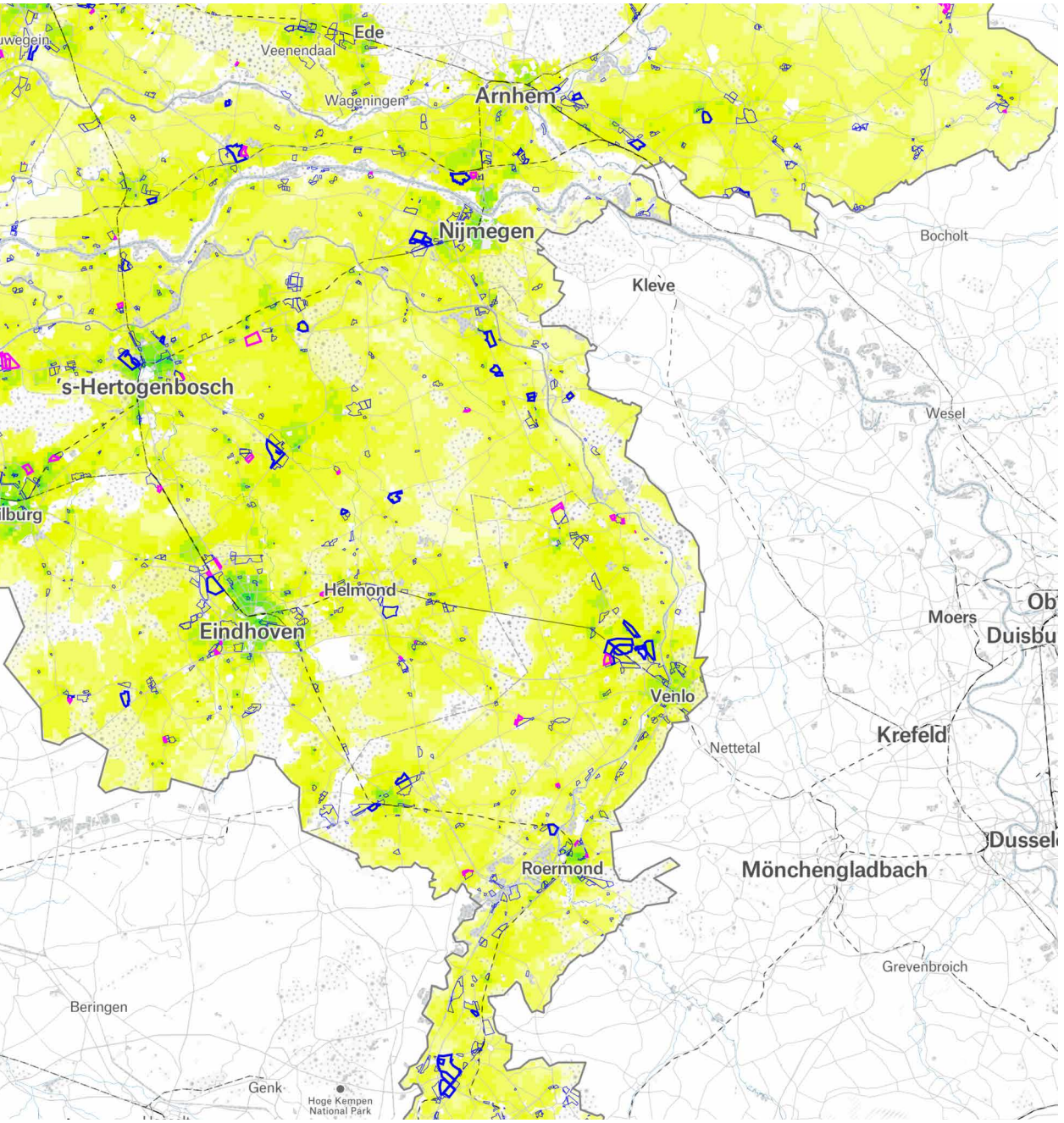
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Nettetal
Krefeld
Roermond
Mönchengladbach
Grevenbroich
Beringen
Genk
Hoge Kempen
National Park

TOC

2.5 Images of individual Dutch distribution centres

While the data above provide statistical and case-independent information on the logistics complex, zooming in to individual DCs is helpful for the multidisciplinary description of this phenomenon. A closer look at individual DCs illustrates aspects of the underlying planning system and actor networks, which are the topic of this thesis. The changing spatial pattern of DCs can often be explained by changing company structures, value chains and consumer behaviour, not visible in the data but quite apparent in the individual case.

2.5.1 An old trade in a new building

The new generation of XXL warehouses emerged quite rapidly and seemingly from a new world of platforms, such as Amazon and Alibaba. Many such buildings, however, pertain to century-old regional companies that have grown, merged and adapted to new forms of trade.

An example is the Dutch transport company Van Gend & Loos, founded in 1809 as a diligence courier. From the 1850s the company focused on parcel distribution linked to railway stations (Figures 2.30 and 2.31), and was purchased by the Dutch Railways in 1928. In 1984 this approach did not work anymore and after sale of the company to Nedlloyd it was turned into a road parcel distributor in the Benelux. In 1999 it was again sold to Deutsche Post AG, who merged it with two other subsidiaries into the current multinational DHL parcel company (Figure 2.32). The case of DSV in Venlo, in **Chapter 4**, is another example of growing and merging of a longstanding regional company.

The so-called Van Gend & Loos-arrest[34] of 1963 played a key legal role in the structuring of trade relations in the European Economic Community, the precursor of the EU. The lawsuit questioned the height of import taxes for different kinds of products. The outcome determined that EU laws on (free) trade prevail above national fiscal legislation.

34 https://nl.wikipedia.org/wiki/Van_Gend_en_Loos-arrest

FIG. 2.30 Van Gend & Loos warehouse Tiel, built around 1900, currently in the Dutch Open Air Museum Arnhem. Photo: Merten Nefs.

FIG. 2.31 Van Gend & Loos warehouse Amsterdam, 1956. Source: Spoorweg In Beeld.

FIG. 2.32 DHL regional sorting hub Dordrecht, 2023. Photo: Merten Nefs.

2.5.2 From post-order retail and teleshopping to e-commerce

In the planning discourse, the rise of XXL DCs is correctly linked to the growth of e-commerce, since many of the new DCs are fulfilment centres for online retail. Traditional brick-and-mortar shops also need to be supplied, often from XXL warehouses as well, but e-commerce usually requires three times as much available stock and therefore more DC space.[35] This can be explained by the different logic of availability: just-in-case instead of just-in-time. Transport emissions related to online versus traditional retail, however, depends highly on the context (Shahmohammadi et al., 2020). It would be an error, however, to think that this type of home-delivery retail is something recent. Already from 1893 Sears Roebuck delivered consumer goods to a large hinterland via the rail network, including entire prefab housing units. In the Netherlands, the Wehkamp company started in 1953 using road transport to deliver matrasses ordered by mail. Later, the catalogue expanded to fashion and home products, while orders shifted to telephone and the internet. Already in the 1970s the company featured urban billboards questioning 'What are you still doing in the shopping street?' (Figure 2.33). From 2021 Wehkamp performs all logistics from a central XXL DC of 110.000 sqm in Zwolle (Figure 2.34).

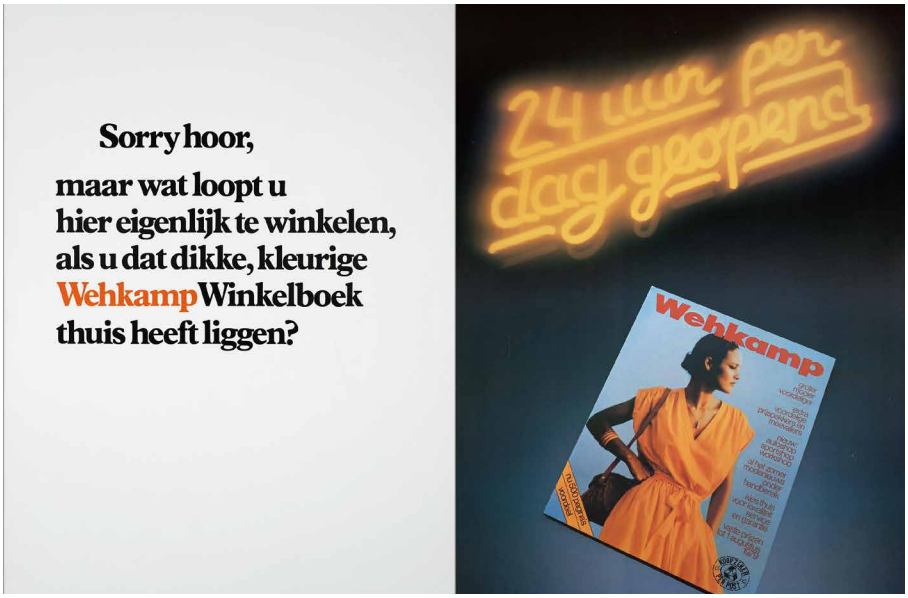

FIG. 2.33 Wehkamp posters, 1972-1980. Source: GeheugenNL.

35 https://www.linkedin.com/pulse/why-e-commerce-needs-more-space-than-store-based-some-howells/

TOC

FIG. 2.34 Wehkamp Zwolle XXL DC, 2021. Photo: Rufus de Vries.

2.5.3 Value-added logistics

Value chains worldwide are becoming increasingly vertically integrated (Sheffi, 2012; World Bank Group et al., 2017), meaning that more and more activities are performed under the control of a small number of large conglomerates as part of their supply chains. This makes it possible to integrate assembly and service tasks with handling of goods in warehouses, often XXL DCs operated by third-party logistics service providers. These activities are structurally invisible in the microdata presented above, and only become visible looking at individual cases.

A Dutch example is the assembly of machines for the construction sector by Broekman Logistics in Born (Figure 2.35). Parts are delivered by container transport from various factories in Europe and abroad, and receive the final assembly and checks in the Netherlands. The building typology, however, is logistical, featuring the typical height and loading docks, similar to the Tesla factory in Tilburg shown above. The difference is that Tesla is registered as an automobile manufacturer and Broekman as logistics service provider. Another example is a large DC in Ruurlo (Figure 2.36), where the Eijgenhuijsen company refurbishes professional printers internationally, by combining supply chains of used chassis and new parts (Nefs, 2023a).

FIG. 2.35 Broekman Logistics Born. Photo: Rufus de Vries.

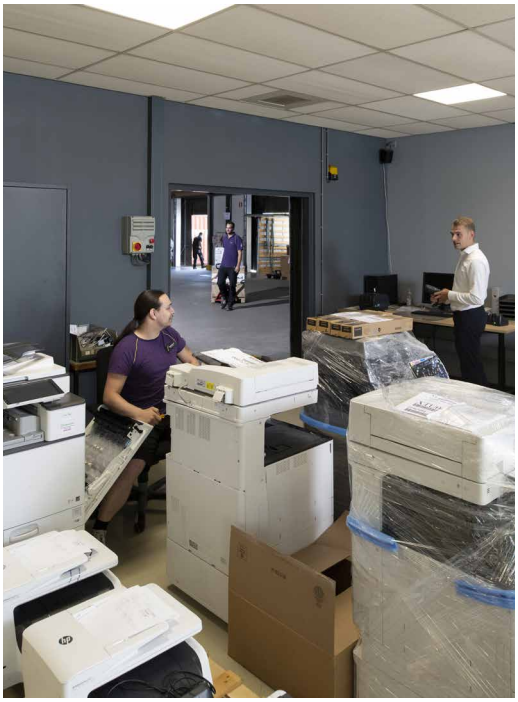

FIG. 2.36 Eijgenhuijsen, Ruurlo. Photo: Rufus de Vries.

TOC

2.5.4 The cool chain as a network of XXL refrigerators

Not always visible from the outside, and only partly from the microdata, is the fact that an increasing number of large warehouses are part of the so-called cool chain. This chain incompasses a large international network of XXL refrigerator buildings, usually for the storage and handling of fresh food products. Several traditional horticultural and fishery areas, such as Barendrecht[36] and Urk[37], have become global hubs for fresh produce. 'Urk is no fishermen's village anymore, but a gigantic freezer. A large, white anonymous box, geared towards industrial food processing.' (Declercq, 2020; translation author)

Bélanger & Arroyo (2016, p. 200) describe how cold is key in expanding the export economy of e.g. the US, because this way perishables become tradable commodities. Cronon (1991) describes how the convergence of rail and refrigeration catalysed a shift in the agricultural geography, now that dairy production could take place near rail hubs in the hinterland instead of expensive urban sites. Thanks to reefer containers equipped with sensors and refrigeration motors, the Netherlands has become the world's second trader in avocados, without cultivating a single one.[38] In recent years, there has been an 11% growth of the Dutch fruit trade, 21% of which has a Dutch origin (Jukema et al., 2021). Below, Europe's most efficient cold storage unit (at the time of writing) is shown in Figure 2.37 and the first fully automatic potato fries cold storage in Figure 2.38.

36 There are emerging cool storage clusters near the agrologistics centre of Westland-Oostland, on the Maasvlakte port extention area, Fruitport Merwevierhaven, Nieuw Reijerwaard near the Barendrecht horticulture auction, all near the Port of Rotterdam. There is another cluster at Greenport Venlo at the German border. These locations have potential access to freight rail and barge transport for reefers, if infrastructure capacity is increased.

37 Vrieshuis AGRO merchants https://www.stedenbouw.nl/artikel/bouw-vrieshuis-agro-merchants-group-urk-vorm-volgt-functie/

38 https://www.cbs.nl/en-gb/news/2017/19/netherlands-second-largest-avocado-importer-worldwide

FIG. 2.37 Van Acht, Veghel, 2023. Photo: Merten Nefs.

FIG. 2.38 Agristo, Tilburg, 2022. Photo: Rufus de Vries.

TOC

2.5.5 The image of the XXL DC

In the critical public discourse on logistics, the scale, anonymity, and context-free design of XXL DCs is often at the forefront (Nefs, 2021b). In the Dutch media, a few examples have appeared regularly, because they particularly demonstrate these aspects. The Primark DC in Roosendaal Borchwerf is probably the number one example used, because of the striped pattern on a 600m façade, and the contrast of scales regarding the houses right in front (Figure 2.39). Another example is the PVH warehouse in Venlo Trade Port Noord (Figure 2.40). The highly anonymous façade, typical for DCs, received a seemingly random window pattern on the side of the mezzanine. A local stakeholder had heard the architect used the windows to represent the lyrics of a Bob Dylan song in morse code: 'Times they are a-changing'. A quick morse code check revealed it is a Bruce Springsteen song: 'Blinded by the light'. What this communicates and to whom is unclear, but it certainly does not provide people in the area with information on what happens inside the DC.

FIG. 2.39 Primark DC, Roosendaal. Photo: Merten Nefs.

TOC

FIG. 2.40 PVH DC, Venlo. Photo: Merten Nefs.

2.5.6 Stacked or mixed DC developments

Compared other densely urbanised areas in the world, such as Hongkong and Paris, warehouses and production facilities in the Netherlands are quite space extensive. Only recently, double layer DCs have been built, such as a building by DSV in Venlo and the LogisticCityhub or CTPark in Amsterdam (Figure 2.41). The latter aims to concentrate city logistics operations when the zero-emission zone policy takes effect in 2025, partly using water transport to supply the city centre. Mixing logistics with other urban functions, as happens in Paris Chapelle International—a development including housing, offices, sports, urban agriculture and education (Nefs, 2023b)—is still not standing practice in the Netherlands. Initiatives for such developments are scarce and do not legally fit the existing land use plans (Figure 2.42). Design research projects have suggested combinations of logistics and other functions for quite some time.[39] A common added function on top of DCs is photovoltaics. Many DCs produce more energy than they need, even considering electric vehicle charging in the future. Some DCs are even informally said to earn more from their PV roof than by performing logistics operations. The growth of PV roofs, however, is hampered by the highly congested electricity grid of the Netherlands, a situation that will remain for several years.[40]

39 For example the combination of logistics and food processing in the Rotterdam Waalhaven area, by Van Bergen Kolpa: https://www.vanbergenkolpa.nl/onderzoek#economische-contextgoederenvervoer-en-overslag-is-een

40 See https://www.rvo.nl/onderwerpen/zonne-energie/geschikte-daken

FIG. 2.41 Amsterdam LogisticCityhub or CTPark. Photo: Merten Nefs.

FIG. 2.42 Plan for medium-size DC in suburban setting. Source: Intospace, Mulderblauw and Apto.

2.6 Conclusion on the data

The compiled dataset provides direct insights into the growth pattern of logistics in the Netherlands. Furthermore, it provides a comprehensive overview in high detail that can be used in various quantitative and qualitative analyses, as is shown in the next chapters.

To facilitate academic and other research into the phenomenon of the logistics complex, regular updates of high-detail open-access data are necessary. These are preferably distributed via a public institution such as CBS, PBL etc. In the effort of updating information, some of the current blind spots in the data could be filled in when better sources become available: (i) double functions of manufacturing and logistics activities, as well as value-added logistics activities; (ii) more complete employment numbers covering the most recent developments as well as the migrant labour share; (iii) vacancy rates; (iv) energetic and material performance of buildings. Beyond the DCs, comprehensive data is required on the various types of nuisance in their vicinity, including noise, road congestion, light, NO_x and other emissions.

3 The Dutch 'Gateway to Europe' spatial policy narrative, 1980-2020

A systematic review

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ABSTRACT Like other countries with large ports, the Netherlands developed a policy narrative to acquire a key position in global value chains starting in the 1980s, through the spatial development of its hinterland logistic complex. The negative environmental effects of logistics, such as landscape transformation and congestion, have increasingly come to be seen as spatial policy problems. The literature on policy narratives emphasizes the importance of balanced trade-offs and learning from alternative views. In this paper, we discuss why the 'Gateway to Europe' narrative has remained in place. This paper systematically reviews spatial planning documents, advisory reports and academic papers between 1980 and 2020 to develop a chronology of logistics planning concepts pertaining to economic and technological milestones. It also maps policy influences, aiming to identify underlying causal policy theories on logistics development and its spatial-environmental effects. We determine that critical reports have been structurally ignored, challenges have been outsourced and advocacy coalitions have been unbalanced, increasing path dependency and risking a spatial-economic lock-in. Looking at the 'Gateway to Europe', we point to pitfalls in the policy narrative and the policy-learning process, enabling policymakers to avoid them in the future.

KEYWORDS hinterland logistics; quality of life; policy narrative; spatial planning; systematic review; Gateway to Europe

3.1 Introduction

Since the 1980s, European countries have strategically positioned themselves in the emerging trade paradigms of global supply chains, global value chains and the free flow of capital, people and goods. This positioning process has entailed the elaboration of policy narratives and high-impact spatial planning decisions concerning transport infrastructure and adjacent logistics area developments, together forming the logistics complex. While the European Union (EU) has promoted transnational corridors to enable 'seamless flows' (Jensen & Richardson, 2007), the Dutch have attempted to become a *distributieland* ('distribution country', formally translated as 'Gateway to Europe'). This policy narrative—created by the government, economic interest groups and state-owned companies such as the Port of Rotterdam—may be considered to be neoliberal, aimed at eliminating companies' transaction costs. It may also be viewed as neo-mercantilist, aimed at enhancing the competitiveness of the Dutch trade and logistics sector (Rodrik, 2018, p. 134; Warlouzet, 2019), see Figure 3.1.

Large logistics complexes with rising spatial footprints have been developed near Antwerp, Hamburg, Los Angeles and across Central and Eastern Europe over the same time period with support from similar policy narratives (Flämig & Hesse, 2011; Frejlachová et al., 2020; De Lara in P. V. Hall & Hesse, 2012). In the Netherlands, the rising number and size of distribution centres—resulting in the so-called *verdozing* (boxification) of the Dutch landscape—is an emerging hot topic in recent spatial planning debates (CRa et al., 2019). This phenomenon, often referred to as 'logistics sprawl' in the literature (Krzysztofik et al., 2019), may be more than just incompatible with established policy goals, such as net-zero emissions and the circular economy (BZK, 2020; Fichter, 2002; IenW & EZK, 2016; Van Buren et al., 2016). It may also seriously compromise the quality of the Dutch living environment via road congestion, heightened emissions and landscape transformation (Aljohani & Thompson, 2016; Heitz et al., 2017). Recent research suggests that knowledge-intensive sectors of the economy require a favourable living environment to attract and retain talent (Nefs, 2016; Rli, 2016). In its most recent planning strategy (BZK, 2020), the Dutch government established this environmental favourability as a national policy goal—and logistics sprawl as a threat—alongside the further development of logistics. This contradiction and the handling of various trade-offs (Surel, 2000) in Dutch national policy constitute the main focus of this paper.

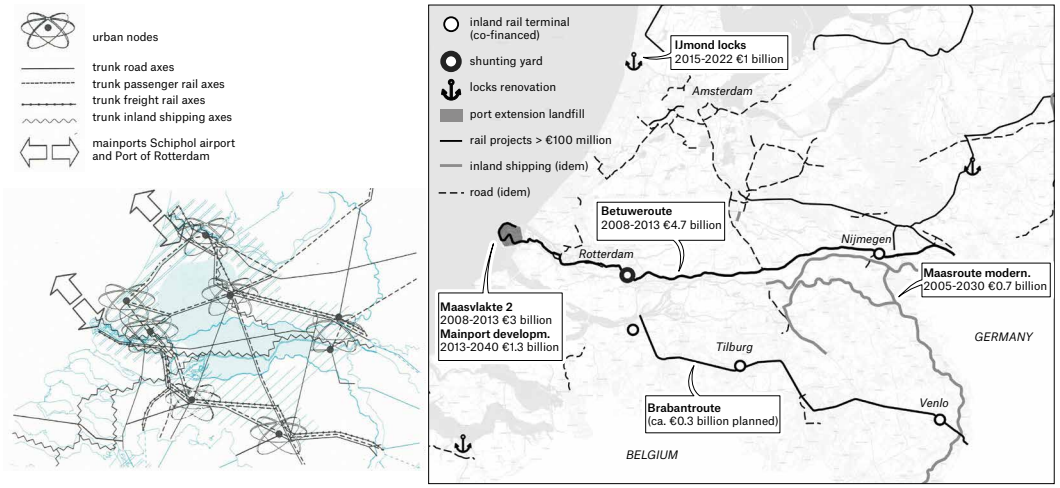

FIG. 3.1 Mainports and hinterland infrastructure. Left: Map of the Fourth Memorandum of Spatial Planning (Ministry of Housing, Spatial Planning and the Environment VROM, 1988), translated by the authors. Right: Investments since 1990 (author's illustration, based on online sources, including MIRT project books)

Despite concerns over its negative effects, the Gateway to Europe narrative has held strong for over 40 years. This raises questions regarding the assumptions on which this policy narrative was based and how these have changed in light of evolving empirical evidence. The literature on policy narratives emphasizes the importance of balanced trade-offs and learning from alternative views (Throgmorton, 1996). It also highlights the need to understand the evolving causal policy theories present in such narratives (Hoogerwerf, 1990). Therefore, in this analysis, we aim to identify the weaknesses of the Gateway to Europe policy narrative dating back to its emergence in the 1980s.

The following section draws on three elements from the literature to define the structure of our systematic review method: exogenous events, influence by advocacy coalitions and independent research, and causal policy statements. We apply this method to carefully selected spatial policy memoranda, policy advisory reports, relevant research and academic papers, from which we extract information on the development of the Dutch logistics complex and its spatial-environmental effects. In the third section, we structure our findings as a timeline of policy concepts and instruments, a table of policy influences, and an overview of the main causal statements in the policy memoranda. In the fourth section, we reflect on our findings through the lens of policy narratives and policy learning.

TOC

3.2 Concepts and methodology

3.2.1 Key analytical concepts

We intend to show that the Gateway to Europe narrative is not only a public-private *policy narrative* but also a *policy-learning* process, the results of which are suboptimal relative to what these concepts entail. Policy narratives have been increasingly theorized since the 1990s. They are broadly understood as causal stories aimed at mobilizing support for a project (Radaelli, 1999; Surel, 2000) or 'side-step[ping] opposition from potential losers and avoid[ing] policy deadlocks.' (Quaglia & Howarth, 2018, p. 993) To begin our inquiry into Gateway to Europe, we can look to Peter A. Hall's practical definition of a policy narrative:

"[T]he terms of political discourse generally have a specific configuration that lends representative legitimacy to some social interests more than others, delineates the accepted boundaries of state action, associates contemporary political developments with particular interpretations of national history, and defines the context in which many issues will be understood." (P. A. Hall, 1993, p. 289)

Planning often comes down to persuasive and constitutive *storytelling*: future-oriented texts that, according to Throgmorton (1996, p. xiv), not only pertain to the planner's own ideas but also 'reflect awareness of differing or opposing views.' This storytelling involves rhetorical framing (De Bruijn, 2019), in which deliberately chosen adjectives, nouns and metaphors are used to achieve the political and societal acceptance of policies and interventions. Spatial narratives, the category to which the Gateway to Europe narrative partially belongs, often include 'framing with images' (Faludi, 1996). For instance, such narratives may highlight the favourable position of a country in the global trade network.

In its most condensed form, a spatial narrative can be a planning concept. The Gateway to Europe narrative contains several such concepts, the most important one being the *mainport*. Planning concepts combine analytical and empirical explanations of spatial elements with normative statements on spatial policy goals (Balz, 2019; Davoudi, 2003). Some concepts become dominant spatial imaginaries, viewed as true representations of reality (Sykes & Shaw in Davoudi et al., 2018). One example consists of contemporary Eurasian trade links, collectively imagined as the Silk Road by combining an oversimplified historical reference with the current Chinese Belt

and Road initiative. While many planning concepts and policy metaphors remain stable over the course of several decades, their underlying meanings may change. The concept of a mainport, for example, was introduced in the literature as an element of wider spatial-organizational and logistics networks. Spatial-economic and infrastructural policy narratives reduced its meaning to a physical hub with a confined hinterland (Van Duinen, 2004, 2013).

Policy narratives are not exclusively developed by either market or state actors; rather, they typically form through public-private collaborations. For this reason, this paper employs the concept of *advocacy coalitions* (Sabatier, 1998). In the context of hinterland logistics, Raimbault argues that purely technical perspectives on transport flows are insufficient to understand developments in the field: 'Agenc[ies] can lobby governments and align with institutional actors to secure interests or pursue development agendas through networking' (Raimbault, 2019, p. 2). Therefore, behind each narrative, there exists a coalition of actors with shared beliefs and ambitions seeking to coordinate in pursuit of desired outcomes. In the context of the Gateway to Europe narrative, these outcomes include port infrastructure, hinterland connections (e.g., roads, rail networks, waterways) and sites for the development of logistics buildings.

Policy narratives contain *policy theories*: the causal assumptions underlying a policy (Hoogerwerf, 1990; Rodrik, 2018, p. 165), including the assumed effects of policy instruments and interventions. These are sometimes—but often not—supported by evidence. The Gateway to Europe narrative entails assumptions regarding the positive economic effects and necessity of infrastructure investments. Such policy theories are often biased, underestimating the costs and overestimating the yields of infrastructural megaprojects (Flyvbjerg et al., 2003). Although policy theories are generally not made explicit in policy documents, they can be reconstructed from causal statements across various sources making a distinction between: problem → policy goal → policy instrument. In this paper, we describe only policy theories that can be traced back to statements in official policy memoranda. In the case of spatial policies pertaining to the Gateway to Europe narrative, we find assertions based on evolving economic conditions, production chains or transport technologies.

This brings us to what's often referred to as policy learning. According to Surel (2000), two types of events are likely to prompt changes in the analytical and normative underpinnings of policy narratives and the composition of supporting advocacy coalitions: shifts in economic conditions and exogenous shocks to policy subsystems. Clearly, the interpretation of exogenous events by planners is of great importance to our case. Spatial planning is increasingly viewed as a learning process 'concerning collaborative action and future challenges regarding society, economy and natural environment' (Janssen-Jansen and Lloyd in Salet, 2018, p. 235). The planning

discourse around the Gateway to Europe narrative is potentially such a learning process. Over the last 40 years, the empirical basis of spatial planning knowledge—and, more specifically, of the Gateway to Europe narrative—remained rather narrow, as will be shown below. The empirical basis has relied on the observation of a limited number of cases, and there is a normative bias in terms of what planners and decision-makers perceive as 'valid' and 'relevant' knowledge (Balz, 2019). Therefore, the learning process not only relates to policy theories but also to the normative foundations of policy narratives and their constitutive spatial analyses and planning concepts.

Applying the above considerations to the Gateway to Europe narrative, we may assume that the cognitive and normative frameworks of this narrative have been influenced over the years by interpretations of exogenous shocks to economic and technological conditions, biased readings of empirical insights and the work of advocacy coalitions.

3.2.2 Methodology

Given the complex 40-year history of the Gateway to Europe narrative, a comprehensive account of its main decision-making processes and surrounding sociopolitical debates would be beyond the scope of this paper. We are primarily interested in how the national government has interpreted the Gateway to Europe narrative in spatial policymaking, how the narrative changed over time and how these changes can be explained. Therefore, we focus on formal documents pertaining to spatial policymaking, including national policy memoranda and other sources explicitly linked to the elaboration of such documents (e.g. reports from government advisory bodies, expert hearings, academic articles). We also looked at relevant reports from government advisory bodies that were not requested by the government, as well as research papers that discord from prevailing policy theories. To keep the analysis as transparent and replicable as possible, we use a systematic review to reconstruct the evolution of key policy theories underlying the Dutch logistics complex alongside exogenous shocks, external influence of advocacy coalitions and empirical research. Specifically, we employ the PRISMA method (PRISMA, 2021), which requires the explicit documentation of both the selection of sources and the treatment of data (Liberati et al., 2009). All of the steps—including the identification, screening and assessment of sources and the analysis itself—are illustrated in Figure 3.2. The spatial scope of the selected documents is the Netherlands and other countries in Northwest Europe; the historical scope is from 1980 to the present, capturing the global shift toward neoliberalism and the growth of global supply chains (Kuipers et al., 2018; Leinbach & Capineri, 2007).

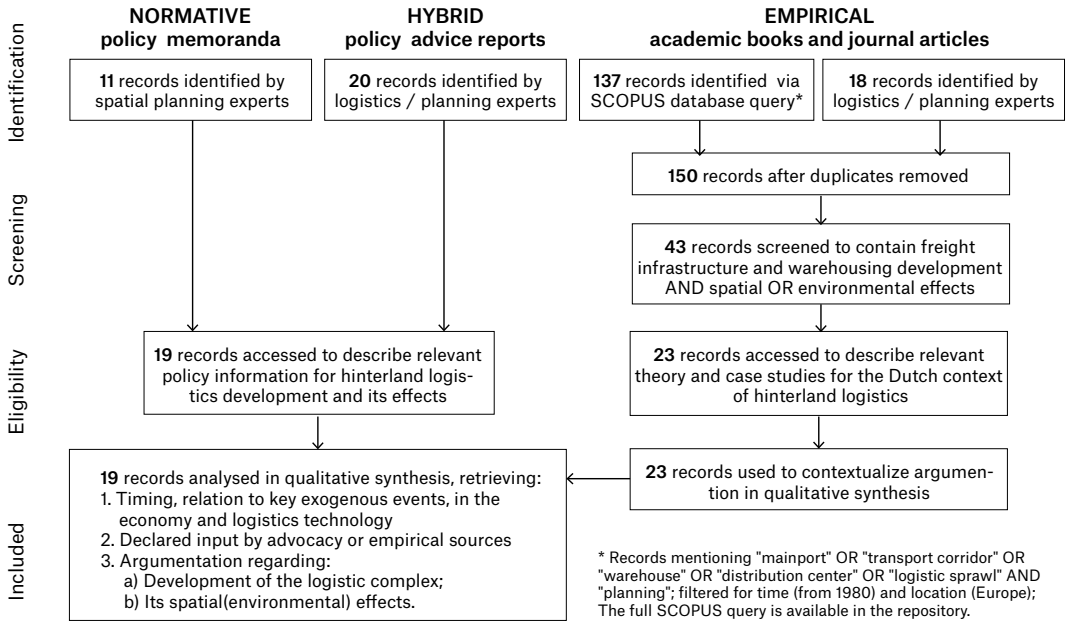

FIG. 3.2 Flowchart of systematic review, adapted from PRISMA model

We ran all sources through a screening process, ensuring that they met explicitly defined criteria before retrieving information from them. The final selection includes six normative policy memoranda, 13 hybrid policy-advice documents and 23 empirical research papers. From the 19 policy and advice documents, we retrieved and elaborated the following information: timing of the document (relating the used policy concepts and instruments to economic and technological milestones on a timeline); declared input by advocacy coalitions and studies (presented in a comparative table to assess the influence on the policy documents); argumentation regarding the development of the logistics complex and its spatial effects (from which the main causal policy theories are distilled).

The 23 selected research papers enabled us to create an overview of the available knowledge at their time of publication, from which we can assess the extent of their use in policy memoranda and advisory reports. The validation of the empirical basis of policy is not the goal of this paper. Since some of the documents were selected with the help of experts, a limited degree of bias may be present in spite of careful triangulation. As we excluded newspaper articles and other such sources, the bias may be expected to favour non-critical information. The findings are available in full

in a repository[41], including a list of assessed documents, a PRISMA checklist and flowchart and 19 annotated policy memoranda and advice reports.

3.3 Analytical results

We structure the findings of this systematic review chronologically in the first sub-section to assess which exogenous events (macroeconomic and technological milestones) coincide with policymaking. The next sub-section identifies the advocacy coalitions and empirical research on which policy memoranda and policy advisory reports have been based. The third sub-section distils those policy theories (from the most relevant reviewed documents) with an eye for how the government has viewed the development and spatial effects of the logistics complex.

3.3.1 Historical periods in the development of the 'Gateway to Europe' narrative

The timeline (Figure 3.3) aligns relevant economic and technological events with the introduction of spatial planning concepts and instruments regarding the logistics complex. Major events, represented by larger stars, predate several key logistics policies between 1980–2020, some of which are explicitly mentioned in planning memoranda and advisory reports. One key example is the economic crisis of 1981—1982, from which the Dutch economy recovered more slowly than other European countries (Den Bakker, 2009); this crisis set the scene for a profound spatial-economic policy shift and the Dutch ambition to become a Gateway to Europe. The logistics revolution of the 1970s reorganized supply chains worldwide (see timeline). Alongside the growth in container traffic in the 1980s, this further stimulated the development of a mainport policy, anticipating the 1992 integration of the EU internal market.

41 DOI: 10.4121/14717019

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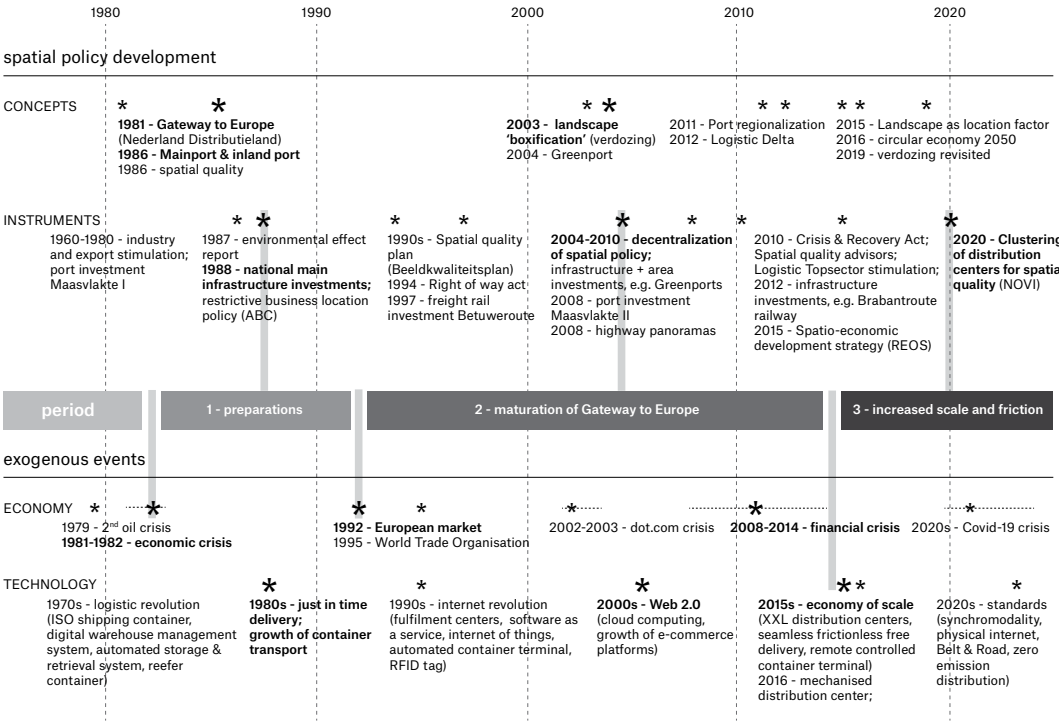

FIG. 3.3 Timeline of Dutch spatial policy regarding hinterland logistics alongside exogenous events

In the hinterland of the port of Rotterdam, emerging e-commerce platforms strongly propelled the development of distribution centres in the 2000s despite the dot.com crisis of the late 1990s. The end of the financial crisis and economies of scale in distribution centres spurred the growth of large 'XXL' distribution centres starting in 2014. Both the dot.com and financial crises were mentioned in policy memoranda (IenM, 2012, p. 9; VROM, 2004, p. 6). In this context, policy concepts and related instruments (e.g., zoning plans) aimed to expand and establish new distribution centres; these efforts can be understood as reactions to exogenous economic and technological events.

While the Gateway to Europe narrative and the need for an attractive living environment in the modern knowledge economy have remained rather stable narratives over the last four decades, this is not the case for all spatial planning concepts referenced in policy documents. For example, when a government research agency revealed a large increase in new business locations along motorways (RPB, 2006a, 2006b), the resultant public and political outcry led to the adoption of the concept of *snelwegpanorama* (motorway panorama). Motorway panoramas

were institutionalized in a dedicated policy document two years later, calling for a spatial strategy around motorways to enhance the 'view on the beauty of the Netherlands' (VROM, 2008). A few years later, the concept was dropped when a new political coalition advocated for a narrower, less interventionist role of the national government in spatial planning.

Based on our estimated impact of exogenous events, the evolution of the Gateway to Europe narrative can be divided into three distinct periods, each kick-started by a significant macroeconomic event and marked by important policy and technological events.

In 1980–1991, the Gateway to Europe narrative was being prepared. The main spatial policy of that period was the 1988 Fourth Spatial Planning Memorandum. The relevant political debates of the 1980s focused on the change from stringent spatial-economic planning to public-private development planning as well as the trend toward internationalization: how to prepare the Netherlands for the 1992 EU market integration? Top-down spatial planning and direct investment in infrastructure were seen as tools to enhance national economic performance. A novel spatial-economic vocabulary became a part of national planning, emphasizing the strengthening of the national spatial main structure and its elements, such as hinterland connections.

In 1992–2013, the country's logistics policies became more elaborate, facilitating the convergence of global production chains, container transport and ICT (Kuipers et al., 2018). The 2004 National Spatial Strategy ushered in the decentralization of most spatial planning issues—other than those pertaining to national infrastructure—to provincial and local governments and called for private-sector involvement in spatial development (Van der Wouden, 2015; VROM, 2004). As the logistics complex emerged as a spatial phenomenon, advocates of motorway panoramas failed to achieve effective policies. During the 2008–2013 financial crisis, austerity politics were combined with the deregulation of spatial development guidance, for example pertaining to logistics business estates. The Crisis and Recovery Act (2010), for instance, created temporary shortcuts in planning procedures. These shortcuts are being integrated into the *Omgevingswet* (Environment and Planning Act), which is expected to take effect in 2023.

In 2014–2020, the Netherlands experienced strong e-commerce growth and economies of scale across its distribution centres, causing friction among policymakers and the public at large. The 2020 National Strategy for Spatial Planning and the Environment (BZK, 2020), like earlier memoranda, attempted to reconcile the growing spatial footprint of logistics with spatial-environmental considerations. However, due to the aforementioned decentralization, several policy

instruments were in the hands of local governments. Today, the national government continues to seek advice regarding its logistics developments (Stec Group, 2020); however, at the time of writing, it has yet to decide on a course of action. The 'boxification' of the landscape became a regular item in the debate around 2018, fuelled by civil and political unrest regarding XXL distribution centres, some of which extend across 100,000 square metres. While some of these 'big boxes' house factories or data centres, most have a logistics function.

3.3.2 The influence of policy advice, advocacy coalitions and research in spatial policymaking

Figure 3.4 summarizes—for each of the six spatial policy memoranda (first column)—the explicitly mentioned input sources. We distinguish between policy-advise reports (second column), advocacy coalition documents (third column) and empirical sources (fourth column). Whereas advocacy coalitions are groups of stakeholders invited to represent their interests, we consider empirical research here to be impartial.

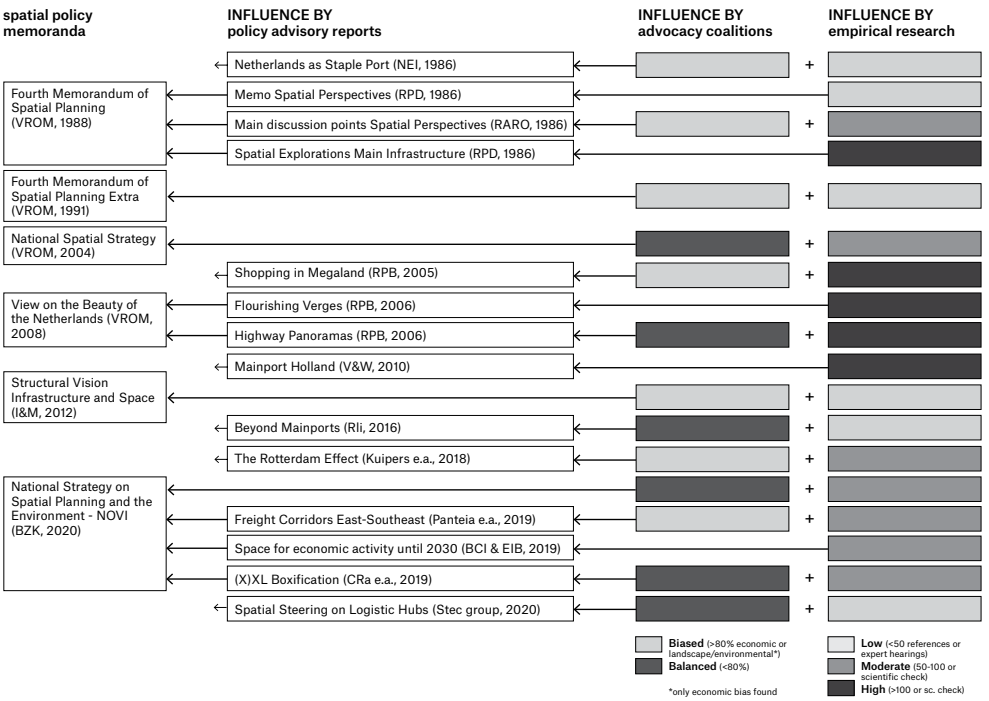

FIG. 3.4 Summary of policy documents and influential sources

TOC

There are a few instances of overlap. For instance, the Rijksplanologische Dienst (RPD; National Spatial Planning Agency, abolished in 2010) gave tailor-made policy advice based on empirical research models elaborated by one of its departments. There are several state institutes among the sources, including the Centraal Bureau voor de Statistiek (CBS; National Statistics Bureau) and the Planbureau voor de Leefomgeving (PBL; Netherlands Environmental Assessment Agency). Empirical references in the policy documents include articles and international organization reports (e.g. OECD, FAO, World Bank) but almost no independent academic works. None of the 23 papers we found through the Scopus database was referenced in the policy documents.

We occasionally uncovered clear evidence of chains of influence, such as the Fourth Memorandum, which references societal input of advocacy coalitions organized by the *Raad van Advies voor de Ruimtelijke Ordening* (RARO; Advisory Council for Spatial Planning) as well as empirical modelling and strategic advice from the RPD. We can distil various empirical sources from the reports of these two organizations. However, most memoranda only implicitly reference empirical data, sources and policy theories. Policy documents frequently refer to other policy documents, such as European Council decisions. Several relevant advisory reports did not—yet, at least—explicitly influence spatial planning memoranda (see small arrows in Figure 3.4).

Figure 3.4 confirms a Dutch tradition of policymaking with the participation of various advocacy coalitions, known as 'poldering' (Hendriks, 2009). Our analysis shows that economic interest groups are more widely represented than environmental groups, except for View on the Beauty of the Netherlands (VROM, 2008), which specifically focuses on the landscape effects of business sites adjacent to motorways. Typical in the Dutch logistics sector are interest groups like Transport and Logistics Netherlands (TLN), EVO-FENEDEX and Holland International Distribution Council (NIDC). The NIDC was founded in 1987 to promote the Gateway to Europe narrative, promote the Dutch logistics sector abroad and serve its interests in the Netherlands. Its approximately 300 members include logistics companies and governments.[42] None of these three organizations, however, explicitly lobby on the spatial effects of logistics companies (Figure 3.5). TLN's lobby targets 7 Dutch ministries, not including the ministry responsible for spatial planning[43], while EVO-FENEDEX does not mention it either.[44] The data show frequent influence on spatial planning with regard to the logistics complex by the Ministry of Economic Affairs

42 https://hollandinternationaldistributioncouncil.com/

43 Web page regarding lobby: https://www.tln.nl/belangenbehartiging-nationaal

44 Web page regarding lobby: www.evofenedex.nl/kennis/juridisch

and the Ministry of Infrastructure. Actors like the Rotterdam Port Authority, a public company owned by the Rotterdam municipality (71%) and the national government (29%), also wield significant influence over the policy debate.

FIG. 3.5 Gateway to Europe. Left: The trade perspective (image by the Netherlands Foreign Investment Agency NFIA, www.investinholland.com, 2021). Right: The environmental perspective—XXL DC mentioned in the boxification debate (photo by the author)

Regarding influence by research or policy advice, it is remarkable that the two main critical policy advisory reports about the role of the Netherlands as a Gateway to Europe have been completely ignored in the policy memoranda (NEI, 1983; Rli, 2016). These reports conclude, based on empirical evidence, that the heavy transportation function is the least profitable and most polluting element of trade. Therefore it would be more economically advantageous to focus on digitalization and trade-management activities, which are highly profitable, while channelling goods traffic partly through other territories. The reports argue that heavy infrastructure has deleterious environmental effects, decreasing the competitiveness of the Dutch economy. Neither of these reports were received warmly (BZK, 2020; VROM, 1988). In an official reaction to the 2016 Rli report (IenM, 2016), the Minister of Infrastructure asserted, without any evidence, that growing transport volumes are necessary to remain a successful trading country and that state programs are effectively dealing with the issue of added value. This reaction ignored the negative effects of freight transport altogether. Spatial policy memoranda also routinely ignored reports discussing the difficult trade-off between risks and benefits of the mainport policy (BZK, 2020; IenM, 2012; Kuipers et al., 2018; Van den Bergh, 2010).

3.3.3 Key policy theories in use

From the policy memoranda, we distilled three dominant policy theories on the Dutch logistics complex and its spatial effects. Here, we introduce each—from broad to specific—with a brief summary of the critical causality chain: problem → policy goal → policy instrument.

Gateway to Europe or perish

The Netherlands must remain a leading trading nation → the country needs to strive for a key position in emerging global value and supply chains = become the Gateway to Europe → public investments in mainports and the hinterland logistics complex are critical.

This argument was particularly prominent in the policy memoranda of the 1980–1991 period (VROM, 1988, p. 41). The hinterland logistics complex was conceptualized in the policy documents as a logistics delta and a port-industrial complex. Government investments included a major extension of the Rotterdam Port beyond the existing coastline, named Maasvlakte 2, which was heavily contested by environmental groups (Van Gils & Klijn, 2007; Wolsink, 2003). The Betuwe line, a dedicated freight railway costing €4.7 billion—four times the initial estimate—was also heavily contested (Priemus, 2007). Meanwhile, policies actively stimulated private initiatives in hinterland distribution clusters (IenM, 2012, p. 83; VROM, 1988, pp. 26–27, 48, 136–140). In recent policies, this notion of the Netherlands as a freight gateway still holds strong (BZK, 2020, p. 32).

The 1988 Fourth Memorandum of Spatial Planning (VROM, 1988) references evidence from the main infrastructure advisory report (RPD, 1986b), which demonstrates two trends in logistics: growing freight volumes and the rising importance of logistics supply-chain management. Spatial policy was clearly adapted to accommodate the former. While a potential threat to the Dutch trade position was mentioned, no evidence of this was provided in the documents. Nevertheless, in 1986, the Dutch Minister of Infrastructure warned that the Netherlands must not become the 'Jutland of Europe' (Van Duinen, 2013), meaning a peripheral country: a typical example of fact-free framing, since Jutland in Denmark should in no way be considered to be a 'backward' region. Similarly, the 2004 Spatial Strategy repeated the self-declared success story of the Dutch economy, confusing the effects of topography and spatial policy: 'The delta provided the opportunity to develop ports and efficient transport systems with significant economic opportunities for trade, distribution and related logistics. Direct connections between the large ports (mainly Amsterdam and Rotterdam) and the hinterland became the backbones for economic development' (VROM, 2004, p. 14).

Ample supply of space for logistics as economic necessity

To maintain economic growth and avoid unemployment → sufficient land for logistics developments must be supplied → regional and local governments need to use their spatial planning competences to make this happen.

This policy theory became popular amid the 2000s decentralization wave (VROM, 2004, p. 9). Initially, the supply of motorway locations for logistics was regarded as both a national interest and a concrete policy task. While the national interest continues, the task was decentralized. Although this remains the norm at the time of writing, the most recent planning memorandum from 2020 emphasizes collaboration with local governments (BZK, 2020, p. 91). The alleged necessity of low-skilled job creation has been a constant aspect of the Gateway to Europe narrative, first of all in national policy during the economic crisis years of the 1980s, and later in local planning policies geared towards logistics developments.

None of the planning memoranda included evidence of the effectiveness of decentralization in spatial policy. The supply of land for logistics development was regarded as an evident success, as growth assessments of the logistics complex in hinterland locations over the last decades showed a steady growth of logistics jobs in logistics regions and even steeper growth in the spatial footprint of logistics real estate—over 300 per cent since 1980 (Bak, 2021; BCI & EIB, 2019). However, the lingering boxification debate suggests that the environmental and landscape impacts have yet to be sufficiently handled. The job argument became less prominent once it became apparent that many of the low-skilled jobs—and even many of the high-skilled jobs—in logistics can only be filled with migrant labour due to Dutch labour shortages (Bakker et al., 2019).

Mitigation of the spatial impacts of logistics

Negative effects are inevitable in the growing logistics complex → the Netherlands should strive to minimize these effects without curbing growth → innovation and win-win scenarios should be stimulated.

This desired win-win scenario for logistics and the environment has been a mainstay in policy documents for the last 40 years. The most recent memorandum promotes space for both healthy living and more air travel; for both an attractive landscape and sufficient land supply for logistics (BZK, 2020, pp. 5, 59, 68, 93; VROM, 1988, p. 54, 1991, p. 112, 2004, p. 176). This firm but almost naïve belief in the potential of a win-win scenario seems to be rooted in a permanently optimistic attitude toward technology (BZK, 2020, pp. 21, 26; IenM, 2012, p. 47; RPD, 1986a,

p. 60). Negative effects, such as the congestion of transport infrastructure and the growing footprint of logistics activities, are expected to eventually be solved by logistics innovations. Such innovations include synchromodality, which aims for infrastructure-, warehouse- and vehicle-use optimization through information sharing among actors in freight transport, and the *physical internet*, an advanced version of synchromodality with high levels of freight standardization, consolidation and automation—still considered utopian by many experts (Ballot et al., 2014; Leinbach & Capineri, 2007). Environmental concerns surrounding logistics have been prominent since the 1980s (RPD, 1986a, p. 29; VROM, 1991, p. 12, 2004, pp. 176, 195). The motorway panorama policy (VROM, 2008) introduced the idea of building-free zones along certain national motorways. The balance between maintaining open space and the stimulation of distribution and production facilities along motorways, however, remained a regional and local responsibility (IenM, 2012, p. 33). As of the most recent memorandum, distribution centres are explicitly linked to cluttering and fragmentation of 'outstanding landscapes', which should be addressed by regional environmental agendas (BZK, 2020, pp. 104–105).

While policy advisors raised concerns early on over the focus on the Netherlands' distribution function with no consideration of its effects on the Dutch landscape and environment (RARO, 1986, pp. 26–81), infrastructure development models of the 1980s showed considerable negative ecological and landscape impacts (RPD, 1986b, p. 10). Nevertheless, the eventual observation of boxification and motorway landscape disruption was met with shock (CRa et al., 2019; RPB, 2005, 2006a). Evidence of a successful mitigation of environmental impacts by technology remains scarce; technology's role as a driver of logistics growth, however, has become readily apparent. Teleshopping (the precursor of e-commerce), for instance, was welcomed with interest in the early 1980s and recognized as a positive game-changer starting in the mid-2000s (RPB, 2005, p. 36; RPD, 1986b, p. 113)—and most of the recent growth of logistics land use effectively stems from this innovation (Heitz et al., 2017, p. 95). Evidently, logistics is no different than coal in Jevons's paradox: the more efficient its application becomes, the greater its consumption (Klumpp, 2016).

3.4 Discussion

3.4.1 Biased policy narrative

'Gateway to Europe' clearly fulfils Hall's criteria (1993) of a policy narrative. First, the sequence of spatial policies has lent legitimacy to the prioritization of logistics infrastructure development over other public interests, such as the quality of the living environment and landscape. This asymmetrical trade-off was explicitly criticized in a 1980s policy advice: '… in the followed approach, the production and distribution structure becomes determinant for spatial quality, while the first should be derived from the second' (RARO, 1986, p. 25). More than three decades later, the Strategic Environmental Assessment of (the 2019 draft of) the National Strategy on Spatial Planning and the Environment repeated the dilemma of 'large economic opportunities versus large environmental quality threats' (Maronier, Véronique, Grote Beverborg, 2019, p. 11). Economic opportunity has consistently carried the heaviest political weight since the 1980s.

Second, national policies consistently use a selective interpretation of Dutch history as a trading nation. The first spatial planning memorandum in 1960 began by stating that 'The foundation of the development of the Netherlands is its location in the focal point of transport routes between the European continent and the world seas' (RPD, 1986b, p. 49). Although policy memoranda suggest a relationship between the Dutch staple ports of the Golden Age and the current containerized logistics sector of re-export and e-commerce, this sector is, in fact, rooted in the more recent transit function of the port of Rotterdam, made possible by the steamship and the telegraph of the 19th century (Van den Bergh, 2010; Van der Woud, 2006). Such a misrepresentation of history, in our view, is comparable to the Belt and Road imaginary mentioned in Section 3.2 (Sykes and Shaw in Davoudi et al., 2018).

Third, the Gateway to Europe narrative has created a policy context that is biased to logistics developments despite the availability of alternative policy pathways. The stimulation of domestic exports could have been less environmentally damaging but equally profitable (Kuipers et al., 2018). Beyond spatial policies regarding infrastructure investments and logistics development, the state also used non-spatial instruments. These include subsidies to strengthen the so-called 'logistics top sector', a favourable Dutch VAT law (tax is due only when goods are re-exported from a warehouse) and labour regulations allowing night shifts in distribution centres,

in contrast to for example Belgian regulations. The next two sub-sections discuss lessons from the Gateway to Europe narrative with regard to the development and adaptation of policy narratives.

3.4.2 Weaknesses of closed policy narratives

A forty-year period with a rather unbalanced trade-off between logistics and its spatial effects has produced two main weaknesses in the Gateway to Europe narrative. Internally, it has led to a widespread belief in an unrealistic *win-win scenario* in which the growth of the logistics complex can coexist with environmental protection. Policy theories pertaining to the success of decentralization of difficult spatial planning decisions and technological silver bullets sustain this belief. Externally, it has strengthened at least three strong counter-narratives: (i) the Netherlands as a trade-control centre, managing flows not only in the Netherlands but beyond (NEI, 1983; Rli, 2016); (ii) the circular economy, relying on shorter (regional) and more closed value chains (IenW & EZK, 2016; Van Buren et al., 2016); and (iii) the knowledge economy, maintaining an attractive landscape with limited boxification to retain and attract talent (Luttik et al., 2008; Nefs, 2016). Academic and policy discussions have begun to explore the effects of the COVID-19 pandemic on 'slowbalization', the regionalization of supply chains and the perceived need to transform the mainport policy to meet circular economy and landscape goals (Kuipers et al., 2018, pp. 14–15; Van den Bergh, 2010, p. 69). Furthermore, policymakers and logistics sector representatives have recently begun to express their hope that a more circular economy with new logistics concepts will soon change the Gateway to Europe approach (BZK, 2020, p. 32).

Overall, the Gateway to Europe narrative resembles—rather strongly—what Throgmorton (1996) calls 'abnormal discourse', in which logistics and landscape advocates passionately attack each other instead of constructing common discourse. This tells us that an important element of Throgmorton's storytelling approach is insufficient in the Gateway to Europe narrative: an awareness of differing and opposing views. The hegemonic nature of the mainport and Gateway to Europe policies (Boelens and Jacobs in Zonneveld & Nadin, 2021, p. 167) seems to have prevented them from improving their narratives by learning from conflicting views. A dynamic environment in which storylines can coexist and interact—which Hajer (1993) calls a 'discourse coalition', has been severely lacking.

3.4.3 Limited spatial policy learning

The Gateway to Europe narrative *has* undergone a policy-learning process (Balz, 2019; Surel, 2000)—though it has not been as productive as was possible and necessary. The process has been influenced by exogenous economic shocks (e.g. crises and the integration of the European internal market), but also technological paradigm shifts (e.g. the logistics revolution and the rise of e-commerce platforms). In the words of the head of the national spatial planning agency in 1986: 'Spatial planning must react on big changes: global economy, European economy, unemployment, technological developments in production and distribution, and interaction among people' (RPD, 1986a, p. 5). The process has also been influenced by advocacy coalitions and, to a limited extent, empirical research. Policymakers must decide on emerging issues with limited evidence on account of their novelty. Nevertheless, more use could have been made of available research in at least two ways. First, had the national government explicitly considered critical research regarding the societal advantages and disadvantages of the logistics complex (Kuipers et al., 2018; NEI, 1983; Rli, 2016; Van den Bergh, 2010), it may have adapted its policy narrative and related spatial interventions to mitigate logistics' negative effects. Second, had the national government commissioned more research—including forecasts and monitoring—into the spatial effects of logistics when the issue was first raised in the 1980s, it would have had a more substantial base of knowledge on which to make decisions for decades to come. While advocacy coalitions of both the logistics and landscape-environmental perspectives were heard over the years, the latter group has been notably less significant, less connected to core policy circles and, in turn, less influential. Logistics interest groups have benefited from infrastructure investments, tax cuts and subsidy programs. Landscape and environmental interest groups only gained occasional compensation projects for ecological damage and a program for motorway panoramas—which was soon dismantled.

Throughout the policy-learning process, leading spatial-logistics concepts increased in scale, from mainport to *Logistieke Topsector Regio* (logistics top-sector region), transnational transport corridors and a *Logistieke Delta* (logistics delta)—all obvious examples of framing with language (Balz, 2019, pp. 112–125). At the same time, the actual spatial planning of distribution centres scaled down, since it became more and more a responsibility of local governments. This scale diversion is widely regarded as a pressing planning problem: well-informed capital-intensive conglomerates make land deals with rural municipalities desperately seeking funds, unhampered by effective policy guidance from regional or national governments. Furthermore, the missed opportunities to consider empirical evidence, critical views and more balanced advocacy coalitions have turned the Gateway to Europe narrative into a

rigid spatial planning story—one that has not shifted its main focus from increased trade volume even in light of what today constitute widely accepted policy goals, such as circularity and the avoidance of boxification. Such strong path dependency is likely to cause a spatial-economic lock-in (Sorensen, 2015; Van den Bergh, 2010), in which the rising spatial impacts of logistics are, over time, combined with its declining added value and societal benefits.

3.5 Conclusion

In this paper, we addressed how the logistics complex has been spatially planned since 1980 in the Dutch hinterland. We conducted a systematic review to select and analyze policy documents, policy-advice reports and research documents. We presented information from these documents chronologically, as an influence flowchart, and as causal policy theories pertaining to logistics developments and their spatial impacts.

In line with Hall (1993), we concluded that over the last 40 years, the Gateway to Europe policy narrative has prioritized trade over other societal interests and selectively interpreted Dutch national history to facilitate its desired logistics developments. Contrary to the 'planning as storytelling' approach (Throgmorton, 1996), the narrative has been unable to address the spatial effects of logistics and learn sufficiently from counter-narratives. Optimistic win-win scenarios, policy decentralization and technological silver bullets prevented policymakers from implementing restrictive policies, instead decentralizing tough spatial choices to local governments, which may find it more difficult to resist land-taking attempts by powerful companies. Gateway to Europe has entailed *some* spatial policy learning; to a limited extent, economic shocks, technological milestones, academic research and advocacy coalitions have influenced the evolution of spatial policy concepts and instruments (Balz, 2019; Faludi, 1996; Surel, 2000). Beyond the disproportional prominence of logistics advocacy groups over environmental and landscape advocacy groups, the use of empirical research has been suboptimal in this policy-learning process. Critical reports pertaining to the Gateway to Europe narrative were structurally ignored by policy memoranda, while research into policy alternatives was never even commissioned. The construction of an open narrative—one that includes accurate spatial effects and is based on research and open discourse coalitions—may provide a way out of the present spatial-economic lock-in.

It would be highly interesting to see comparative research into the formation of Gateway to Europe policy narratives in other countries, on various governmental levels. To achieve a detailed understanding of policy-learning processes, we suggest that future researchers employ stakeholder interviews and the detailed mapping of lobby networks.

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TOC

4 Behind the big box

Understanding the planning-development dialectic of large distribution centres in Europe

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ABSTRACT

In Europe, very large distribution centres (XXL DCs) are increasingly appearing on planning agendas due to their growing spatial footprint and environmental impacts. Although the emergence of XXL DCs has gained traction in academic research, empirical knowledge about the process that leads to their oft-debated location choice, geometry and landscape integration is still scarce. This paper aims to improve our understanding of this process, analysing the decisions of key stakeholders in the planning-development dialectic behind four exemplary XXL DC transactions, in the Netherlands. Our analyses shed light on the motivations of public and private actors as well as the (lack of) planning rules that shape these transactions. We find that specific incentives in the Dutch decentralized planning and legal-financial system contribute to logistics sprawl. Existing planning instruments that could steer logistics developments, such as environmental and employment quality regulations, are largely left unused. Our study suggests that multilevel planning competencies and international market standards are important variables in explaining XXL DC outcomes. Unlike often assumed in the literature, internationalization has—next to stimulating the growth of XXL DCs—contributed to more sustainable location choices and landscape integration.

KEYWORDS

distribution centre, logistics, spatial development, governance, spatial planning

4.1 Introduction on the emerging of XXL DCs in Europe

Since the 1980s, distribution centres in the logistics hinterland of main European ports have increased considerably (Flämig & Hesse, 2011). Since 2000, there has also been a trend of developing so-called XXL DCs with floor areas above 40 thousand square meters. This phenomenon and its environmental effects have, until recently, been largely neglected in the policy and academic debates (Hesse, 2020). In the hinterland of Rotterdam, Europe's largest port, the logistics building footprint has quadrupled since 1980. During this period, the average footprint of a single distribution centre (DC) in the exemplary East-Southeast corridor—stretching from Rotterdam to the German border—has tripled.[45] Researchers estimate that not only the growth of the logistics complex, but also the changing location choice for individual DC developments is an important factor in the fragmentation of the logistics complex, a phenomenon described as logistics sprawl (Heitz et al., 2017; Krzysztofik et al., 2019).

The growth and sprawl of the logistics complex—understood as a combination of DCs and transport infrastructure—challenges quality of life in hinterland locations in Europe and North America (Aljohani & Thompson, 2016; P. Witte et al., 2016). Truck movement causes congestion and air pollution, and the footprint and elevation of DCs often eliminate alternative spatial functions while the added value of many DCs to the regional economy is increasingly questioned (Kuipers et al., 2018; OECD, 2014; Rli, 2016). Therefore, there is an increased interest, particularly among European policy advisors and planners, for understanding how to effectively steer logistics developments in order to mitigate their impacts (Danyluk, 2019; Hesse & Rodrigue, 2004). The Dutch Board of Government Advisors and Environmental Assessment Agency, for instance, have called for national regulations to steer logistics developments and avoid a 'waterbed effect' (CRa et al., 2019; Van Dam et al., 2019). The recent Dutch National Spatial Vision has outlined some of such regulations (BZK, 2020) and in response, government agencies and consultants have started to explore what planning tools could help steer XXL logistics developments towards predetermined clusters and stimulate brownfield over greenfield development (Stec Group, 2020).

45 Numbers and mapping from the open access research dataset DOI:10.4121/19361018

TOC

In the backdrop of these planning responses, this paper aims to contribute to academic insights into the forces shaping the remarkable growth of European distribution centres. We perceive these forces are part of a spatial planning-development dialectic (Figure 4.1), revealed in the transactions between government agencies and companies, each with their respective motivations and scope of influence (Healey, 1999; Heurkens et al., 2015). Although logistics firms are often blamed for the poor spatial outcomes and impacts (Frejlachová et al., 2020), we assume that the local planning-development transactions, leading to the spatial outcomes of logistics centres witnessed across Europe, are also shaped by particular institutional arrangements. Hence, instead of merely focusing on the behaviour of particular actors, our approach aims to also understand the rules and resources that shape the transactions between them (North, 1987; Scharpf, 1997; Williamson, 1998)).

Although the problem of logistics sprawl has gained attention in the recent literature, in-depth empirical enquiries into recent DC developments as such remain scarce. We aim to contribute to the latter by exploring one of the busiest logistics corridors in Europe and provide an explanatory framework for XXL DC transactions. Regarding the Dutch logistics planning-development dialectic we ask: what are the key forces behind XXL DC transactions? We define XXL DCs as the tangible outcomes of these transactions in terms of location choice, geometry (shape and size) and landscape integration. In addition, we hypothesize that the DC transactions under study are influenced by 1) *the involved tiers of government planning*; and 2) *the internationalization of the DC developer*. These two forces emerged as key variables in our case study analyses. In the latter part of this paper, we propose to use them as the basis for a DC planning-development typology in the European context.

Below, we first present a framework to explain our conceptualization of the planning-development dialectic behind XXL DCs. This helps us to operationalize our main hypothesis about the two key forces that explain large-scale logistics development outcomes in Europe. In the next section, a literature review sheds light on the existing knowledge regarding spatial outcomes of DC planning and development, and discusses insights about key actor decision making in this field. In the subsequent section, we explain our research method and case study selection. Finally, we present, analyse and discuss the results of our case studies, draw our conclusions, and make recommendations for further research.

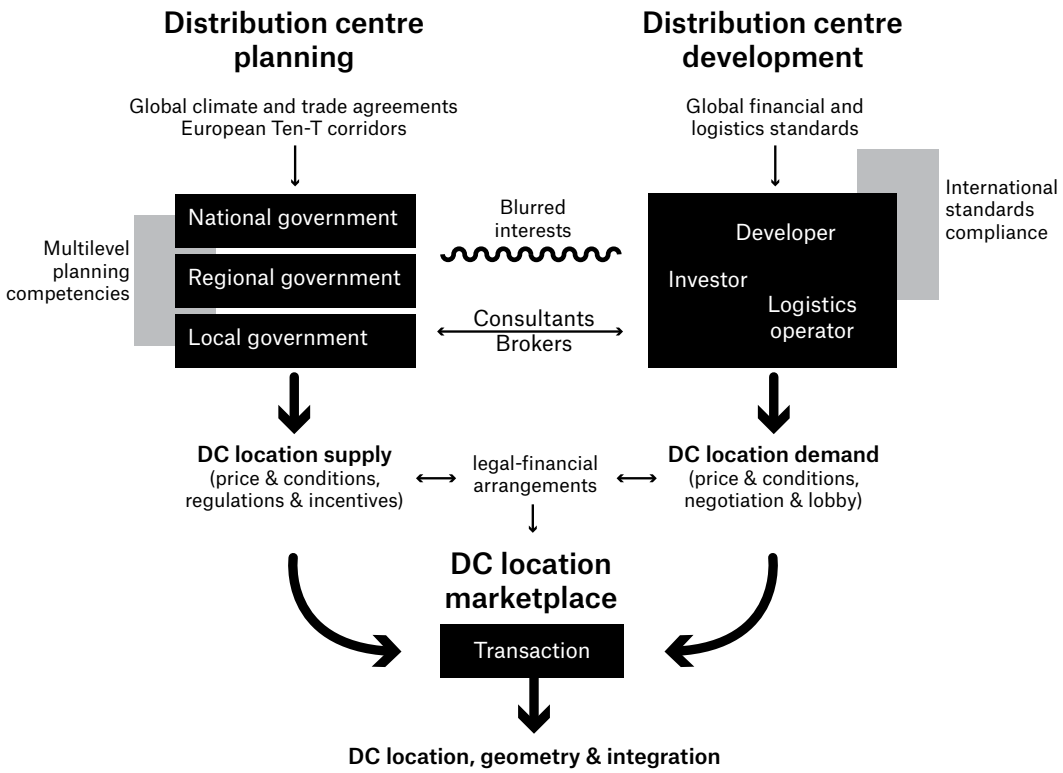

FIG. 4.1 Framework of DC planning-development dialectic

TOC

4.2 A framework for studying DC transactions and outcomes

We propose to view European XXL DCs as the spatial outcome of a transaction between DC development demand generated by logistics markets, and DC location supply generated by planning processes. This equilibrium of planning and development is established in dialectic processes as described by (Healey, 1999). We divide the spatial outcomes in three components: location, geometry and landscape integration. Hitherto, most studies have focused on either logistics sector explanations, focusing on changing supply chains, or on (the lack of) planning requirements in relation to DC location and geometry, ignoring landscape integration. However, the latter is an increasingly important feature of the spatial outcomes observed by citizens and experts (CRa et al., 2019), and therefore of possible policy measures aimed at steering logistics developments.

The XXL DC transaction is conceptualized in Figure 4.1. Adapting the theory of (Edmondson et al., 2018), spatial planning is considered a part of the policy subsystem, influenced by international agreements regarding emissions, trade regulation and infrastructure. The logistics sector is part of the sociotechnical system, influenced by global finance and logistics standards. In this section, we identify the most important actors in these (sub)systems, because these play a key role in our case study approach. DC planning actors focus on making the best spatial conditions and trade-offs for society, while the DC development actors focus on their level of service, added value, and sometimes on the sustainability of their activities.

Government agencies (Figure 4.1, left) typically have a broader scope than private actors since, besides supporting the development process, they also "moderate adverse externalities, safeguard social needs, conserve resources and environmental assets" (Adams et al., 1994). Furthermore, government regulations have helped to sustain industrial land values and decrease market risks. *Local governments* seem to have the most direct role in spatially accommodating DCs. At the same time, some municipalities seem to be insufficiently informed to make these decisions, while competition with other municipalities may create a race to the bottom in terms of land price and quality criteria (Louw et al., 2009; Raimbault, 2021). *Regional organizations*[46] attempt to avoid this by coordination of DC location planning.

46 E.g. in the Netherlands: Oost NL, REWIN, Ontwikkelmaatschappij Midden-Limburg and Midpoint Brabant

TOC

National and regional governments (provinces in the case of the Netherlands) may stimulate DC clusters through directive or restrictive planning decisions and (multimodal) infrastructure investments.

On the logistics sector side (right), the *logistics operator* typically looks for functional site requirements such as connectivity and building restrictions, while a *developer* concentrates on exchange value (Adams et al., 1994). Large companies are increasingly expected to follow corporate social responsibility (CSR) and sustainability principles such as zero-emission logistics, besides their business interests. Institutional (e.g., pension funds) and private equity *investors* develop distribution centres with specialized *developers*, advised by *consultants* and *brokers*. The resulting pricing and other conditions, on both the supply and demand sides of the DC location marketplace, shape the transaction that determines the spatial outcome.

In recent DC developments, however, interests have blurred substantially. The *operator* of a DC may also be the *investor* and *developer*, while *semi-governmental development companies* under private law mix political and entrepreneurial goals (Raimbault, 2021; Raimbault et al., 2016). In this context, local authorities are easily biased towards the economic advantages of jobs and land sales despite the increasing environmental disadvantages, such as congestion and visual impact of DCs (Flämig & Hesse, 2011; Yuan, 2019). Additionally, *corporate lobby and negotiation*[47] constantly influence *regulations and incentives* on various government levels.

The framework focuses on the changes within the timespan of a decade, playing what Williamson (1998, p. 26) calls 'the game of transaction cost economics'. The dialectic suggests an equilibrium, while the principal agent theory (Higgs, 2018) suggests the possibility of a power and information asymmetry between companies and regulatory organizations in the determination of prices and conditions in land development. The case studies shed light on the transactions between the actors mentioned above. However, we first review the existing knowledge on the spatial outcomes and decision-making regarding distribution centres more in depth.

47 Dutch logistics lobby is performed by Transport & Logistiek Nederland (TLN) and Evo-fenedex, joined in the Logistiek Alliantie. The sector is promoted abroad by the Netherlands International Distribution Council.

4.3 Location choice, geometry and landscape integration of XXL DCs

We address the spatial outcomes of logistics developments through the parameters *location* (demand side choices and supply side policies), *geometry* (DC size and shape) and *landscape integration* (quality standards in façade and public space design). In practice, there is an interdependency between these parameters. Location choice, for instance, depends on the availability of large sites to accommodate the increasing geometry of DCs (Bak, 2020; Onstein et al., 2019). Some studies speculate that between comparable sites, companies would prefer those with lower standards of integration to avoid extra investments and maintenance costs, and that local governments use this factor to compete amongst each other in search of blue-collar jobs and land sales (Louw et al., 2009). Logistics real estate is distinct from traditional industrial, office and residential developments, since according to Raimbault (2021), the integration of international real estate developers and fund managers is unique for the logistics sector. Secondly, the sector is more strongly determined by rapidly changing global construction and operating standards than other sectors (Santos, 2006). Thirdly, logistics real estate is more dynamic, featuring typical short-term leases and profits (Hesse, 2004). This means that to gain insight in DC development, existing knowledge on other developments is insufficient and specialized information from DC developers is necessary.

4.3.1 Location: beyond traditional factors

Logistics costs, generally mentioned as the main argument in location choice, still depend highly on traditional location factors such as connectivity through transport networks; availability of land, labour and consumer markets; and local economic factors such as taxation, labour union power, costs of doing business, cost of living and local economic incentives (Woudsma in: P. V. Hall & Hesse, 2012; Heitz et al., 2018; A. T. C. Onstein et al., 2019; Strale, 2020; Verhetsel et al., 2015). Additionally, the spread of DCs along hinterland corridors is pushed by centralization of distribution networks, to serve for example the entire market of North-Western Europe, and high land prices and congestion near the seaport of Rotterdam, while it is pulled by the establishment of logistics hotspots near consumers (Flämig & Hesse, 2011; Heitz et al., 2017; A. T. C. Onstein et al., 2019).

Over the years, authors have indicated that neoclassical location theory, assuming a market of perfect competition, cannot explain European practices of industrial land development (Adams et al., 1994, p. 5; Bertaud, 2018). There exist several restraints to land supply and other influences on location choice besides land price and profit maximization. Two international trends are increasingly pointed out. First, many distributors no longer make the location choice themselves in the emerging fourth-party logistics (4PL) networks, but rather a 'service provider offering the use of several supply chains' (Hines, 2013). This volatility explains the decrease of building ownership by the user, as well as an increase in short term leases[48] (Hesse, 2004). Second, logistics real estate development and investment firms, often integrated into international conglomerates with large portfolios (Flämig & Hesse, 2011; Raimbault, 2021), make location choices primarily based on real estate market arguments—based on expected profits rather than efficient logistics operations.[49]

Additionally, the Dutch *Mainport* strategy, including large hinterland infrastructure and land developments, has stimulated the logistics sector and increased the demand for logistics real estate in hinterland corridors since 1980 (Kuipers et al., 2018; Nefs et al., 2022; Raimbault et al., 2016; Rli, 2016). To guarantee the success of such developments, local governments often provide incentives to attract businesses. Multimodal logistics clusters in The Netherlands are often nationally planned, in the context of European freight corridors (Ten-T) and spatial-economic policies. These are referred to as *outside-in* developments (Raimbault et al., 2016). Other clusters emerge from an existing concentration of growing logistics activities, stimulated by a local or regional government and then acknowledged as hub of national importance, known as *inside-out*. Given this difference, we hypothesize that DC location supply is more strictly planned in outside-in clusters. In both kinds of developments, there is still limited empirical knowledge on the role of the various stakeholders, as well as the legal-financial arrangements and regulations that shape their transactions.

48 Logistics real estate in Dutch provinces Noord-Brabant and Limburg is currently financed for 95% by foreign investors, while 75% of the buildings have a lease shorter than 5 years, and 50% are leased to logistics service providers with frequently changing client portfolios (see Bak, 2021).

49 Developers active in Europe have portfolios including millions of sqm in logistics space and land banks of hundreds of hectares (https://www.prologis.nl/over-ons, https://heylenwarehouses.com, https://www.vgpparks.eu/nl/properties/). Dutch logistics real estate development profits are comparable per sqm to the London office market (see Trappenburg in Financieel Dagblad, 2019).

4.3.2 Geometry: global standards

Between 2010 and 2020, the average footprint of large logistics buildings (>2.500 sqm) in the South-Southeast freight corridor of The Netherlands tripled from ca. 6.000 to 18.000 sqm, due to the rise of XXL DCs (>40.000 sqm). According to Valkanova (in Frejlachová et al., 2020), architects have little influence on the shape, size and functionality of a DC since these aspects are largely determined by lawmakers, international conglomerates and investment funds. The trend of large scale DCs, with footprints that can reach almost 200.000 sqm, is visible across Europe and is explained by three factors. First, the centralization of logistics facilitates the handling and value adding activities of goods in global supply chains (CRa et al., 2019; Hesse, 2004). Such operations often serve multiple markets in North-Western Europe from a single—and thus larger DC (Andreoli et al., 2010). While according to Hesse (2020) DC centralization in several countries peaked in the late 2000s, in The Netherlands this peak seems to occur at the time of writing.[50] Second, the growth of e-commerce shifts demand from retail space to e-fulfilment. Competition between online platforms, as well as mergers, tend to increase the catalogue and service levels, while decreasing price and delivery time (Andreoli et al., 2010; Hesse & Rodrigue, 2004). This calls for economies of scale in DCs, made possible by information technology, automation and larger building geometry. And third, logistics developments, which are increasingly performed by real estate firms rather than the users, opt for large multitenant DCs to decrease construction costs and the risk of vacancy. The demand for sites larger than 10 ha has therefore increased, a size that can rarely be found on brownfield sites (Flämig & Hesse, 2011). We assume the increased scale of XXL DCs occurs in The Netherlands for the same reasons, given the large share of international DC developers and investors, apparently facilitated on greenfield sites by the traditionally strong Dutch spatial planning system.

50 Logistics development in the US has recently shifted to smaller DCs near consumers in (sub)urban sites. This trend has only recently begun in Europe.

4.3.3 Landscape integration: local variation

While geometry of large DCs seems to be highly standardized, the landscape integration—including façade and open space design—has more variation. The geographic and landscape literature rarely mentions the landscape integration of DC projects. (Waldheim & Berger, 2008) see the rise of the logistics landscape as among the most significant transformations in recent years, and divide it in three emergent landscape categories: distribution and delivery, consumption and convenience, and accommodation and disposal. There are, however, spatial policy and design instruments available to guide the spatial outcome of DCs. Common instruments include the American concept of landscape embedded industry (Hough, 1991) and building regulations—more common in Europe—concerning maximum building dimensions, style guidance, bulk envelopes and vegetation screens (Lehnerer, 2009). In the Netherlands specifically, there exist spatial quality plans since the 1990s and so-called Q-teams since the 2000s (Van Assen & Van Campen, 2014), both consisting of expert advice—sometimes legally binding—regarding architecture and landscape impacts of spatial developments. However, these instruments are rarely used in logistics developments.[51]

In several countries, European funds finance logistics developments, such as the European Investment Bank, the European Regional Development Fund and Joint European Support for Sustainable Investment in City Areas (Frejlachová et al., 2020). At the same time, national development programs aim to increase competitiveness and attract foreign direct investment, for example ChechInvest and the Netherlands International Distribution Council. None of these programs include quality criteria, concerning consequences of soil sealing, land-use change, or effects on social inclusion and added value.

In the academic literature and in journalism, multinational companies such as Amazon are often criticized for disruptive practices (Hesse, 2020). This suggests that locally rooted companies might strive for better spatial outcomes than international developers. On the other hand, international investors often demand certificates with strict quality criteria, such as BREEAM (Bulwiengesa, 2020). Critical literature suggests, however, that these standards may also be used to avoid stricter local quality regulation (Easterling, 2014). We hypothesize therefore that the level of internationalization may affect the way stakeholders approach the location choice and integration of their DC, in different ways. Furthermore, similar to location supply, we presume outside-in clusters with multilevel planning to invest more efforts in landscape integration than inside-out clusters.

51 Spatial quality plans explained on https://iplo.nl/thema/ruimtelijke-ontwikkelingen/bijzondere-onderwerpen/beeldkwaliteitsplan/. The only two logistics developments with a Q-team are the ones near the airports of Schiphol and Eindhoven.

From the literature, we conclude that DC planning and development is a distinct emerging sector with strong information and competency asymmetries among actors, in need of additional empirical investigation. DC geometry seems to be generally determined by international standards. In our case study, we want to confirm whether this is also the case in the Netherlands, given its strong planning culture. Location choice and landscape integration seem to be influenced mainly by two factors: the requirements enforced by the relevant planning system(s), and the level of internationalization of the developer. In our case study, we specifically test and discuss the difference between outside-in and inside-out planning of DC clusters, as well as the influence of regionally versus internationally initiated DC developments, regarding the actual spatial outcomes.

4.4 Case study method and areas

Building an understanding of DCs as spatial outcomes of a planning-development dialectic requires a qualitative, in-depth approach. To prepare our case interviews, we compiled a repository of relevant planning documents, including property information, municipal land-use plans, provincial and national strategic plans, landscape and urban masterplans.[52] Ten in-depth semi-structured individual interviews and several conversations (see acknowledgements) were conducted online in 2020 with all types of key actors defined in the framework: spatial planners on various levels, consultants and real estate brokers, as well as development-, distribution- and investment companies. The interviewees are familiar with one or both of the case study areas and the cases in that area. The purpose of the interviews was to identify patterns of stakeholder actions and motivations behind the spatial decisions regarding DCs, constrained or enabled by rules and (un)available resources.

The interviews focused on aspects typical for the interviewee's role, but all addressed the three spatial DC outcomes (location, geometry, landscape integration) in open questions, as well as the influence of involved planning tiers and internationalization of the logistics sector. The interviews were recorded and transcribed with the help of software[53] and manual review. Prior to the interviews, all ten interviewees filled in a digital poll, scoring the influence of ten types of public and private actors in spatial decisions regarding DCs in the Netherlands, in a five-step range from none to dominant influence.[54] The same poll was also filled in by twelve academic experts of spatial planning and development, to validate the scoring by case stakeholders.

The results section below presents the triangulated case findings in three steps. First, we present short descriptions of the planning-development process of the two case study areas, and analyse the influence of planning and internationalization levels in two DC transactions in each of the areas. Next, we present the views of the interviewees regarding the legal-financial arrangements that shape the current DC planning-development practice. And thirdly, we explain how the stakeholders and experts judge the influence of different actors on spatial DC decisions.

52 Repository DOI:10.4121/14717058

53 MS Teams and Amberscript

54 See repository

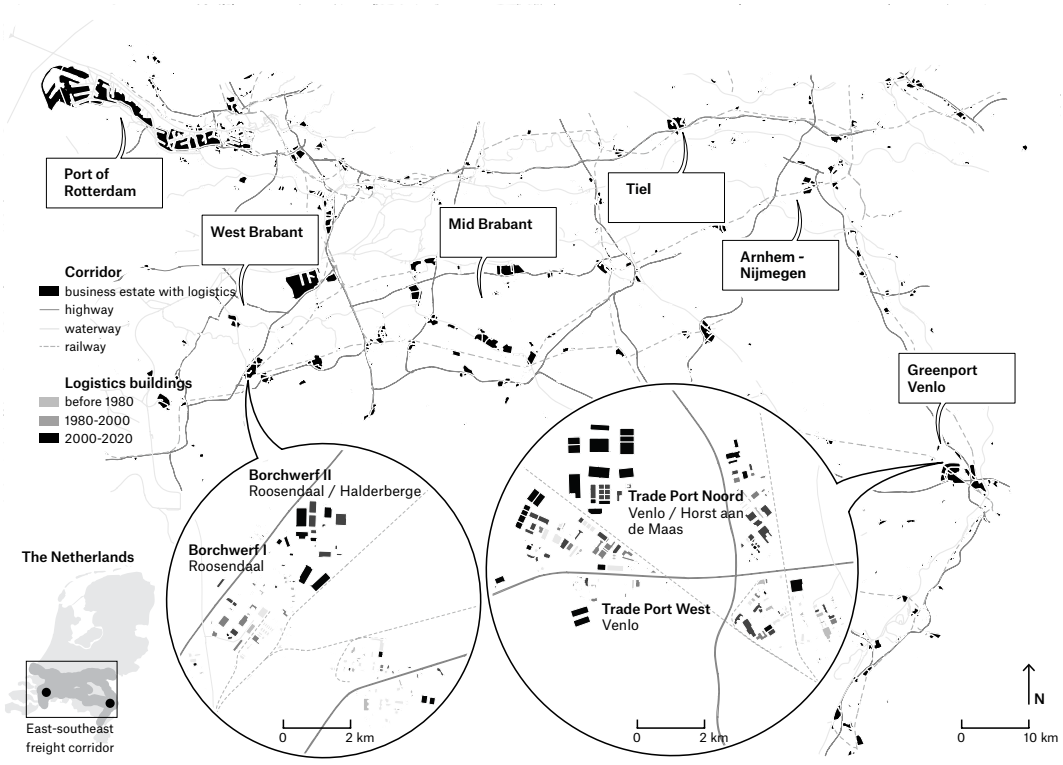

FIG. 4.2 Growth of the logistics complex in the East-Southeast freight corridor. Interactive map at https://mertennefs.eu/landscapes-of-trade/

The case studies concern four XXL DCs in the East-Southeast freight corridor (Figure 4.2), developed since 2015. The selection of the areas was guided by our aim to test the key variables of the hypothesis described above. Two DCs are therefore located in an *outside-in* location: Venlo Trade Port Noord; and two in an *inside-out* location: Borchwerf, Roosendaal. While all four DCs are largely financed internationally and represent a blurring of stakeholder roles, the VidaXL DC complex in Venlo is developed by a locally rooted e-commerce company for its own use, the DSV cluster (Venlo) by an international logistics operator for flexible operations, and both the Primark and VGP park DCs (Roosendaal) by pan-European logistics real estate companies with regional branches. Of the latter two, the first is dedicated to one large international retailer while the second is built for flexible lease.

TOC

4.5 Elements shaping transactions and spatial outcomes

We describe the planning and development process of four case DCs in two areas by focusing on the elements shaping the transactions—land pricing and other incentives, governance structure, land-use plans and regulations, actor competencies and resources—and their spatial outcomes.

4.5.1 Trade Port Noord, Venlo

In national planning documents, Venlo has been defined as an important inland logistics hub from the 1980s onwards, "building on its history as a border town with trade and customs functions", explains an interviewed regional government official. After the year 2000, infrastructure and area developments have sought to strengthen Venlo as an agro-logistics hub, a so-called *Greenport*. In 2007 the development concept started in a multilevel collaboration, according to the project leader of one of the local governments involved: "our work group also included regional and national government, as well as the private sector." In 2020, construction of a third rail terminal started in Venlo, initially planned as extended gate of the port of Rotterdam, which soon turned out to be rather an important e-commerce link to China via Central Asia.

Trade Port Noord (Figure 4.3) is part of Greenport Venlo, for which the 2009 masterplan foresees an area development of 5.400 ha, combining agro-business estates with 600 ha nature development. In the area, the 2012 Floriade was organized, an international horticulture and landscape event. The Greenport Venlo Development Company, a merger of local land development vehicles with Limburg Province and three municipalities as exclusive shareholders, has since been in charge of land sales. Land price discounts incentivised initial DC developments. At the former Floriade site, the development of the Brightlands agro-innovation campus aims to retain talent in the region and stimulate the agro-food sector, "by bringing knowledge institutions, governments and entrepreneurs together in the field of healthy food and safe nutrition".[55]

55 https://www.maastrichtuniversity.nl/research/food-claims-centre-venlo

TOC

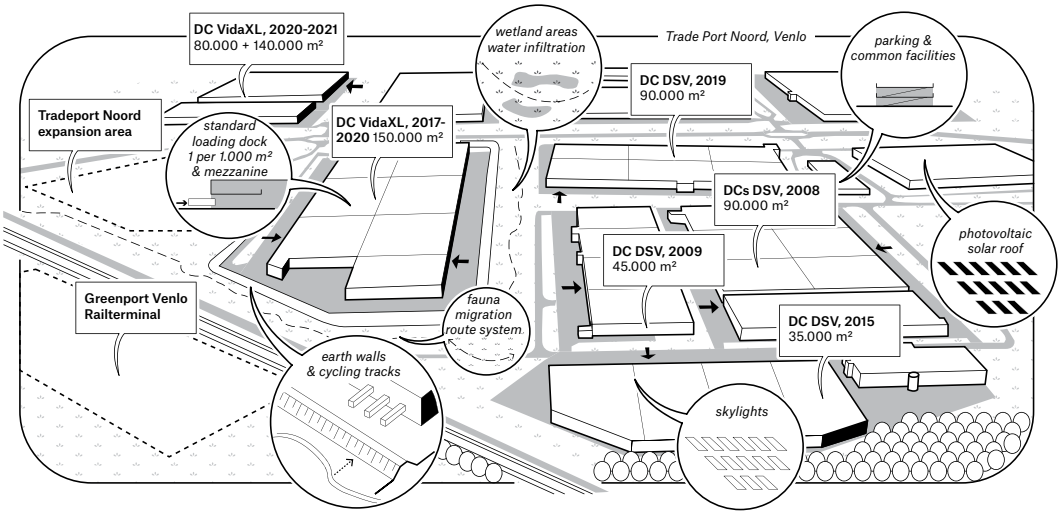

FIG. 4.3 Trade Port Noord, Venlo

Several of the high spatial ambitions regarding landscape integration as well as nature development were realized successfully in Venlo. They are described in the regional and co-municipal visions, masterplan and landscape plan (BRO, 2010; Greenport Venlo & Studio Marco Vermeulen, 2009; Heusschen Copier, 2010; Limburg, 2014; Venlo, 2012). Other ambitions, such as attracting agro-food production companies and setting up a Cradle-to-Cradle business cooperation, have not (yet) been met. See the masterplan, landscape plan and the national Greenports implementation (Rijksoverheid, 2010).[56] The last phase of nature development (200 ha) was cancelled after the withdrawal of national funding in 2011. The most successful sector occupying Trade Port Noord has been the European distribution of consumer goods, medical supplies and, above all, fashion. The local government project leader: "We agreed on mixing logistics with agro-food and manufacturing. Big fashion companies are not part of the regional DNA." The commercial director remains optimistic: "Due to the recent DC real estate boom and the proven success of the location, the Greenport Venlo Development Company can select companies with socioeconomic relevance for the region. […] Developers of new DCs are required to show lease contracts of at least 5 years for at least half of the floor area in the masterplan, to avoid speculative developments and vacancy."

56 In 2021, a large agro-logistics company was landed in Trade Port Noord. Similar to the fashion DCs, the agro-logistic company's arrival was criticized in local politics for the dependence on migrant workers.

TOC

Trade Port Noord's spatial outcomes include XXL DCs, accessible through road loops linked directly to a regional highway to avoid mixing with local traffic. The area in between DCs is large enough to include earth walls that block the view of the loading docks from outside the area, a design approach to integrate the complex in the landscape. According to the masterplan, the infrastructure zones include ample space for rainwater containment and shared business facilities, such as a canteen and recycling facilities. Until now, only shared parking facilities have been realized, the commercial director explains, since "buildings started to scale up to such an extent that each needs its own facilities." Ecological corridors and recreational cycling infrastructure have been realized as part of the plan. To accommodate the increasing scale of DCs, Trade Port Noord's original lots have been joined into larger units, while the initial zoning plan, in contrast, was broken up into smaller legal units to increase the flexibility of future developments.

In the area, Dutch company Vida XL operates three e-fulfilment DCs for furniture and home accessories, while a fourth development started in 2021, increasing the company's building footprint here to 370.000 sqm. Danish-founded logistics multinational DSV operates four multitenant DCs here[57], from which the company provides logistics services to various producers and traders. Their DC footprint in Trade Port Noord measures 260.000 sqm, whereas DSV's portfolio in the Netherlands amounts to about 800.000 sqm in 2020.

4.5.2 Borchwerf, Roosendaal

Borchwerf is a mixed industrial area at the northern fringe of Roosendaal, planned since the 1980s (Figure 4.4). Some parts are recently being redeveloped. Its recent extension, Borchwerf II, became a logistics hotspot during the development process. This happened, according to the interviewees, mainly by coincidence, since a nearby multimodal location, Logistics Park Moerdijk, was put on hold due to legal issues concerning the European nitrogen emission ceiling. "Logistics developers, who had become interested in the area right in between Europe's largest ports, Rotterdam and Antwerp, decided to build in nearby Roosendaal. […] Like Trade Port Noord, Borchwerf II has a freight rail connection, paid by the national government. There is, however, no project for a rail terminal, since there is already one in Moerdijk", explains a local economic policy advisor.

57 DSV is present in Venlo since around 1900, in the form of transport company Frans Maas, acquired by DSV in 2006.

TOC

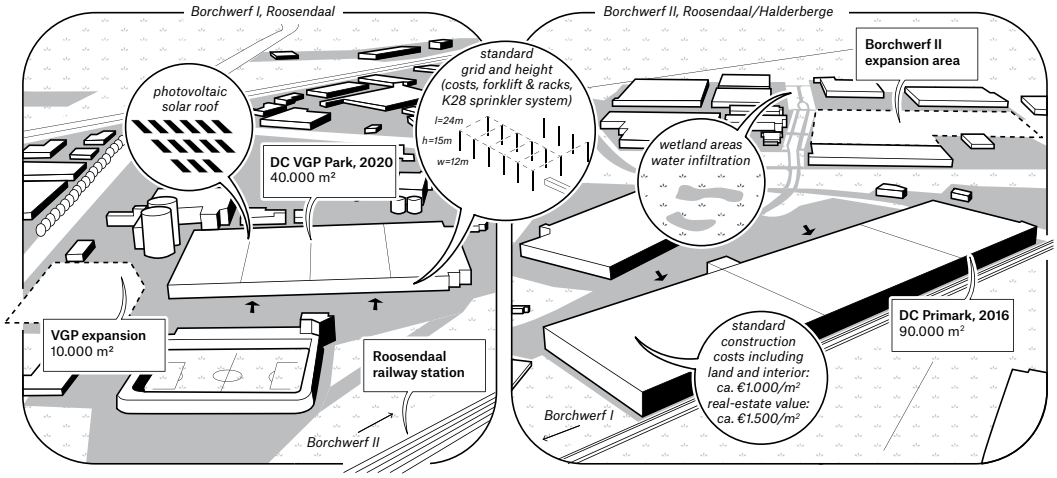

FIG. 4.4 Borchwerf, Roosendaal

The lots in the business estate are sold directly by a joint venture sales office of the municipalities Roosendaal and Halderberge. Also in Roosendaal, incentives have helped to attract the early businesses in the area, but these were non-monetary. Instead, local labour and education programs facilitated the DCs, which would be needing thousands of employees. Borchwerf II has become a recognized cluster for e-commerce and other DCs targeting the Benelux, including food, consumer goods and fashion companies.

As in Venlo, the DCs in Roosendaal have in-between infrastructure zones, integrating a water buffer facility (wetlands) and a recreational cycling network. Buildings are slightly smaller and no earth walls are built here, because of limited space. The land-use and spatial quality plans demonstrate moderate spatial ambitions regarding architecture, and some ecological performance (Dhondt, 2013; Halderberge, 2017; Roosendaal, 2012; Roosendaal & Halderberge, 2013). Both municipalities have realized temporary housing facilities for migrant workers near the DCs.

TOC

In the southern edge of Borchwerf II, Irish fast-fashion retailer Primark realized a 90.000 sqm e-fulfilment DC.[58] There has been expert and public criticism[59] on the extensively visible façade along the railway, as well as the façade pattern, which changed from horizontal to vertical in the second construction phase. On a brownfield site near the railway station of Roosendaal, pan-European developer VGP Group has developed a multitenant DC of 41.000 sqm, leased to small e-fulfilment operators such as Active Ant. An additional 9.000 sqm building across the street is planned to be built for a specific operation.

TABLE 4.1 Case comparison

	Venlo Trade Port		Roosendaal Borchwerf	
	VidaXL	**DSV**	**Primark**	**VGP Park**
Spatial outcome location choice, geometry, landscape integration	*Location choice* based on large available plots near international terminals and infrastructure. *Geometry* follows international standards, facilitated by increased lots. *Landscape integration* follows Trade Port directives (earth walls surrounding lots, public green structure and water buffering zones).	Expansion of existing company at *location*, based on increased customer demand. Greenport reputation was important factor, no use of rail/barge. *Geometry* follows international standards. *Landscape integration* follows Trade Port directives and Danish architectural façade design of DSV.	*Location* near Belgian border, serving both countries under favourable Dutch labour law. Rail link not used. *Geometry* follows international standards. No *landscape integration*, except for (publicly criticized) horizontal/vertical façade pattern.	*Location choice* based on Logistics Hotspot 2017 status, proximity to station and highway Rotterdam-Antwerp, as well as potential workforce in West-Brabant region. *Geometry* follows international standards, but limited by available land. *Landscape integration* follows company standards, based on BREEAM, of durable concrete façade panels behind tree line.
Planning tiers local, regional, national	Strategic investments by national government in infrastructure and ecology, paired with infrastructure and area planning by regional and local governments.		Business estate planned only by local government. Switch to logistics due to delayed development close by.	
International-ization development, standards, financing	Development by e-commerce company VidaXL itself, supported by local consultants. Financed by German investment bank Deka Immobilien as sale-lease back and forward purchase.	Development by logistics service provider DSV itself, following company's international standards. Financed by international investors as sale-lease back.	Developed and managed by Logistics Capital Partners, including land negotiation, permits and tender. Financed by German investor Dietz AG. DSV performs Ireland-based Primark's logistics operations.	Speculative development coordinated from nearby VGP Benelux (Antwerp). Local engineers and contractors involved in construction. VGP founded an electricity company to exploit PV roofs on its DCs.

58 https://www.logisticscapitalpartners.com/Case-studies/Primark.htm

59 In our interviews as well as newspapers: https://www.ad.nl/binnenland/hoe-ze-roosendaal-tegenwoordig-noemen-dozendaal~a7f73b05/

TOC

4.5.3 Legal-financial arrangements influencing DC transactions

Interviewees explain that specific legal-financial arrangements observed in the cases—some aggravated by the governance structure in place, as well as the (lack of) regulations and actor competencies—tend to incentivise undesirable spatial outcomes such as logistics sprawl. Frequently mentioned are *'quick flips'*, in which developers and municipalities make land deals based on short-term lease contracts (ca. 3 years). According to a critical developer, "shortly after such a deal, property is sold to an investor, leaving the area with an uncertain future". Short term profit-oriented companies with large financial resources tend to make deals with municipalities suffering from budget shortages, both hoping to take advantage of the high demand for logistics development sites in the region. According to a logistics real estate advisor "this can cause a speculative bubble and vacancy." An investor regards it as "the main explanation for the boxification of the landscape".

Semi-public development companies are also common. These provide more knowledge and better negotiation power than a municipality. At the same time, they are more distant from public scrutiny and democratic decision making[60], which increases the risk of watering down of social goals. For instance, in case of a lack of demand by the targeted manufacturing or agro-industrial companies, development companies approve developments that do not match the original high standards. According to a real estate advisor, "local governments should collaborate more in *land banks*, instead of competing amongst each other."

The aforementioned *sale-and-lease-back* allows construction and financing of a large DC, quickly shifting the real estate from the company's balance sheet and liquidating the considerable profits[61], which can be invested in the supply chain or paid to shareholders. German investor Deka Immobilien explains that this usually includes *forward purchase and funding*: "In a matter of weeks, on paper, the DC is funded, bought and leased by Deka, before a developer such as Vida XL starts construction (6 months), followed by interior works (racking and conveyors, 4 months). This arrangement is used by Deka in 35 countries, with almost identical contracts." While the investor calculates with a building lifespan of 30-40 years and renovation after 15-20 years, the developing logistics operator typically leases for a period of 10 years. Certain conditions attract logistics operators to the Netherlands,

60 The Greenport Venlo Development Company, although owned 100% by local governments, is not subject to the Public Administration Transparency Act (WOB).

61 In 2020, a typical DC of 100.000 sqm in the Netherlands has a land and construction cost of around 100 million, and a real estate value of 150 million on the balance sheet.

close to the Belgian and German borders, such as Value Added Tax and night-shift labour legislation.[62] Furthermore, low interest rates have stimulated large logistics real estate investments, which can be leveraged with foreign capital and give a low-risk return. Deka reports a growing importance of logistics real estate since the Covid-19 pandemic, from 10% to 50% of their investment pipeline, while the investor has stopped considering projects smaller than 70.000 sqm.

Speculative developments, as opposed to *built-to-suit* developments, are often seen as an important factor in vacancy and logistics sprawl. “Developers take building lots hostage—out of the market—by making promises to the local government in exchange for land options, without actually constructing,” the spatial-economic advisor explains. An interviewed speculative developer, however, claims the opposite: that “speculative DCs are more flexible than custom-built ones, optimized for a broad range of tenants in the DC market on the long run.” Another expert claims that “while this is true, the flexible leases often attract companies that do not necessarily fit in the economic DNA of the region, and lead to shorter contracts and more migrant labour.”

Land price and scarcity are seen as key factors in location choice. Governments do not take sufficient advantage of these, to promote brownfield developments for instance.[63] Stacked logistics developments, similarly, have not taken off in the Netherlands, due to the low land prices. An NIDC representative: “land scarcity is raising prices already, and government policies can further steer locations and innovative developments.” Deka recently financed its first stacked logistics project in the Netherlands.

62 Dutch VAT legislation allows for an attractive delay for re-export and e-commerce: tax is not due until goods are exported from the warehouse. In contrast with Belgium, Dutch DCs can operate 24/7.

63 Recently, large logistics developments on brownfield sites have also been criticized, for competing over industrial land with small local companies.

4.5.4 Actor influence on DC transactions

In the context of the cases, especially the interviewees of the logistics and real estate sectors surprisingly share the concerns regarding rapid logistics sprawl and the *boxification* of the Dutch landscape. Although their expressed estimation in the survey indicates a great fragmentation in influence (Figure 4.5), the graph also demonstrates two clusters of relatively influential actors: the local and regional governments, and the combination of developers, investors and logistics operators. Municipalities are considered influential through land-use plans (Woudsma in: P. V. Hall & Hesse, 2012), while they rarely acknowledge that power themselves. Planners, architects, citizens, as well as national and EU governments are considered of little influence.

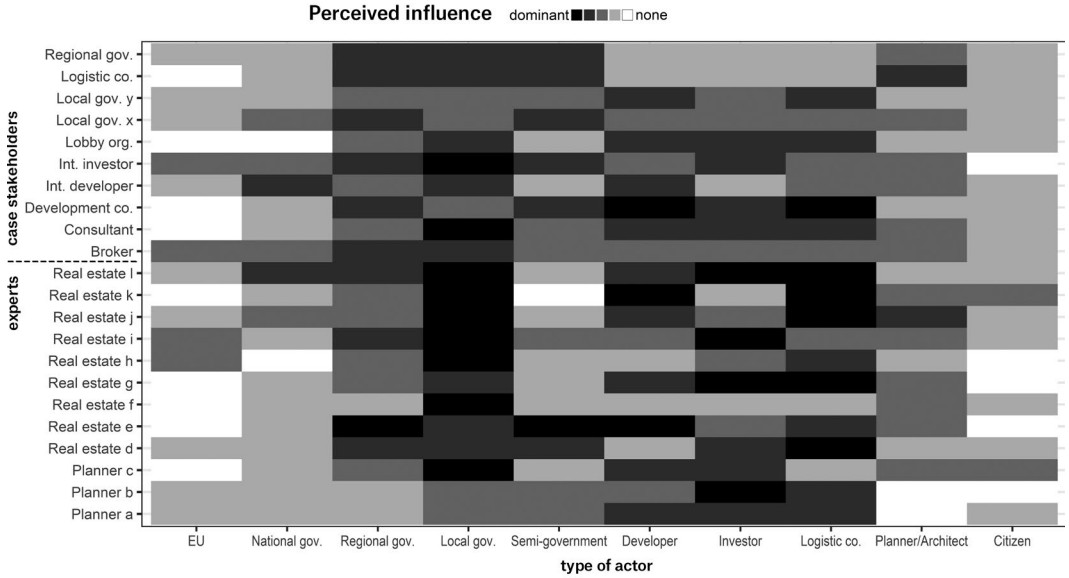

FIG. 4.5 Perceived actor influence on spatial decisions regarding DCs, estimated by the interviewed stakeholders and experts

TOC

Besides pointing at each other—municipalities versus developers for instance, stakeholders point at specific subsets of other actors during the interviews, such as *private equity investors* who aim for short-term profits. These might be less interested in the sustainability of the development than institutional investors. *Small municipalities* (<100.000 inhabitants) are often mentioned too, because they are often not as experienced and informed as big cities. In the words of many interviewees, such municipalities "don't know what they're doing and can be taken advantage of by developers." In practice, there are many shared responsibilities. Location choice for example, according to most logistics developers and investors, is determined mainly by the choice of the client, e.g., a producer or trader. Corporate players, in turn, are regarded more powerful than local planners and might be making choices from foreign headquarters. Investors and consultants, however, do influence the location choice of their client, when they think it is too risky or not profitable enough.

The interviewees suggest a high level of corporate pan-European standardization, and in contrast a large diversity in government behaviour, including spatial and fiscal legislation, as well as facilitating government bodies who wish to attract logistics companies. Many stakeholders note that the DC planning focus in the Netherlands, compared to other European countries, is rather narrow—emphasizing visual impact, while it should emphasize social-economic effects and sustainability as well, including circularity, energy transition and modal shift.

4.6 Discussion

The presented Dutch case studies confirm that land pricing and incentives, governance structure, land-use plans and regulations, international standards, actor competencies and resources, are all relevant in explaining the spatial outcomes of European XXL DC transactions. While these variables are also found in other studies, our results suggest that two forces are particularly dominant: multilevel planning and internationalization.

4.6.1 Multilevel DC planning competencies

We found evidence in the cases that planning competencies—especially experience and knowledge about logistics developments—can deliver higher degrees of control over location choice (clustering near multimodal hubs for instance) and landscape integration (e.g. embedding ecological and recreational developments). In larger logistics-savvy cities such as Venlo, these competencies are stronger, and sometimes combined with planning efforts between the local, regional and national scales. The analysed planning documents regarding Venlo Trade Port Noord show the elaboration of spatial regulations and structures, based on expert views, (design) research and collaboration among the local, regional and national governments. Strict local planning, as in Roosendaal, entails less control and less use of specialized information, as is shown in the documentation regarding Borchwerf II and affirmed by both the private and public stakeholders during the interviews. In other more rural municipalities, non-institutional investors seem to cause fragmented DC developments associated with logistics sprawl. Since the 1970s, there has been a large information disparity between large logistics corporations and small municipalities (LeCavallier, 2016). While governments use spatial-economic consultants and often publish the reports online, logistics firms are advised by specialized fiscal experts and real estate advisors/brokers. This increases the competency asymmetries between actors in the DC transaction.

According to Stec Group (2020, pp. 52–53) multilevel policy instruments could make a difference in location choice and landscape integration, if these were better used. Indeed, the Dutch instruments found in our study are quite similar to those used in most European municipalities and the US: “conditional land-use provisions on landscaping and sound proofing, minimum job density, infrastructure and traffic impact fees, property tax, truck exclusion/concentration zones, and land use buffers

TOC

between logistics and housing." (Yuan, 2019, p. 534) Additionally, a brownfield redevelopment fund, filled by charges from greenfield developments, may be a good instrument too, as well as the emerging cross-regional coordination of the East-Southeast corridor (Panteia et al., 2019). The latter, however, we did not observe in our cases.

4.6.2 International DC developers: standards and blurring

Our cases show surprising evidence about the role of local rootedness—or by contrast the internationalization—of companies plays in the spatial outcome of DC developments. It turns out that multinationals do care about sustainable location choice (established multimodal logistics clusters) and landscape integration. Not only do they work with local representatives in the Netherlands, familiar with the regional landscape and socio-economic context. They also have various quality control and risk-avoiding mechanisms in place to safeguard their investments in DCs in the long run.[64] Such developers invest in flexible building layouts, durable materials and higher than required energy standards, to keep buildings profitable for a period of 30-40 years. Both in Venlo and Roosendaal, there are examples of logistics or parcel operators that invest heavily in automated equipment, written off in about 15 years. By contrast, it appears that especially local and private equity investors, focused on short-term profits, have developed DCs outside of established clusters, with lower construction and integration standards.

Our interview results confirm a strong internationalization in DC development practices, standards and geometry related to the more general internationalization of supply chains. Local land-use plans have adapted to the growing scale of DCs. Integration of the DC in its surroundings often follows from international standards as well, unless a local or regional plan imposes additional requirements, such as Venlo's Trade Port Noord. It seems therefore, that the concern of (Easterling, 2014, p. 200) about "international standards being used to undermine national environmental laws" does not apply to Dutch DCs—sustainability standards of BREEAM NL are higher than its international peer. Some multinationals, such as Amazon, are held responsible for the decline of local businesses and reasonable

64 Especially closed-end fund investors (not registered at the stock market) have a strong influence on DC location choice. They prefer larger clusters in the East-Southeast corridor of the Netherlands, within reach of 150 million consumers in a 500 km radius.

working conditions (Hesse, 2020) and are therefore, according to an interviewed investor, “explicitly not welcome in certain municipalities in Germany.” We did not find a similar restrictive practice in the Netherlands. Our study shows that, although government-owned land development companies have distanced logistics land transactions from public scrutiny, they enhance the competencies necessary to deal with (multinational) companies and uphold public values.

Finally, we find that logistics companies—regionally or internationally originated—that have strong regional ties depend on the economic vitality of the region as a whole and a positive public image for their ‘license to operate’. This matches a recent conclusion by Raimbault (2021) that international DC developers depend on local coalitions to dominate the market. For example, Greenport Venlo and international parcel operator DPD have invested in landscape and cultural heritage as part of their CSR policies. The damaged sector image is a risk for long-term logistics investors and operators, who would therefore welcome stricter regulation of logistics greenfield developments and incentives for brownfield development[65], effectively creating a level playing field across the Dutch East-Southeast corridor.

65 Sometimes as their personal opinion rather than an official company statement.

4.7 Conclusion

In this paper, we assumed that very large distribution centres (XXL DCs) in Europe are the spatial outcomes of a specific planning-development dialectic (Figure 4.1). In this view, the location choice, geometry, and landscape integration of XXL DCs are a combined result of transactions between localized planning and development efforts, which in turn are shaped by a variety of rules and available resources. Four Dutch DCs, with differing planning-development interactions confirm that, next to land pricing and other common incentives, multilevel planning competencies and international DC development standards strongly explain the Dutch DC transactions and outcomes studied. While internationalization of the sector has been an important driver of XXL DC growth, it appears that austerity and a lack of knowledge among local governments, best explain the logistics sprawl witnessed in Europe outside of established clusters.

Our framework goes beyond a neoclassical land price mechanism to include other transaction costs, particularly those associated with multilevel planning competencies and international development standards. An interviewed investor illustrated the relevance of such costs very clearly: “From an accessibility point of view, we would like to invest in DCs in Rotterdam. The maximum land-lease of 25 years typically offered by the Rotterdam Port Authority, however, does not match our investment horizon, in which we write a building off in 40 years. So, we take our demand to other locations.”

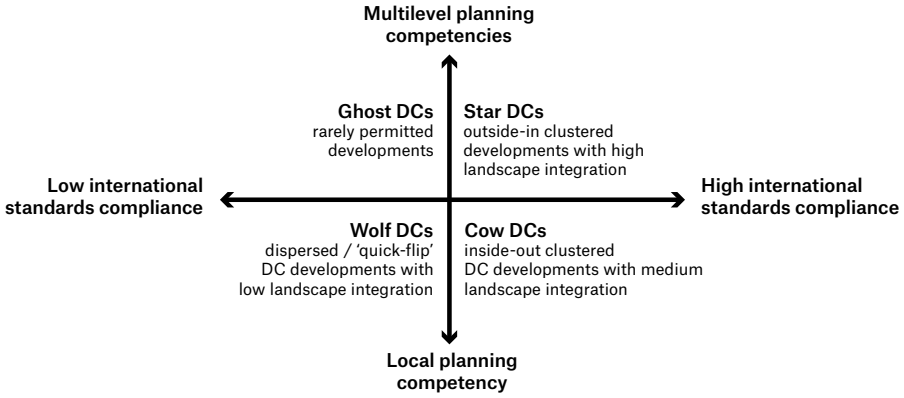

FIG. 4.6 European DC planning-development typology

TOC

Venlo used land price incentives to attract logistics companies, while Roosendaal offered favourable labour programs. Both municipalities eased their selection criteria for targeted company types (agrofood and manufacturing) to keep land sales going during periods of slow growth. Such incentives are still largely a local affair and the politics behind them remain somewhat of a black box. If governments decide to regulate spatial DC outcomes, our study suggests that a distinction is needed between companies that depend on a specific location and those that are relatively footloose. While the first can be stimulated by local incentives for better performance, the latter may be persuaded to settle in high-performance locations elsewhere through higher industry standards and/or government policies. The theoretical typology resulting from these variables in Figure 4.6 demonstrates why especially the large multinational firms—in combination with large multilevel government programs—can lead to better clustering and integration of DCs in the landscape. Less competent public entities, in contrast, sometimes face short-term private equity interests and property developers who produce 'quick flips' in suboptimal locations. Multilevel logistics planning, which is an unusual practice in the US, has improved the balance between regional flows and local impacts in Los Angeles (De Lara in P. V. Hall & Hesse, 2012). Our research shows that the same seems to be true for the European context.

The DC planning-development dialectic offers several pathways of further research, for example into how certain price conditions stimulate innovative sustainable DC practices—multifunctional, stacked, or DCs with climate adaptive landscapes. Developing empirical and normative DC assessment methods, e.g. to promote more sustainable spatial DC outcomes, also seems relevant and promising. Besides the two rational components of planning competence and internationalization, however, there is clearly a softer, more irrational component at work in the development and planning process of DCs that consists as much of rhetoric, persuasion and framing as of hard financial-economic assessment (Healey, 1999; Nefs et al., 2022). Both rationalities and the irrational component should be part of further research.

For planning practitioners, the two variables that stood out in our analysis offer good starting points for effective policies aiming to influence transactions and hereby improve spatial DC outcomes. Existing local planning instruments and guidelines, if combined with regional and national coordination—perhaps with incentives such as a brownfield redevelopment fund—seem promising spatial steering tools. Also, in the high-profit margins of DC development, there seems to be enough room to improve landscape integration, given a level playing field across regions. Market demand could be enhanced by promoting higher (international) standards in logistics investment funds and the sharing of best practices, for example for creating high-density and landscape integrated DCs.

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5 The limited regional employment benefits of XXL-logistics centres in the Netherlands

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ABSTRACT

In the Netherlands, a shift occurred over the last two decades from positively framed spatial-economic policies promoting the development of extra-large distribution centres (DCs) and their claimed positive employment benefits towards a critical stance questioning the benefits of such policies, fuelled by the connected debate regarding the extensive land use and environmental impacts of DCs. In this paper, we unravel the assumed regional employment benefits of DCs into (i) direct employment benefits within the DCs, (ii) indirect employment benefits in the supply chain, and (iii) employment benefits from structural changes in regional production systems around DCs. We analyse these benefits using detailed business microdata and logistics-building data over a 20-year timeframe in the East-Southeast freight corridor (from Rotterdam to Germany). In the corridor, logistics footprint has doubled, and average DC size has tripled in this timeframe. We demonstrate that, although part of the hypothesised benefits can be spatially identified, employment benefits of new DCs decrease over time, due in part to automation and use of migrant labour. The expected co-agglomeration of manufacturing near DCs does not occur structurally, and although DC-favouring regions have successfully established competitive

logistics business ecosystems, they can be vulnerable to a spatial-economic lock-in, relying primarily on the logistics sector. The spatial-economic policy narratives framing DCs as employment catalysts are thus of limited validity.

KEYWORDS logistics employment; XXL distribution center; hinterland region; spatial policy; employment; corridor

5.1 Introduction

Globally, extra-large distribution centres (XXL DCs) have grown at an unprecedented rate to accommodate the growing e-commerce sector and to support multinationals in buffering their inventories (Heitz et al., 2017; Lafrogne-Joussier et al., 2022; A. T. C. Onstein et al., 2019; P. A. Witte, 2014). The potential of logistics clusters—and logistics services within broader clusters—as drivers of employment and economic growth has been suggested by various researchers (Hesse, 2020; Palazuelos, 2005; Rivera et al., 2014; Sheffi, 2012). The assumed importance of DCs in providing direct and indirect employment, productivity gains due to innovative *smart-logistics*, services for citizens and companies, and broad contributions to regional prosperity are typically the main arguments (Danyluk, 2019; Hesse, 2020, p.8). Long-standing trade hub regions such as Rotterdam and Chicago have constructed narratives around their position as a vital gateway (Cronon, 1991; Nefs et al., 2022). Regions in the hinterland of such hubs often tap into the possibilities of logistics, being the "conveyor belt of the globalized world" that has gained great power to organise regions (Hesse, 2020, p. 7). Logistics is seen as "the flattener" in the playing field of suppliers (Sheffi, 2012, p. 267, 2013) that makes it possible for any connected region to attract businesses in the same fashion as metropolitan centres. Similarly, Stimson et al. (2006, pp. 8- 9, 214) claim that the presence of large-scale logistics is a pre-condition for a regional competitive environment. Nearly three decades ago, Castells (1996) considered logistics and other network systems as vital conditions in the *network society* to concentrate services, production, capital, and power.

More recently, there are concerns about the added value of DCs. Since the late 1990s, regional economic policy goals have gradually shifted from generating employment in absolute numbers to simultaneously increasing the wages and living conditions within a region (Stimson et al., 2006, p.3). It is argued that flexible, precarious jobs in e-commerce DCs are linked with undesirable working conditions and decreasing income (WRR, 2020; Yuan, 2019, p. 535). In the Netherlands, this discussion

includes critiques that DC-favouring policies lack proof of local added value and sustainability, instead resulting in extensive land use, congestion, and *landscape boxification* (CRa et al., 2019; Rli, 2016). Several Dutch regions nonetheless attempt to stimulate, attract, and facilitate logistics cluster development, through regional and local policies or as part of national strategies, such as the Dutch *Topsector* policy (identifying and providing stimulus for the industries in the Netherlands with the highest added value, including logistics) and a *Freight Corridor* strategy (EZK, 2019; IenM, 2017; I&W, 2019; Panteia et al., 2019; Raspe, 2012). Since the economic crisis of the 1980s, characterised by large unemployment particularly in the Netherlands, job creation has been a key motivator to stimulate and facilitate spatial policies that favour logistics developments in the Netherlands (Nefs et al., 2022; VROM, 1988).

Currently, a public-private narrative is under development, which concentrates on so-called *smart logistics*, or the integration of logistics and reshoring of manufacturing (Dhyne et al., 2022); in the Netherlands, these are branded with names like Make it in Tilburg[66] and Makes & Moves. The indirect employment reasoning for the development of DCs is often based on successful case-study evidence, such as the value-added logistics activities of the automobile DC in the Port of Rotterdam (Sheffi, 2012, p. 142). Similarly, the reasoning of poor labour conditions is based on fragmented and exemplary information (Bergeijk, 2019). Overall, it remains unclear how spatial employment effects of large DCs have structurally developed across regions in the Netherlands beyond the limited number of harmful or beneficial practices reported in the literature and media. Specifically, more clarity is needed regarding the different employment effects of spatial policies promoting XXL logistics developments to inform current policy approaches between the polarised extremes from full stimulation to a construction ban.

Much of the recent growth in the number and size of DCs worldwide has occurred in hinterland regions (Hesse, 2004; Raimbault, 2021; Yuan, 2019), some of which have actively stimulated logistics developments through spatial-economic policies. It can be argued that these regions distinctly changed their spatial employment structure (toward distribution-related activities) compared to similar regions that did not adopt such policies. The contribution of this study is to analyse this argument by investigating three employment effects: (i) direct employment growth in DCs; (ii) indirect effects in manufacturing and supplying sectors; and (iii) agglomeration effects concerning the regional business ecosystem with an enlarged and more dedicated regional production system.

66 Midpoint Brabant https://midpointbrabant.nl/smartlogistics/ and Dinalog https://www.dinalog.nl/

Although these effects have been discussed in existing literature on aggregate level—for instance, estimating the employment share of logistics at around 5% of total employment and the regional (employment) density of warehousing—a systematic quantification at the individual firm level is largely absent, arguably due to limited availability of detailed data (Cidell, 2010; Coe & Hess, 2013; Yuan, 2021). In our case, we have the rare opportunity to combine microdata on the firm and building level, concerning logistics real estate developments and employment numbers in the entire country over a long period.

The main question addressed in this paper is as follows: *How have employment patterns in regions with spatial policies favouring logistics developments evolved compared to nearby and similar regions without these policies?* We address this question by analysing the Dutch East-Southeast freight corridor, which is the main transportation axis between the port of Rotterdam and Germany, in the period between 2000 and 2020. We use establishment microdata of employment numbers as well as data on the development of individual logistics buildings. Our establishment level microdata do not contain information on the quality or skill-level of employment. A complementary literature, largely from California, points to increasing automation and low-skill migrant labour in DCs, as well as declining working conditions and employment benefits in DCs (Bakker et al., 2019; De Lara, 2013; Emmons Allison et al., 2018; Gutelius, 2015; Husing, 2004; Yuan, 2019).

In Section 5.2, we formulate our hypothesis by reviewing the literature on the employment effects of logistics cluster developments and spatial policies favouring specific sector clusters such as logistics. Section 5.3 presents our three-fold methodology to unravel three complementary employment effects over time and introduces the datasets. Subsequently, we analyse the case of the East-Southeast corridor in the Netherlands, focusing on policy approaches regarding DC developments. In Section 5.4, we interpret the study results. In Section 5.5 we propose a framework for the evaluation of employment impacts of spatial policies favouring clusters of a particular industry such as logistics. Finally, in Section 5.6 we conclude on policy implications and opportunities for further research.

5.2 Spatial policies aimed at employment effects: a review applied to logistics

Job creation through sector-specific spatial policies as a form of place-based policy (Barca, 2009; Neumark & Simpson, 2015) has been adopted in many regions across the globe, based on the belief that beneficial spatial conditions will attract firms and thus create employment opportunities (Kline & Moretti, 2013). Conversely, these conditions may attract skilled talent and thereby knowledge-intensive firms (Florida, 2000). While intuitive to practitioners, the causal mechanism underlying place-based employment policies is the subject of a longstanding debate among researchers (Steinnes, 1982; Hoogstra et al., 2017). A related question is whether these place-based policies result in local employment or outsourced effects in other locations in the production chain through interurban growth transmission (Pred, 1977). In Dutch spatial-economic policy, logistics developments have often been proposed to reduce unemployment (Nefs et al., 2022). In line with current literature, we evaluate the regional employment effects of logistics developments from three perspectives: direct, indirect and agglomeration effects.

5.2.1 Direct effects: distribution centres as employment generators

Stimulation of DC development is generally associated with significant growth in blue-collar jobs and positive yet limited growth in technical and managerial jobs within the DCs (BCI, 2019a; Hesse, 2020; Yuan, 2019). Coe and Hess (2013, p. 34) describe a bifurcated labour market with on the one hand "the growing need for skilled workers to operate in a sector that is partly driven by technological innovation" and on the other hand a large workforce "characterized by low skills, low wages, contingency, insecurity and racialization." Logistics employment growth may be partially offset by relocation effects caused by (de)centralising distribution structures (Cidell, 2010; Onstein et al., 2019) and employment loss in retail due to e-commerce (Anderson et al., 2003). Furthermore, the effectiveness of DC development as a policy strategy to reduce unemployment may be partially offset by regional scarcity of specific skills and competencies and unavailability of low-skilled personnel. This may result in labour migration (Bakker et al., 2019) as well as automation to substitute for routine labour inputs (Autor, 2015). A benefit of automation is that it is shown to increase the knowledge intensity of DC employment (Yuan, 2019). Many researchers and policy makers have assumed logistics locations

to be fungible, partly footloose, and therefore spatially homogeneous (Santos, 2006; Van Geenhuizen & Nijkamp, 2005), while others have emphasised the heterogeneity and concentration of DC locations (Heitz et al., 2019). As there is no consensus on this issue, the first analysis of this study seeks to assess the direct employment growth of logistics and its spatial patterns in detail across regions, by analysing microlevel direct logistics employment.

5.2.2 Indirect effects: employment benefits of distribution centres in related sectors

The discourse on indirect effects of DCs is rooted in the economic clusters and place-based policies, which have become increasingly popular since 2000 (Delgado et al., 2010; Porter, 1998, 2000). Proponents of logistics cluster development claim that employment spillovers occur in nearby locations through co-agglomeration by attracting other logistics firms, manufacturers (e.g. tech, agrifood), retailers, and service providers in the value chain (Chhetri et al., 2014; Sheffi, 2012, p. 121). An example of indirect employment creation is value-added logistics (VAL) which enable *product differentiation* closer to the end user, services for (SME) manufacturers, and the *servicification* of the manufacturing sector (Hill, 2020, p. 61; Soinio et al., 2012). VAL is a particularly relevant example of indirect employment effects organised in the DCs themselves, generating "relatively complicated jobs commanding higher salaries" (Sheffi, 2012, pp. 121–122, 140) and interspatial competition (Danyluk, 2019, p. 94).

The precise identification of this spatial-economic multiplier effect of logistics is a subject of debate. Political and business proponents of DC developments, for example, in free trade (sub)zones in the U.S., have used manufacturing job generation as a primary argument for over a century, despite the inability of researchers to fully identify the net employment effects (Orenstein, 2019, pp. 176, 185). While there are some notable successful examples of (reshoring of) manufacturing and high-skilled jobs related to DCs (Sheffi, 2012), the geographic scope of these effects is not clear. In contrast, others argue that DC development is needed to keep up with existing growing regional manufacturers (Stec Group, 2020), in which case increasing manufacturing jobs might also be expected. Although new forms of manufacturing—in tandem with logistics—are considered to be of importance to circular and socially inclusive regions (Hill, 2020), there is still a lack of evidence of DC developments structurally attracting manufacturing firms in regions. In the Dutch context, this issue would relate to subsectors such as agrifood and (high)tech manufacturing, which can co-evolve with and depend on logistics

activities (Van Oort et al., 2015). This second empirical analysis, therefore, focuses on whether firms that may be involved in such supply chain spillovers should structurally locate nearby DCs.

5.2.3 Agglomeration effects: distribution centres as catalysts in regional business ecosystems

Regional agglomeration effects of co-agglomerating economic activities were first classified by Marshall (1890); they reduce search costs associated with labour demand and supply matching (labour pooling), subcontracting relations (input-output linkages), and learning relations (knowledge spillovers). Such effects explain the success of several economic clusters by reducing the cost of moving goods, people, and ideas. Ellison et al. (2010) determined that input-output linkages were most influential in co-agglomeration, followed by labour pooling and knowledge spillovers in the U.S. More recent studies focusing on sector heterogeneity (Faggio et al., 2017) have found that "technology-intensive industries value knowledge spillovers more, while labour market pooling and input-output linkages are more relevant for low-skilled industries" (Diodato et al., 2018; Steijn et al., 2022, p. 2). In addition, knowledge spillovers have become more important than the other two agglomeration effects, stimulated by increased skill intensity of most sectors as well as trade and technology shocks (Diodato et al., 2018; Steijn et al., 2022). While the Marshallian effects are rooted in regional specialisation, diversification of economic activities has also been found to determine agglomeration effects (Jacobs, 1969; Van Oort et al., 2015), or combinations thereof, such as *smart-specialisation*.

According to Van den Heuvel et al. (2014), clusters with co-agglomerated logistics establishments produce the three Marshallian agglomeration effects: (1) availability of truck drivers and warehouse personnel, (2) scale and scope advantages regarding transport capacity, accessibility and expansion opportunities, and (3) better maintenance and logistics services. The study offers disadvantages of logistics agglomeration as well, such as infrastructure congestion and increased land prices. Logistics clusters also have the potential to facilitate knowledge spillovers (Van Oort & Bosma, 2013). Furthermore, Warffemius (2007) states that "economies of agglomeration—and not the air transport services themselves—are the most important location forces responsible for the attraction of EDCs [European DCs] into the Schiphol area". This third analysis therefore assesses the role of DC developments as a catalyst of regional agglomeration effects.

We empirically assess the employment effects of DC developments in Dutch regions pertaining to the ESE corridor as generally accepted in policy and research to test the threefold hypothesis that DCs (i) stimulate direct employment in situ, (ii) attract nearby manufacturers and suppliers in the value chain, and (iii) create regional agglomeration effects. Particularly for dedicated XXL logistics developments, with international rather than local linkages as well as rapidly changing operational contracts, we analyse whether logistics activities are spatially co-agglomerated with other sectors locally and regionally.

5.3 Methodology and case study corridor

5.3.1 Methodology and data

We use three applied methods from economic geography to test the three multilevel employment effects hypothesised in the previous section. These methods are not only effective in evaluating the separate effects, but they are also able to take longitudinal business microdata as input. As such, they provide a coherent view of the three effects in the same period in the same local and regional areas, in comparison with the case study corridor and national scales. The three effects are complementary rather than cumulative or overlapping. First, we assess the direct employment effects of DCs by mapping detailed spatial employment density. Second, we assess indirect effects by applying the co-agglomeration index (Ellison et al., 2010; Steijn et al., 2022), showing the degree of physical proximity of logistics firms to other industries in our study area. Third, we assess regional agglomeration effects by identifying the national, industry-mix, and regional components of employment growth in a shift-share analysis—utilised by Marti (1982) and Adão et al. (2019) for distribution applications. We use the results of the threefold methodology to propose an evaluation framework for the impacts of spatial policies favouring developments of an economic sector such as logistics over time. Our approach to employing these methods is briefly outlined below.[67]

For the analyses, we use longitudinal employment microdata containing full and part-time jobs per firm establishment location (geo-specific points) for all firms in the Netherlands, organised per 5-digit sector code for the years 2000, 2010, and 2017.[68] We aggregate these data into different spatial units: 100mx100m grid cells and NUTS3 labour market regions for direct employment, NUTS4 municipalities and the corridor for co-agglomeration, and NUTS3 versus the national level for regional agglomeration effects. By taking this approach, our analysis is more detailed than many studies that utilise only regional data. Additionally, we use

67 Results for all three parts of the analysis are reproducible via a technical appendix and scripts in the repository (DOI:10.4121/21438021)

68 This data is gathered by the LISA Foundation (Stichting LISA) from municipal surveys in collaboration with local chambers of commerce, similar to the facility level data available in Belgium (Strale, 2020, p. 3). This proprietary and privacy-sensitive data can only be published in aggregated or treated form, not revealing individual firm information. An academic license can be petitioned at https://www.lisa.nl/

a dataset of approximately 26.000 logistics buildings located in Dutch business estates (Nefs, 2022b), including employment figures for those buildings.[69] In the literature, a DC is often broadly defined as any warehouse to stock products to (re) distribute to retailers, wholesalers, or consumers. Real estate consultancy tends to focus on the subsector of large logistics service providers and e-fulfilment DCs because they are financed and developed differently than other types of real estate (Bak, 2021; Raimbault, 2021). We choose the rather broad definition to capture as much as possible of the disputed employment effects associated with the spatial development of DCs. Therefore, we use a large subset of the logistics-building data, including the logistics subsectors of trade, import and export and goods transportation, warehousing, e-commerce, and logistics services, similar to Heitz et al. (2019) and Strale (2020), in size categories ranging from S (<2.500 sqm) to XXL (>40.000 sqm). Particularly for newer DCs, employment data are lacking. To generate density maps, we compensated for this by interpolating average employment numbers of DCs with the same function and size.[70]

Direct effects: mapping employment density score

We generated a comprehensive raster map that displays the employment density of the logistics sector in cells of a 100mx100m grid. This provides a spatial detail that is comparable to individual buildings. We used a kernel density estimation (KDE) heatmap algorithm in QGIS from the individual company points to calculate the density scores. The algorithm is weighed by the number of employees and uses a *quartic* spatial decay function (similar to a normal Gaussian curve) which is a common function for this type of research (Ward, 2016, p. 38). The radius of the decay is set to 2 km, which is similar to the size of a medium-sized business estate in the Netherlands. We found that smaller radii result in a map of individual DC developments without showing cluster effects, while larger radii produce a flat map in which employment concentration areas are not distinguishable. The resulting map provides a highly detailed representation of the spatial concentration of employment in the logistics sector. It enables the identification of emerging and declining sites in the time intervals

69 An open-access version of this treated data is available on a repository (DOI:10.4121/19361018). The dataset contains three layers: the ESE corridor area, the business estates (based on public information compiled in the Ibis data), and the buildings. For the purpose of this paper, the authors used an enriched version, where the forementioned LISA employment data are joined to each building. Similarly, this information cannot be disclosed for individual buildings. Reproducibility of the analysis, however, is guaranteed by publishing the data treatment scripts on this paper's repository (DOI:10.4121/21438021)

70 The 5-digit SBI codes included in the logistics sector, as well as the treatment of missing data, are explained in detail in the technical appendix on the repository (DOI:10.4121/21438021)

between 2000, 2010, and 2020. Specifically, the concentration of employment in designated XXL logistics parks is well represented via increasing density scores. Additionally, we have summarised regional employment and development figures for logistics employment in a descriptive table. Both the map and the table are longitudinally constructed, allowing a detailed comparison per region over time.

Indirect effects: co-agglomeration index

Spatial concentration of sectors can be measured by various indicators, including the location quotient, its derivation horizontal cluster location quotient, the locational Gini coefficient, the Herfindahl-Hirschman index, and Moran's I indicators (Andreoli et al., 2010, p. 81; Fransen, 2020, p. 81). Input-output analysis is designed for analysing intermediate industry deliveries, but it provides little spatial detail. A study on the employment effects of logistics on high-tech manufacturing in South Korea (Kim et al., 2021) shows this limitation. Here, we instead apply the Ellison-Glaeser Index (EGI) for co-agglomeration, which is calculated as the spatial occurrence of 2-digit sector pairs relative to a random co-agglomeration, in the municipalities of the ESE corridor introduced below. The logistics subsectors, the public sector, and primary sectors (agriculture, forestry, fishing) are excluded from the results since these are not relevant to our analysis of co-agglomeration in the supply chain. The advantage of EGI is that it allows for the interpretation of the observed sector pairs as either potential outcomes of supply chain relations (positive co-agglomeration), relations reflecting natural advantage (e.g., availability of a waterway or natural resources), or spatial incompatibility (negative co-agglomeration), while it eliminates the random location effect. The aggregated company microdata for municipal spatial units provides a higher level of detail than that of the study in the U.S. by Ellison et al. (2010), which aggregates to state and county levels. For brevity, we present bar charts of the ten sectors with the highest and lowest co-agglomeration scores in the corridor for 2000, 2011 and 2017, filtered for sectors known to exhibit location behaviour sensitive to first-nature (not man-made) advantages (Ellison & Glaeser, 1999).

Agglomeration effects: shift-share analysis

In line with a study on the rise of mega DCs by Andreoli et al. (2010), we perform a shift-share analysis for 2000–2017. Whereas the authors use the U.S. state level, we use business microdata aggregated on the NUTS3 regional level. The analysis separates the regional share (advantages in the regional production system) from two other components of employment growth: the national growth share and industry mix (shift) effect. This is performed for the logistics sector itself, of

two suggested productive sectors—agrifood and tech/manufacturing—and all remaining sectors combined. We interpret the regional share as an indicator for the total Marshallian agglomeration effects in these sectors, without calculating its components—labour pooling, input-output linkages, and knowledge spillovers—separately (Steijn et al., 2022). The higher the regional share component, the more competitive the region in a sector compared to the other regions. For this, we assume the natural advantage of the separate regions in the case study corridor to be comparable. In the interpretation of the resulting shift-share graphs, we closely examine regions introducing policies favouring DC developments.

The multifaceted view generated by the three applied methods enables us to test our hypothesis of employment effects as claimed and expected by policymakers and researchers.

5.3.2 Dutch East-Southeast freight corridor

We apply our empirical analysis to the East-Southeast (ESE) freight corridor in the Netherlands (Figure 5.1), encompassing the busiest goods transport routes in Northwest Europe, between the port of Rotterdam and the German Ruhr area, as well as many DC developments. These conditions make the corridor suitable for analysis in terms of the issues introduced above. The ESE corridor spans ten NUTS3 regions which we take as a proxy for the corridor, including 150 NUTS4 municipalities. This approach provides the opportunity to distinguish regional policy regimes targeting DC development.[71] The entire ESE corridor has seen stimulation of the logistics sector through national as well as regional/local policies (Kuipers et al., 2018; Nefs & Daamen, 2022; Raimbault et al., 2016; Raspe, 2012; Rli, 2016; Witte, 2014), including port and hinterland infrastructure investments as well as VAT and labour legislation favourable to DCs[72]. At the provincial and municipal levels, stimulation measures were adopted, and land was supplied to strengthen hinterland logistics clusters such as Greenport Venlo in the east and Port of Moerdijk in the west of the corridor (Panteia et al., 2019).

71 See https://ec.europa.eu/eurostat/web/nuts/background for definitions. While NUTS3 (COROP) region level is not an administrative level in the Dutch governance system, it reflects the (labour) market regions quite well, making it a frequently used scale for spatial-economic research. Spatial-economic policy is for a great deal made by local governments (NUTS4), which often collaborate on NUTS3 level.

72 In the Netherlands, VAT on goods is delayed to the time of export from the DC. Compared to the more unionised Belgium, less restrictions on night shifts apply in Dutch DCs.

TOC

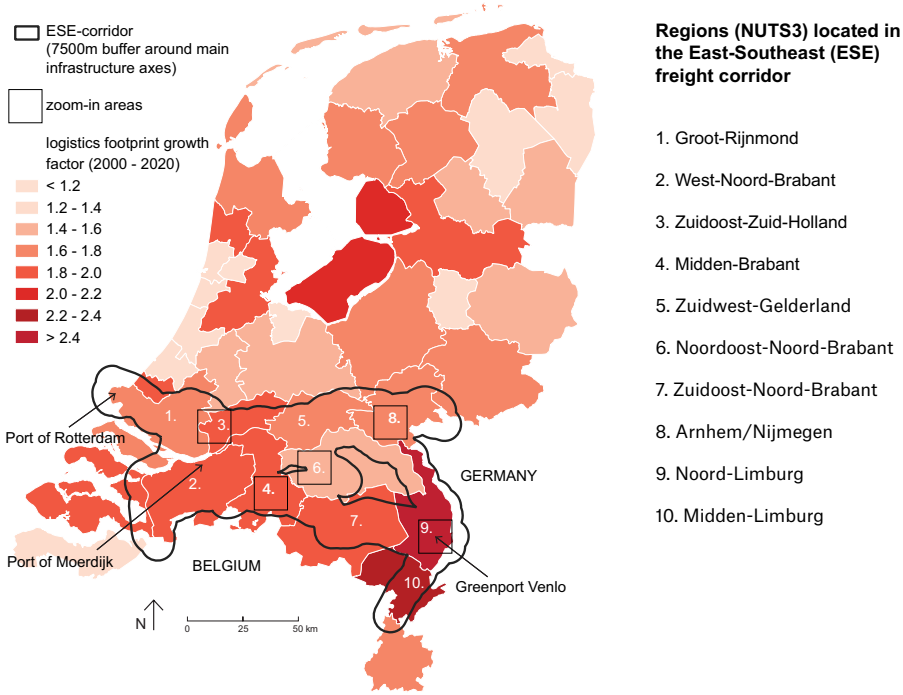

FIG. 5.1 Growth of the logistics building footprint in Dutch NUTS3 regions for 2000–2020. Most dynamic regions lie within the outlined East-Southeast freight corridor.

Fransen (2020) maps the region-specific compositions of the logistics sector in the ESE corridor between 2010 and 2018, finding an increased spatial concentration with regional specialisation in logistics in most regions, measured as location quotient. This may be related to the national and regional policies in the corridor mentioned above. We observe in the microdata that the logistics building footprint in the corridor doubled between 2000 and 2020, while the average building size tripled. A study in the Noord-Brabant Province, in the centre of the ESE corridor, shows that manufacturing firms are clustered, and many (but not all) are located near large transportation terminals and logistics clusters (Meijer, 2020).

Based on earlier research and policy (Kuipers et al., 2018; Rli, 2016), we focus on three types of regions in the corridor: the port region around Rotterdam traditionally stimulating the logistics sector, hinterland regions with policies favouring DC developments, and hinterland regions without such policies. We identify three regions with strong DC-favouring policies: West-Noord-Brabant, Midden-Noord-Brabant, and Noord-Limburg, which are the top three of the *Logistics Hotspot Ranking*.

This ranking[73] was first introduced in 2005 and is based on six criteria, including the relevant policy measures of available logistics construction sites as well as cooperative government. These three regions show a relatively large increase in DCs and have inter-municipal economic development organisations focusing on logistics.[74] The arguments supporting DC development outlined in Section 5.2 can be clearly observed in the corridor, for example, by Logistics Capital Partners CEO announcing 1.000 jobs in Roosendaal (West-Noord-Brabant): "not only warehouse personnel, but also managers and specialised IT crew".[75] Another example is an alderman in the Arnhem-Nijmegen region stating "With this new distribution centre and the employment growth of 800 to 1.000 jobs we show that Zevenaar is indeed a logistics hotspot".[76] Research journalism has recently described several cases of this trend in the Netherlands (Joosten, 2020; Klumpenaar, 2022; Van der Borst et al., 2022). A more systematic view on the argumentation regarding DC development by private and public sectors in the ESE corridor is provided in recent studies (Nefs, 2022a; Nefs & Daamen, 2022).

73 The Logistics Hotspot Ranking, performed by approximately 35 industry experts, is published annually by Logistiek Magazine. https://digimagazine.logistiek.nl/vastgoed/zo_komt_de_logistieke_hotspot_2020_tot_stand (See top 3 data in the repository).

74 REWIN, Midpoint Brabant and Brightlands/Greenport Venlo

75 BN De Stem, July 8th 2018 (https://www.bndestem.nl/roosendaal/duizend-banen-in-nieuwe-distri-doos-in-roosendaal~af1e07bf/)

76 7Poort business park, November 2019 (https://www.7poort.nl/nieuws/symbolische-start-bouw-distributiecentrum-xxl-op-businesspark-7poort/)

5.4 Results

5.4.1 Direct effect: regional and local variations in employment growth concentration

Despite the image of a ubiquitous and rapid-growth sector, logistics footprint (Figure 5.1) and employment growth for 2000-2020 are not spread evenly across the Dutch territory. Measured across the whole country between 2000 and 2017, the employment microdata show a sector increase of 10.6%, well under the national growth average of 14.2% over all industries; however, there is a significant logistical employment increase in most ESE corridor[77] regions (Table 5.1). Furthermore, the data show a large increase in logistics footprint and sprawl, particularly in the ESE corridor (Figures 5.1 and 5.2). This changing spatial pattern is the result of land supply policies and business decisions, both of which occur on various scales and involve different mechanisms varying per DC size class.[78] In this paper we focus on the ESE corridor, which is by its proximity to Belgium and Germany preferred for (X) XL national and European DCs, and on regions in the corridor stimulating this type of DC.

Figure 5.2 shows the direct spatial employment effects in five areas in the ESE corridor, selected to demonstrate the highly varying logistics employment landscape across business estates in the time intervals between 2000, 2010, and 2020. The top two DC-favouring regions (Noord-Limburg and Midden-Noord-Brabant) show a strong increase in logistics employment concentration in XXL logistics sites, such as Trade Port Noord (Venlo)—with the highest density score in the Netherlands—and Vossenberg-West (Tilburg). Regions without DC stimulation policy show smaller changes in the spatial pattern. The Arnhem-Nijmegen region, for example, experiences smaller growth, whereas Zuidoost Zuid-Holland experiences a shift of employment concentration from older to newer areas around Dordrecht. Some areas even experience a logistics employment decline, such as the business estates of Den Bosch. These heterogeneously changing patterns are confirmed by the regional direct employment numbers provided in Table 5.1.

77 Some other sectors grow faster inside the corridor, including real estate, ICT, and energy.

78 A body of literature deals with the spatial supply and demand issues of DCs (for example Onstein et al., 2019; Verhetsel et al., 2015)

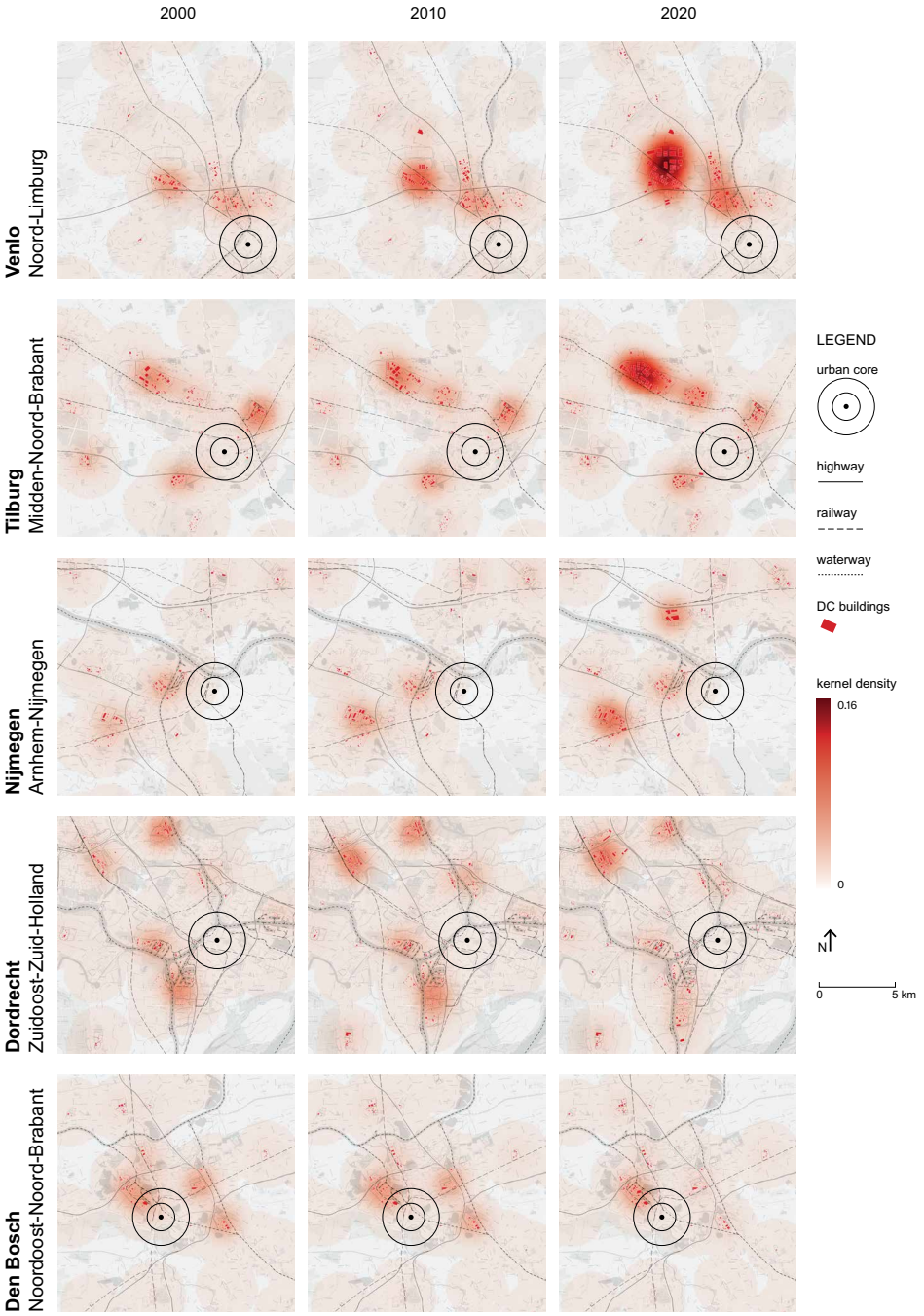

FIG. 5.2 Logistics employment density maps of business estates in the ESE corridor. The top layer shows the DCs. See the zoom-in squares of Figure 5.1 for geographical reference. Based on LISA data & Dutch Distribution Centres geodata.

TOC

TABLE 5.1 Employment and warehouse growth in the ESE corridor. Based on LISA data & Dutch Distribution Centres geodata.

Region	Population growth	Logistics employment (jobs)			Logistics warehouse space (sqm)			Space quote** (jobs/sqm)		
Corop	2000-2017	2000	2017	growth	2000	2017	growth	2000	2017	growth
Noord-Limburg*	2,8%	15.566	22.463	44,3%	1.878.869	3.857.767	105,30%	0,008	0,006	-29,7%
Midden-Noord-Brabant*	7,1%	23.728	31.717	33,7%	2.279.685	3.752.634	64,60%	0,01	0,008	-18,8%
Midden-Limburg	7,6%	9.316	12.095	29,8%	580.062	1.305.658	125,10%	0,016	0,009	-42,3%
West-Noord-Brabant*	6,1%	35.234	41.586	18,0%	3.414.983	5.748.339	68,30%	0,01	0,007	-29,9%
Zuiwest-Gelderland	7,0%	16.323	18.811	15,2%	1.269.787	2.030.930	59,90%	0,013	0,009	-27,9%
Zuidoost-Zuid-Holland	-1,9%	23.430	26.738	14,1%	830.653	1.314.341	58,20%	0,028	0,02	-27,9%
Arnhem/Nijmegen	5,7%	26.250	29.942	14,1%	1.551.682	2.331.437	50,30%	0,017	0,013	-24,1%
Groot-Rijnmond	6,5%	88.701	95.232	7,4%	4.872.473	7.125.875	46,20%	0,018	0,013	-26,6%
Zuidoost-Noord-Brabant	7,4%	37.540	39.993	6,5%	2.009.277	3.374.861	68,00%	0,019	0,012	-36,6%
Noordoost-Noord-Brabant	5,6%	38.079	39.763	4,4%	2.326.647	3.262.430	40,20%	0,016	0,012	-25,5%

* *top 3 logistics hotspot ranking regions*

** *including logistics sector jobs outside business estates (e.g. offices)*

Table 5.1 shows the highest logistics employment growth occurs in the regions with a higher increase in logistics footprint, particularly those with logistics favouring policies. Although this may be a case of correlation rather than causation, it seems evident that adding logistics buildings would result in more jobs in that field. Contrary to some assumptions (Geffen et al., 2019), logistics employment and population growth do not correlate unequivocally since logistics employment peaks occur both in regions with low and high population growth. While the regions in the bottom part of Table 5.1 experience job growth along with population growth, Noord-Limburg experienced a dramatic 44,3% increase in logistics jobs with a doubling of the logistics building footprint and only a 2,8% population increase. On close examination, logistics employment concentrations shift away from population concentrations, particularly in regions with DC-favouring policies (Figure 5.2).

Another notable variation concerns the jobs generated per warehouse footprint (space quote). Table 5.1 lists all logistics sector jobs in the region, including those registered at a DC as well as in offices. Over time, all regions experience a strong decline of approximately 25–50% in employment space quote. Both in 2000 and

in 2017, the logistics-stimulating regions show the lowest quotes. This points to a trend of decreasing marginal returns: each added square meter of warehouse yields fewer jobs. We discuss this trend in the next section. Another relevant factor is the average building size: S- and M-sized logistics buildings typically have an employment space quote more than double that of XL and XXL buildings (Nefs, 2022b). In the 2000s and especially after 2010, more XL and XXL warehouses have been built.

In summary, the analysis points to a strong direct effect of DC development and favourable policies, a highly heterogeneous spatial pattern of logistics employment concentration in and across regions, and a decreasing effect of jobs generated per added square meter of the warehouse.

5.4.2 Indirect effect: weak spatial ties between logistics and other activities

Contrary to the hypothesised effect, Figure 5.3 shows that logistics firms do not co-agglomerate strongly with other economic activities in the same municipality.[79] Most sectors show a EGI score of near zero, meaning that they have an essentially random spatial co-agglomeration with logistics. The top-ten co-agglomerating sectors experience a pull effect of logistics that is closer to random than the push effect experienced by the bottom ten, suggesting that logistics does not generally attract other businesses nearby. The two highest co-agglomeration scores (lotteries and casinos, insurance and pensions) are not related to the logistics sector. Recycling, agricultural services, lodging, and printing (e.g. packaging), however, can be considered to relate to logistics and especially VAL activities. Since the co-agglomeration score of waste and recycling can partly be attributed to first-nature drivers of location behaviour (i.e. the availability of natural infrastructure, resources and space), the employment spillovers in the supply chain are also only partly related to the occurrence of DCs (also found in agreement with Steijn et al., 2022). While logistics is increasingly clustered in the ESE corridor, the results do not indicate increased co-agglomeration of other activities in the supply chain in this area. This outcome is further supported by the ten least co-agglomerating sectors with respect to logistics (Figure 5.4), including R&D and innovation. These sectors also include more high-tech forms of manufacturing, such as computers, opto-electrics, auto manufacturing, and pharmaceuticals, which are generally high-value-added industries and among the sectors often targeted by policy makers.

79 As a comparison, the highest EGI co-agglomeration scores in the study by Ellison et al. (2010) are around 0.2, while the scores in our analysis do not reach 0.01.

TOC

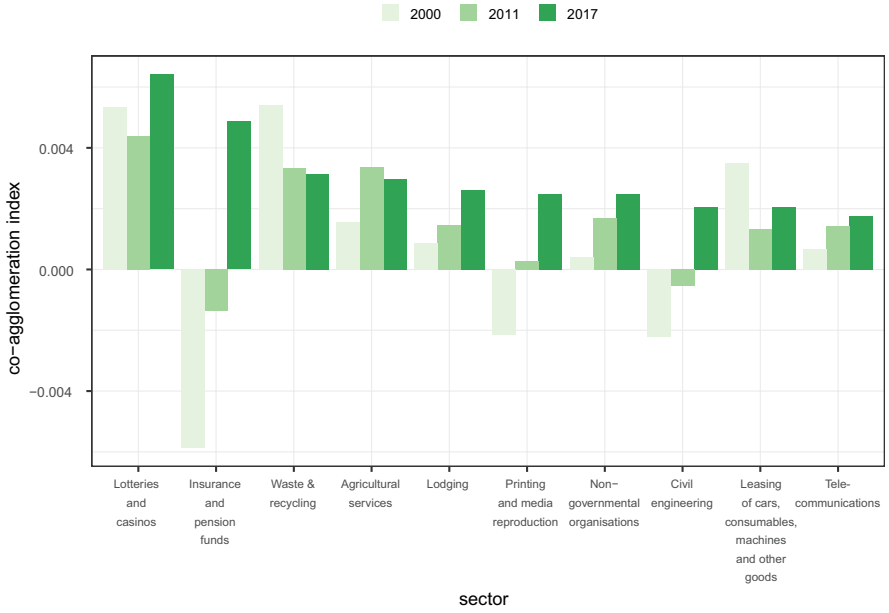

FIG. 5.3 Top-10 (positive) co-agglomeration scores between logistics and other economic activities in the ESE corridor. Based on LISA data.

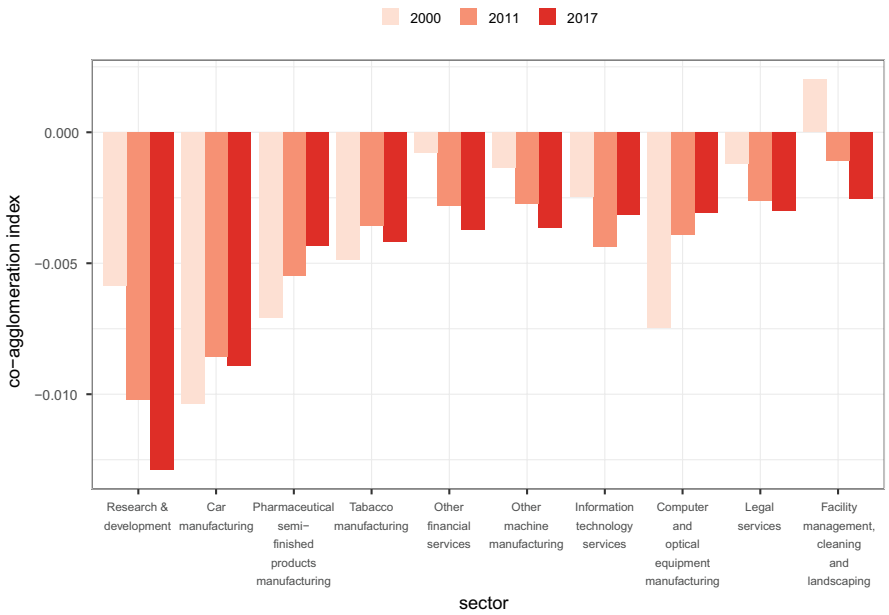

FIG. 5.4 Bottom-10 (negative) co-agglomeration scores between logistics and other economic activities in the ESE corridor. Based on LISA data.

TOC

By comparing different periods, we find that both positive and negative co-agglomerating scores change considerably and do not show a consistent pattern of growth or decline. Some co-agglomeration patterns slowly strengthen (e.g. logistics and printing), some already weak ties weaken further (e.g. logistics and R&D), and most co-agglomeration pairs of logistics remain essentially random. In summary, these results do not support the policy reasoning that logistics activities attract value-added activities through supply chain relations at the local level.

5.4.3 Agglomeration-effect: strong yet monofunctional logistics ecosystem

The results of the shift-share analysis of the regions in the ESE corridor are shown in Figure 5.5. The darker tones in the bar charts represent the regional share, which we use to assess the regional agglomeration effects (or regional competitiveness) as explained above. This measure is the result of the regional employment growth minus the national and industry-related expectations. In the Netherlands, the considerable national employment growth raises expectations across all sectors. In practice, however, some sectors perform below average on the national level, as is the case for the logistics sector. In contrast with the national average, however, the regions in the ESE corridor have experienced a strong growth in logistics employment, represented by a large regional share. This difference is greater in the three DC-favouring regions. The results, therefore, suggest that strategic positions in the transport network—a key characteristic of the corridor as a whole—as well as DC-favouring policies play an important role in establishing a competitive regional business climate, including specialised services and personnel. Noteworthy exceptions are the regions of Groot-Rijnmond and Zuidoost-Noord-Brabant, including the larger cities of Rotterdam and Eindhoven, which have a more diversified economy.

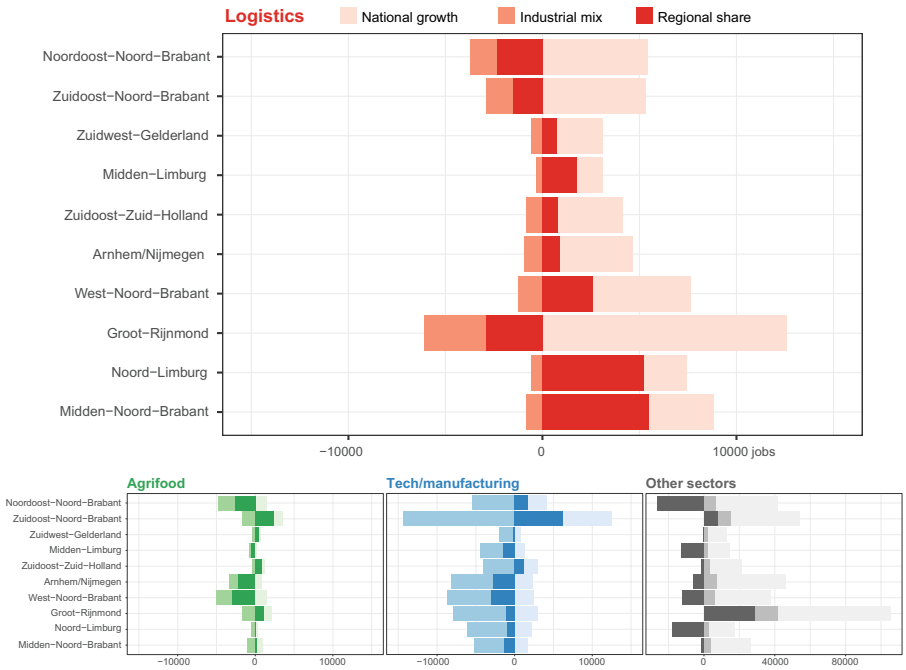

FIG. 5.5 Shift-share diagram of ESE corridor regions ordered by absolute logistics employment growth for 2000–2017. The three smaller diagrams show the shift-share results for the same regions, in the same order, regarding agri-food, tech/manufacturing, and the other economic sectors. Based on LISA data.

Contrary to our hypothesis, the observed agglomeration effects of the logistics sector do not correlate with increased regional competitiveness in the key sectors of agrifood and tech/manufacturing, which are often targeted in spatial-economic policies as well. Tech/manufacturing jobs and regional competitiveness declined in most regions of the corridor; this effect was less significant in Zuidoost-Noord-Brabant, which can be explained by the booming tech sector of the *Brainport* Eindhoven. In particular, the logistics-stimulating regions also experienced a decline in agrifood jobs and employment in the other sectors (e.g., services). Across the corridor, increased regional competitiveness of logistics correlates with a decline in competitiveness in the agrifood, tech/manufacturing, and other sectors.

5.4.4 Summary of employment effects

The threefold analysis shows that (i) a considerable direct logistics footprint and employment growth were realised in the corridor, more so in the regions with DC-favouring policy; (ii) co-agglomeration patterns of other sectors relative to logistics, promoted by policy makers and suggested by researchers, are weak (e.g. printing) or even negative (tech/manufacturing); and (iii) regions in the corridor, particularly those with DC-favouring policies, specialised quickly and developed competitive logistics business ecosystems (agglomeration effects). However, these same regions underperformed in the other sectors of the economy, including those on which they focused, such as tech/manufacturing and agri-food.

The spatial variation within and among regions is significant. Direct employment creation in DCs occurs primarily in new XXL logistics business estates, which are increasingly located distant from population centres. On the regional scale, we observe both concentration and de-concentration of logistics activity, as identified earlier by Rivera et al. (2014) and Heitz et al. (2017), sometimes shifting from declining to emerging locations. The strong co-agglomeration effect of logistics with manufacturing, as described in the U.S. and in South Korea (Kim et al., 2021; Sheffi, 2012), was not observed throughout the ESE corridor. The effect may not structurally occur in the Netherlands and possibly in other European countries. There are three plausible explanations for this: (1) such effects are increasingly being *outsourced* through the value chain to other regions or countries; (2) value-added logistics activities, such as manufacturing, services, and suppliers, could be increasingly *insourced* in the same XXL warehouses, where they cannot be accurately distinguished via the employment microdata at establishment firm level[80]; or (3) the stringent environmental zoning of business estates in Dutch planning practice restricts the potential co-agglomeration of manufacturing and logistics.[81] The analyses suggest in general a more modest effect than suggested in many logistics growth narratives.

80 The data categorise an entire company into one (sub)sector.

81 The often-used maximum environmental planning category of 3.2 allows logistics but not industrial activities, for example.

TOC

5.5 Discussion of logistics development policy

Beyond the insights provided by the three separate analyses, an integrated view can extend the evaluation of the DC-favouring spatial-economic policy in relation to the regional employment effects. For this purpose, we recombine the data regarding the three employment benefits into a multidimensional diagram (Figure 5.6) to show, for the regions with (red) and without (blue) favouring policies, changes in building footprint (horizontal axis) and specialisation (vertical axis). Both changes are assumed to be stimulated by policies. The sectoral employment growth (indexed) of each region is represented as the dot size. The cumulative shift-share graph on the right shows the performance of all regions with and without DC-favouring policy, which can be interpreted as discussed in Section 5.4.

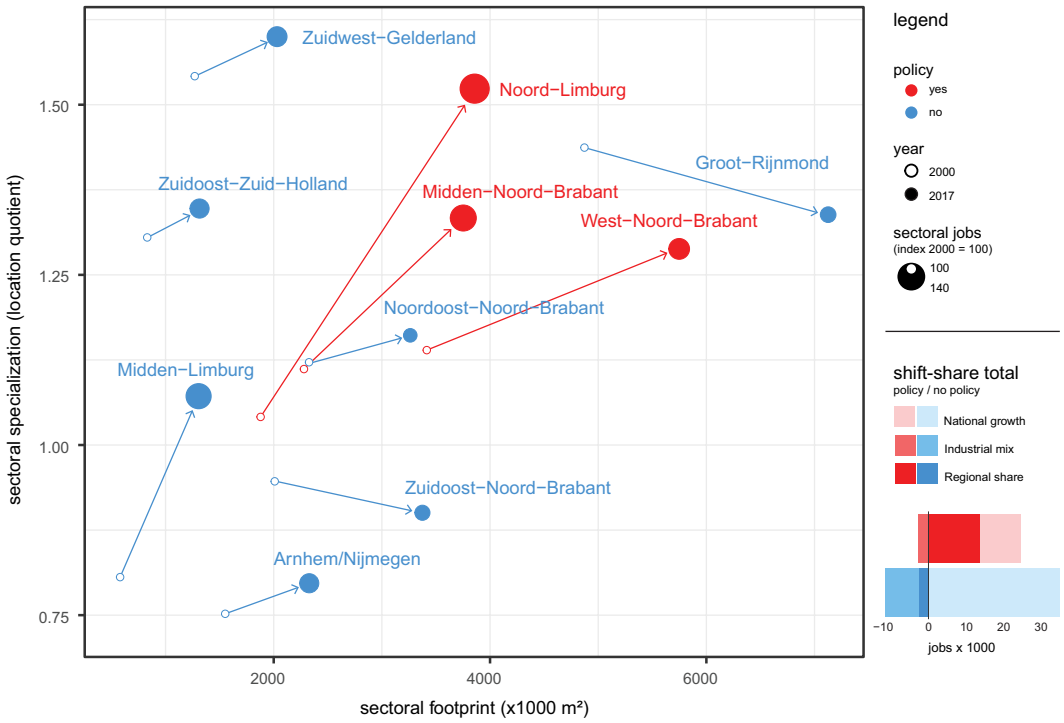

FIG. 5.6 Multidimensional diagram showing regional policies aimed at the growth of a sector applied to logistics in the ESE corridor for 2000–2017. Based on LISA data & Dutch Distribution Centres geodata.

TOC

The diagram shows that all regions in the ESE corridor experienced a growth in logistics footprint and employment, while eight out of ten increased logistics specialisation. The evolution is not homogeneous across regions, however. In the port region Groot-Rijnmond, the added footprint does not result in increasing specialisation and competitiveness, possibly due to the fact that the historical port region is now shifting towards a service economy, while its hinterland is catching up logistically (Manshanden et al., 2022; Rli, 2016). While West-Noord-Brabant achieved the largest DC footprint growth, the increase in specialisation and employment is moderate. In contrast, Midden-Noord-Brabant shows a higher impact with a considerably lower footprint growth. Midden-Limburg presents an interesting case of a region with rapid growth in specialisation and employment, without dedicated policy or extensive footprint growth. This could be explained by some DC developments, or redevelopments, in tandem with the decline of other sectors (Van Oort et al., 2015).

There is a clear difference between hinterland regions with and without DC-favouring policies in the ESE corridor. The former experience higher levels of footprint growth, logistics specialisation, and favourable competitive positions. The shift-share graph demonstrates that most employment growth in DC-favouring regions can be characterised as regional competitiveness, while most growth in other regions relates to national employment growth. When combined with the detailed shift-share results of Figure 5.5, in terms of the performance in other sectors, particularly the three DC-favouring regions face the risk of a spatial-economic lock-in. Under such a scenario, the regions become focused on logistics and have invested a great deal of land, policy efforts, and other means into the sector—arguably at the cost of developments in other sectors; it becomes increasingly hard to change this self-reinforcing dynamic, which has become hardwired in the spatial-economic conditions, such as land use and infrastructures, and available skills.

5.6 Conclusions on the employment effects of logistics development policies

In this paper, we analysed changing regional employment patterns of the logistics sector, in the case of the Dutch ESE freight corridor between 2000 and 2020. The results demonstrate that some of the assumed benefits of DC developments can be spatially identified in the analysed corridor. Employment benefits of new DCs decrease over time, potentially due to automation and the use of migrant labour. Furthermore, the expected co-agglomeration of manufacturing and suppliers near DCs does not occur structurally. Finally, although DC-favouring regions have successfully developed competitive logistics business ecosystems, they may experience a sectoral lock-in: a self-reinforcing dynamic hardwired in their land use, infrastructures and skills. The spatial-economic policy narratives framing DCs as employment catalysts are thus of limited validity.

5.6.1 Policy implications

Our results caution against policy narratives that propose logistics developments as a one-size-fits-all solution or quick fix for regional employment growth. Detailed employment density maps show large spatial variations, in addition to numeric differences in specialisation, footprint, and jobs added in logistics. The fact that three regions in the corridor (West-Noord-Brabant, Midden-Noord-Brabant, and Noord-Limburg) dominate the top of the Logistics Hotspot ranking for almost 20 years suggests that the success of logistics clusters, similar to other economic clusters, can largely be attributed to regional advantages and path-dependence, which are not easily reproducible through policy implementation in other regions (compare see with earlier research by Delgado et al., 2010; Held, 1996; Taylor, 2010; van Oort et al., 2015; Van Oort et al., 2016; Van Oort & Bosma, 2013; Weterings et al., 2007). Also, non-spatial sectoral stimulation policies, such as the Dutch *Topsectors* policy (Raspe, 2012), are likely to generate localised benefits in the regions in which the sector is already strong. Therefore, policies that promote local logistics development run a risk of reinforcing spatial-economic lock-in in areas with logistics specialisations. Conversely, when logistics is not a local specialisation yet, our results suggest that these policies are not as effective as the narrative promises. Rather than focusing on policies of logistics specialisation, diversification into structurally related industries (by subcontracting relations, skill-relatedness or cooperation relations) may have higher potential for local employment development (Boschma & Frenken, 2009; Neffke & Henning, 2013).

In the supply of land for logistics developments, governments are advised to first assess and explore the role of logistics in the functioning of the regional economic ecosystem of consumptive and productive sectors. Depending on the context, logistics can be argued to usurp supply from labour and land markets at the expense of other (competitive) sectors or the foundational economy (sectors necessary for basic needs provision). Second, governments may adopt an integrated and more balanced view on the costs and benefits of the logistics development, taking into account other demands for space (housing, nature, SMEs, etc.). A societal cost-benefit analysis based on a broader set of metrics than solely employment, land revenue and tax income, is desirable. A better-informed land supply process can filter out investors that do not contribute significantly to local added value or job creation and maintenance.

5.6.2 Further research

We emphasise that more in-depth research is needed regarding the causal effects of specific logistics projects on the quantity and quality of work in the vicinity (Tabak, 2022). This should include the value-added activities inside XXL warehouses (e.g. assembly and service tasks currently invisible in the data) and the decreasing number of jobs per square meter of warehouse. The latter may be attributed to economies of scale and automation of logistics, for instance with regard to truck driving, forklifting and cargo-handling (Frey & Osborne, 2013, pp. 23, 41). Whether this would instead entail an increase in skilled workforce involved in logistics data handling and robotics and reduce low-skilled labour, is still uncertain. Lower-skilled labour involved in delivery platforms for example is growing (Chicchi et al., 2022). More research is also required with respect to triple-helix policies that link co-developing businesses, education and knowledge institutes to governmental programs, aiming for knowledge creation and spillovers in the field of automation and *smart logistics*.

Despite automation, there is still a growing demand for a low-skilled workforce in the Netherlands, which is increasingly supplied by labour migration from Eastern Europe (Bakker et al., 2019; BCI, 2019a; Stec Group, 2020). Sector and media sources show an increase in logistics migrant labour totalling nearly 200.000 workers in 2021 in the Netherlands.[82] Working conditions and housing issues for migrant labour are thus other urgent topics for further research.

82 https://www.groene.nl/artikel/opgepropt-in-het-vakantiepark; https://www.buitenkans.org/post/19-mei-huisvesting-van-arbeidsmigranten; www.brabant.nl/arbeidsmigratie; www.arbeidsmigratiewerkt.nl; https://noord-brabant.maps.arcgis.com/apps/MapTour/index.html?appid=48d4b33d-0c7e46f487e86cb2516af254; https://www.limburger.nl/cnt/dmf20220507_94174882

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TOC

6 Global gains and local pains

Spatial justice in the planning discourse on hinterland logistics

Based on: Nefs, M. (2022). Beyond Global Gains and Local Pains – spatial inequality of hinterland logistics. In Aesop (Ed.), *AESOP 2022 Tartu: Spatial Justice* (Aesop, pp. 249–256). Aesop.

ABSTRACT Trade infrastructure and logistical activities have long been regarded as a source of both prosperity and nuisance. However, the benefits and burdens of logistics are not distributed equally in space. Therefore, this paper assumes that logistics planning is a spatial justice issue. The planning literature suggests that (i) logistics developments are causing and increasing socioeconomic inequality in hinterland areas worldwide, and (ii) that hinterland communities might use local democratic processes to influence the trade-off between logistical benefits and burdens. The two hypotheses in this paper are listed as follows: (1) spatial justice argumentation serves a role in the policy discourse and decision-making on logistics developments at the local and provincial level, which is crucial in the current spatial planning system of the Netherlands; (2) discourse and decision-making vary by province. The paper analyses the regional media discourse on logistics in two provinces, as well as political stances on this topic in provincial elections. It zooms in on two local planning cases. Whilst the spatial justice arguments on the benefits and burdens of logistics have clearly influenced the planning discourse, as well as local and provincial decision-making, the topic remains highly polarised. Thus, national policies are crucial to create a level playing field for logistics developments across regions, in which gains and pains are more balanced.

KEYWORDS hinterland logistics, spatial planning, spatial justice, landscape degradation, congestion, trade

6.1 Introduction to the gains and pains of logistics

Trade infrastructure and logistical activities have long been considered a source of prosperity in the form of employment and business opportunities. Simultaneously, they impact the landscape and represent sources of nuisance, such as air pollution, noise and road congestion. However, the gains and pains of logistics are not equally distributed across regions and cities.

Important trade hubs such as Rotterdam have built strong trade institutions and accumulated urban wealth, thereby making a successful trade-off between the global gains of trade and the local pains of congestion and pollution (Cronon, 1991; Geerlings et al., 2018; Kuipers et al., 2018). Since the rise of global supply chains, such hubs have regionalised beyond their city boundaries and formed logistical hinterlands characterised by a fragmented pattern of distribution centres (DCs) and infrastructure, often near residential areas. These extensive hinterland areas appear to represent less favourable trade-offs between gains and pains, judging by the increasing criticism against DC developments, citing landscape degradation (CRa et al., 2019), congestion and precarious jobs (Bergeijk, 2019; Coe & Hess, 2013). In the increasingly populated hinterland of Europe's largest port, Rotterdam, the building footprint of logistics has increased fourfold since 1980 (Nefs, 2022b), whilst road congestion and labour shortages have also increased steeply. This makes the hinterland of Rotterdam a critical case for studying the spatial justice of logistics.

This paper aims to shed light on hinterland logistics development as a spatial justice issue by answering the following question: **What role does spatial justice argumentation serve in the provincial and local planning discourse and decision-making on hinterland logistics?** Additional questions stemming from this include the following: **What are the critical dimensions of spatial justice when applied to hinterland logistics? To what extent does it represent sentiments of NIMBY (not in my backyard) or spark a constructive discourse resulting in better-accepted policies?** To answer these questions, the paper reviews spatial justice literature and analyses the regional media discourse and recent decision-making on logistics in two provinces, as well as political stances on this topic in the provincial elections. Furthermore, it zooms in to two local planning cases in these provinces. The paper seeks to provide a framework for logistics planning trade-offs that may structure the rather confusing societal debates.

In the next section, the literature is reviewed to define spatial justice and assess its applicability regarding hinterland logistics developments in general and in The Netherlands in particular. The third section presents the case of the Dutch planning discourse, focusing on two provinces and two local cases in the hinterland of the Port of Rotterdam. Methods are presented to analyse the discourse in provincial media outlets and political stances on logistics during the provincial elections of 2023, as well as decision-making on the provincial level and in two local planning cases. Section 6.4 presents the results of the analysis. Section 6.5 proposes a multilevel framework of logistics planning trade-offs to explain the findings. The final section draws conclusions for further research and provides recommendations for trade-offs in spatial planning practice.

6.2 Spatial justice applied to hinterland logistics

Large infrastructure projects such as Rotterdam's post-war port extensions, as well as DC developments such as XL Business Park Almelo and Greenport Venlo, are usually promoted by emphasizing national and regional gains. Such gains include contributions to the strategic national spatial-economic structure and improvement of the regional business climate and employment (Chhetri et al., 2014; Flyvbjerg et al., 2003; Van der Wouden, 2015). However, since the 1980s, local pains have increasingly influenced the discourse on such projects and developments. Local—as well as regional—pains include the destruction of natural and cultural landscapes, increased road congestion, noise and air pollution (Aljohani & Thompson, 2016; Krzysztofik et al., 2019; Yuan, 2019, 2021). More recently, the negative impacts of large DCs on local small and medium-sized enterprises (SMEs) and the labour market have been added to the discussion of pains (Bouwhuis, 2022; Stec Group & Denc, 2022). Increased criticism regarding such developments suggests that those who experience the pains do not always benefit from the gains. The concept of spatial justice may help to shed light on this issue.

The concept of spatial justice emerged in the early 1970s when Harvey and other geographers applied Rawls' (1971) theory on the *fair distribution* of gains and pains to planning, an idea that has gained traction in recent years (Barbieri et al., 2019; Bret, 2018; Moroni, 2020; Przybylinski, 2022; Rocco & Newton, 2020; Soja, 2010;

Yuan, 2021). This not only relates to the effects of infrastructure on spaces but also the distribution of *'financial, environmental and social benefits and burdens issued from urban development.'*[83] These developments include built objects such as DCs. Since public goods (e.g. schools and shops) and negative externalities (e.g. noise) are not equally distributed geographically, both *accessibility* and *proximity* serve important roles in spatial justice. In the case of logistics, DCs are often dedicated to one company and thus present limited gains to other companies in the vicinity, whilst accessibility for workers via public transport and cycling networks is also often limited.[84] The proximity of DCs to residents is evidently an important explanation behind the experience of nuisance. As Bret (2018) explained, the geographical scales used in such discourses should also be seen as social constructs, which may be used to legitimise the outsourcing of pains to other territories or NIMBY positions.

Besides the distributive concept of spatial justice described above, there is also a procedural and recognitional understanding of spatial justice. A just planning system that recognises various stakeholders and gives them a voice enhances the fair distribution of gains and pains, according to Healey (1996) and Ostrom (2015). Moroni (2020) reminded us that distributive justice cannot cover the full range of social justice issues since not all goods are scarce, divisible and transferable. This also applies to aspects discussed in this paper, such as the gains of e-commerce enjoyed by a wider region and the pains of congestion that cannot be transferred to areas without heavy infrastructure.

Physical landscapes mediate economic relations, and 'justice emerges through struggle over the production of landscape', Przybylinski (2022) argued, because it is 'the spatial form that social justice takes' (Mitchell in Wescoat & Johnston, 2008, p. 45). Although institutions such as local governments are often seen as part of the problem in the critique of spatial inequalities, these organisations appear also to be crucial to the stimulation of just cities and regions. For example, Perry and Atherton (2017) demonstrated how a co-production process of institutions and civil society involving the development of shared critique and the exploration of options and pilot actions can improve spatial justice. It seems possible that this process of influence can apply to spatial developments of logistics. Place-based policies, as well as policies aimed at reducing intra- and inter-regional imbalances, have become increasingly common at various scales (Barca, 2009; Kline & Moretti, 2013; Madanipour et al., 2022; Neumark & Simpson, 2015; Van Haaren et al., 2019). Nevertheless, researchers have highlighted that not all inequalities can be remedied by spatial means, whilst spatial justice is not always the top political priority (Przybylinski, 2022).

83 https://just-city.org/

84 A large proportion of DC workers are migrants who live in temporary facilities near the DC, or are brought in by vans.

Although not always framed as spatial justice, the logistics planning literature frequently addresses distributive problems. Whilst the regionalisation of distribution centres in California along the Alameda Corridor has improved the air quality and congestion in downtown Los Angeles (LA) and the whole region in general, it has significantly worsened living and working conditions in the Inland Empire region east of LA (De Lara, 2013; De Lara in P. V. Hall & Hesse, 2012; Yuan, 2021). This situation is regarded as a conflict between the regional gains of logistics developments and the local pains in hinterland areas experienced by vulnerable communities (De Lara in P. V. Hall & Hesse, 2012; Yuan, 2019). Another recent case of spatial effects and inequality around trade infrastructure is the Chinese Belt and Road Initiative, which has been known to cause localised water stress, soil erosion and pollution effects in central Asia (Teo et al., 2019). It seems likely that the hinterland of the Port of Rotterdam, Europe's largest port, experiences similar conflicts.

The spatial inequality of logistics is at least partly rooted in the inherently unstable and heterogeneous territorial manifestations of logistics networks. As Santos (2006: 163, 176–185) explained, building on the work of Castells and other geographers, such networks constitute spaces in regions that serve economies at a higher (inter)national level, creating various territorial dialectics and instabilities: 'local vs global, slow vs fast, competitive vs lagging'. The idea here is that well-connected places can serve more important roles in the economy and gather more gains. The expansion of logistics into the hinterland theoretically makes it possible for communities outside of large metropolitan centres to also capture such gains (Sheffi, 2013, p. 267). However, (Witte, 2014, p. 22) acknowledged this asymmetry in transport corridors and emphasised that socioeconomic benefits of transport infrastructure are widely spread across and even beyond the corridor, whilst direct environmental costs are localised near the infrastructure. Therefore, this paper uses the concepts of *global gains* and *local pains*.

Since the gains and pains of logistics developments are felt on such different scales and among so many different actors, making a good trade-off is extremely difficult. Although a company can seek an optimum of costs pertaining to, for example, the service level and location of a distribution centre (Onstein et al., 2019), the societal trade-off is much more complex, involving changing political positions regarding a multitude of gains and pains. Societal cost-benefit analyses cannot remedy this by themselves since they still need political interpretation and fail to consider aspects such as biodiversity or landscape quality, which are difficult to measure (Hickman & Dean, 2018). Nor are spatial-economic models equipped to incorporate and evaluate this variety of spatially distributed gains and pains (Verhoef & Nijkamp, 2003). As a result, *persuasive, coordinative and justificatory discourses* (Healey, 1999, p. 39) remain key elements in deciding on large economic developments with environmental

impacts to respectively command support, to join investment and regulatory powers, as well as justify choices such as land use for logistics.

The Netherlands is regarded as having the necessary institutions and motivation to enhance spatial justice (Michels, 2006; Salet, 2018) due to its long-standing history of democratic water and land management, which has often dealt with land scarcity in the context of economic and ecological ambitions. Since the planning system has been decentralised over the last two decades, shifting the responsibility of area development to the provinces and local governments (Nefs et al., 2022; Van der Wouden, 2015), the aforementioned persuasive, coordinative and justificatory discourses can be expected to occur at these levels in the Netherlands. This paper seeks to find out if this is the case.

The literature on spatial justice vis-à-vis logistics and planning reviewed above suggests that logistics developments can be regarded as a spatial justice issue, impacting the socioeconomic benefits and environmental burdens experienced by different groups on different scales. DC developments might reinforce existing social-economic inequalities, as is the case in California, whilst the decentralised governance structure of spatial planning in the Netherlands might also enable a more just and area-specific democratic trade-off between the pains and gains in the hinterland. As previously mentioned, the gains typically include economic benefits such as an enhanced national spatial-economic structure, an improved regional business climate and employment. The pains typically include environmental burdens, such as landscape destruction, congestion, noise and air pollution, and sometimes negative side effects for local businesses. Therefore, the hypotheses of this paper are listed as follows: (1) spatial justice argumentation serves a role in the Dutch local and regional policy discourse as well as decision-making on logistics developments; (2) this varies by province (e.g. depending on its position in the hinterland). In the next section, the case of the Netherlands and the methodologies of the analyses are introduced.

6.3 Analysing spatial justice argumentation in the Dutch planning discourse

The case study aims to shed light on the public planning discourse about logistics developments, including the media as well as political and decision-making discourses. The analysis identifies the use of spatial justice arguments—pointing to gains and pains of logistics—and changes in local and provincial policymaking influenced by these arguments.

The Netherlands, especially the East-Southeast (ESE) freight corridor in the hinterland of the Port of Rotterdam—which includes many distribution centres and transport hubs—is a critical case for this topic for three reasons. First, the Netherlands accommodates increasing logistics activities in a limited and increasingly urbanised territory, in which trade-offs (as previously described) must be made (BZK, 2020). Second, the country has a long history of national stimulating policies regarding logistics. More recently, a national policymaking process focused on mitigating the negative effects of logistics has been introduced, which is still being incorporated in new national planning legislation[85] (Bontenbal, 2022; Nefs, 2023a; Nefs et al., 2022). Third, local protests against logistics developments have become common features in the planning discourse at the local, regional and national levels over the last 5 years (CRa et al., 2019).

The analysis first identifies spatial justice arguments regarding DC developments and their effects on the media political discourse and decision-making in two provinces where oft-debated developments take place: Limburg and Noord-Brabant. Secondly, the analysis zooms in on two of these local development cases: Klaver 7 in Horst aan de Maas and Wijkevoort in Tilburg. All parts of the analysis focus on DC buildings (rather than infrastructure), reflecting the focus in the recent discourse. Notably, an analysis looking back 15–20 years might have instead focused on infrastructure projects. Evidently, the DC developments have impacts on the pollution and congestion levels of the existing infrastructure.

85 National Spatial Strategy (In Dutch *Nota Ruimte*), expected in the coming years.

6.3.1 Regional discourse and decision-making on logistics developments

To discuss the regional political debate and identify the regional differences within and outside of the ESE corridor, the positions of political parties on the province level are analysed. In the Netherlands, provinces are the authority directly above the municipal level.[86] The provincial government level in the Netherlands has become responsible for spatial planning since the 2000s (Nefs et al., 2022; Van der Wouden, 2015). The development of distribution centres has been a hot topic in the provincial spatial planning discourse over the last decade—persuasive but also coordinative and justificatory. New (often populist) political parties have used their stances on either the 'boxification' of the landscape, labour migration or the job-creation by DCs to increase their provincial electorate. For the first time, a specific statement regarding DCs was part of KiesKompas, the official information website[87] for voters during the 2023 provincial elections on 15 March, in 8 out of 12 provinces (Figure 6.1):

'Distribution centre developments should be banned, even at the cost of jobs.'

The analysis uses data scraped from the KiesKompas website, in JavaScript object notation (JSON) format, including the positions on the statement above by all political parties, organised by province. The positions by party and province have a quantitative component, representing the level of (dis)agreement with the statement, as well as a qualitative component referring to the party programme. The quantitative part is filled in by the party and organised from -2 (strongly disagree) to +2 (strongly agree). The qualitative argumentation is either supplied by the party or taken from the party websites by KiesKompas. To improve the overview and analyse varying political positions across provinces, political parties active in only one province were excluded from the dataset. The quantitative data are represented in a diagram, visualising the position of each party in various provinces.[88] In the diagram, the provinces located in the busy ESE corridor are highlighted.

86 Regional institutions also exist in the Netherlands; however, these are not democratically represented nor responsible for spatial planning.

87 KiesKompas matches voters with relevant parties through an online questionnaire system addressing a few dozen statements (https://nlps23.kieskompas.nl/landing/provinciale-statenverkiezingen-2023/). The original statement on DCs in Dutch was: 'De provincie moet de komst van grote distributiecentra tegenhouden, ook als hierdoor banen verloren gaan.' (English translation author)

88 The data are visualised as a jitter plot to avoid the overlapping of different province datapoints per party. The JSON file, the treated data and the R script used to produce the diagram are available in the repository. DOI: 10.4121/f7ac0c2c-94d8-4aab-9803-ed5f601012e1.

TOC

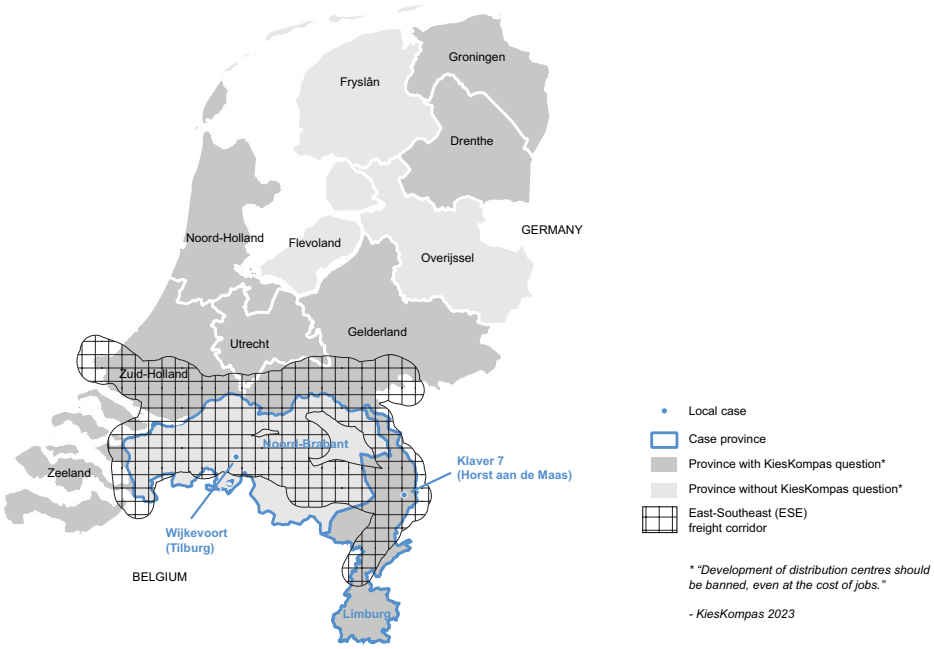


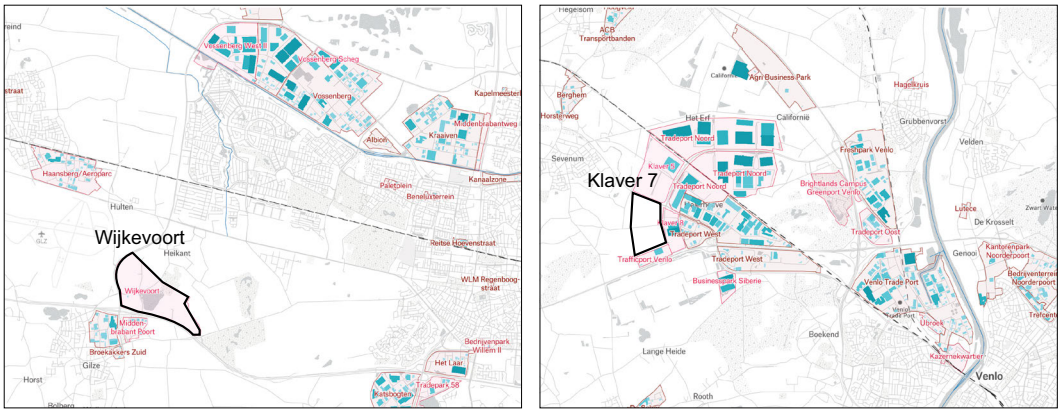
FIG. 6.1 Provinces featuring the question regarding the banning of distribution centre developments during the 2023 elections.

To identify the discursive arguments of logistics developments in hinterland areas, the paper analyses regional newspaper articles in two provinces in the hinterland of the busy ESE freight corridor: De Limburg (Limburg province) and Brabants Dagblad (Noord-Brabant province) (see Figure 6.1). The articles were selected from the newspaper websites by using the keyword 'distribution centre' (in Dutch *distributiecentrum*) and the names of the two respective projects analysed below: 'Klaver 7', part of 'Greenport Venlo', as well as 'Wijkevoort'.

6.3.2 Case study of two Dutch local polemic logistics developments

A more detailed analysis is made regarding the two aforementioned local projects: Klaver 7 and Wijkevoort (Figure 6.2). Similar to the media analysis, the municipal council websites are queried using the terms 'distribution centre' and the respective project names. For context and the triangulation of these findings, an informal interview is held with an expert in each case. Additionally, in both cases, municipal council reports of the decision-making process are analysed.

TOC



Tilburg Greenport Venlo

FIG. 6.2 Cases in the logistical hinterland of the Netherlands.

The logistics development Klaver 7 (Horst aan de Maas municipality, province of Limburg) is the most recent phase of the ongoing Greenport Venlo development[89], following the 2009 masterplan including the simultaneous realisation of ecological and recreational zones in the area (Greenport Venlo & Studio Marco Vermeulen, 2009; Heusschen Copier, 2010; Rijksoverheid, 2010; Venlo, 2012). The expansion of ca. 60 ha is expected to attract logistics and local (non-logistic) SMEs. The housing of migrant workers, who have been necessary in great numbers to run distribution centres, has been a hot item in the debate, which radicalised in a xenophobic direction on certain social media groups.[90] Greenport Venlo is generally considered a best practice in Dutch logistics planning; nevertheless, the development of Klaver 7 caused a fierce local debate (Nefs & Daamen, 2022). For this case, the 28 articles filtered prior to 21 May 2022 in De Limburger[91] are analysed (Figure 6.3) to discuss the pains and gains of the Greenport development. This regional news outlet has been an important platform for the planning discussion on why 'Thousands of square meters have become prey to the cathedrals of 24-hour consumerism' (De Limburger, 16-04-2019).

89 https://www.greenportvenlo.nl/

90 'Arbeidsmigranten Horst aan de Maas' and 'Horst Online', on Facebook.

91 https://www.limburger.nl/

TOC

FIG. 6.3 Cartoon by Berend Vonk in De Limburger (2019-03-14). In regional dialect: 'Nobody understands how beautiful our Limburg is.'

FIG. 6.4 Left: Wijkevoort protester counting his days in front of the town hall in Tilburg. Photo by Bart Kuipers. Right: Socialist Party leader giving an election campaign interview on favouring new homes instead of distribution centres. Photo by SP.

TOC

Wijkevoort (Tilburg, province of Noord-Brabant) is an 80-ha logistics and industry development near a motorway junction situated within an agricultural landscape. Tilburg is considered a logistics hotspot by experts and regional/local politicians, but Wijkevoort is located quite far from existing logistics activities in the municipality. Wijkevoort[92] has had a 20-year-long controversial planning process[93] involving analyses of economic, employment and environmental effects (Bakker et al., 2019; BCI, 2019b; Kruit Kok, 2019). More than 500 protest letters were handed in during the approval process, and for over a year, protesters waved banners in front of the city hall daily (Figure 6.4). Meanwhile, the municipality worries about the high demand for industrial sites and the construction of 25000 housing units, whose inhabitants need jobs. For this case, the 28 articles filtered prior to 21 May 2022 from Brabants Dagblad[94] are analysed, mentioning the gains and pains of Wijkevoort.

The newspaper articles are manually screened for any arguments used regarding the possible gains and pains of the logistics development. Since most arguments are used repeatedly across the articles, the use of each argument is counted and ranked in a table. The council reports[95] are screened for decisions regarding the DC development and the argumentation used. The municipal decisions, generally mentioning the causal policy theories linking a policy measure to a policy goal or problem (Hoogerwerf, 1990; Nefs et al., 2022), are summarised in a table.[96]

92 https://www.tilburg.nl/actueel/gebiedsontwikkeling/wijkevoort/

93 https://tilburg.groenlinks.nl/nieuws/4-vragen-en-antwoorden-over-wijkevoort

94 https://www.bd.nl/

95 https://horstaandemaas.raadsinformatie.nl and https://tilburg.raadsinformatie.nl

96 All screened newspaper articles and municipal documents are available in the repository. DOI: 10.4121/f7ac0c2c-94d8-4aab-9803-ed5f601012e1.

6.4 Analysis results

6.4.1 Regional political discourse on logistics developments

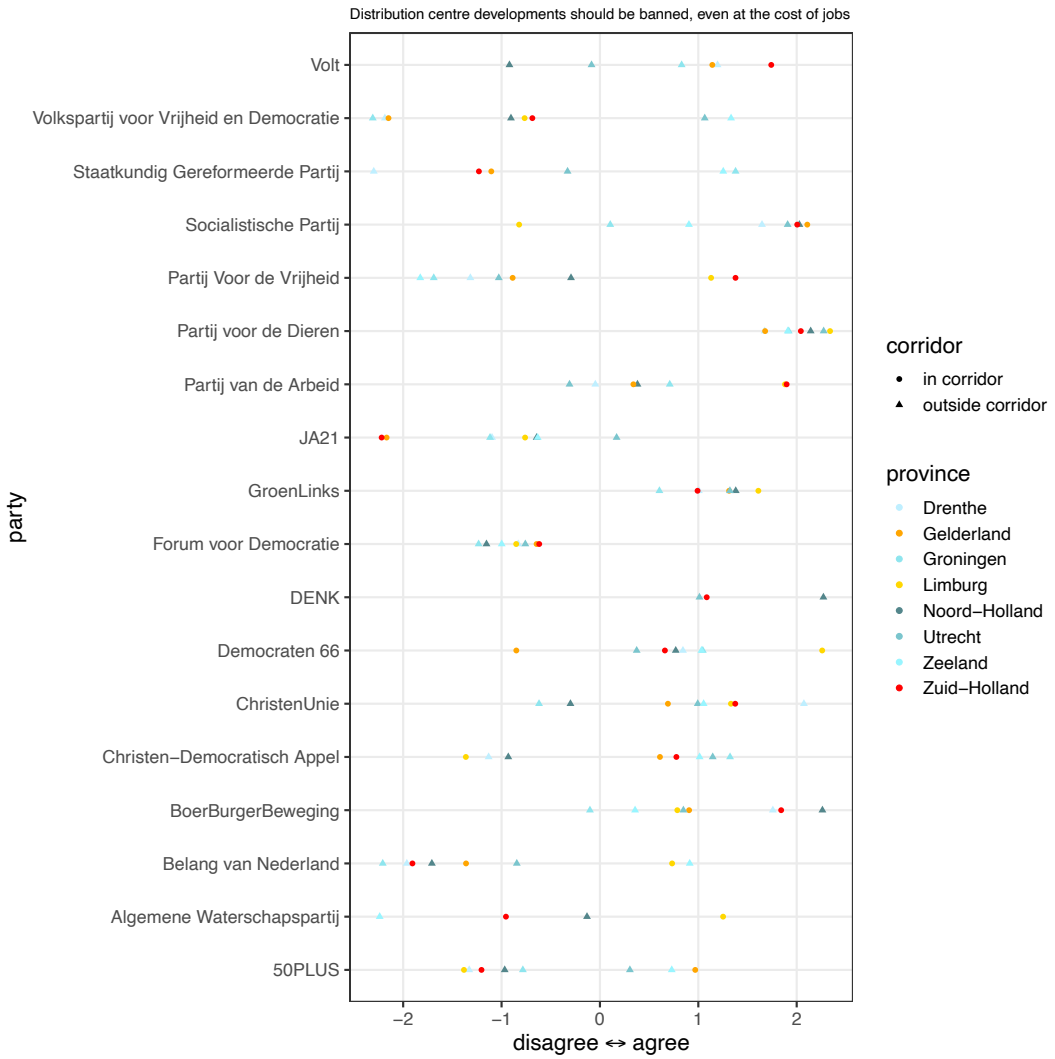


FIG. 6.5 Political party positions on distribution centres. Source: author based on data from KiesKompas.

TOC

The political stances of parties in the provincial elections in 2023 concerning logistics developments are shown in Figure 6.5. What stands out is that the parties in most provinces do not occupy a neutral position on the topic and rather seek the polarised flanks. Some variation occurs along traditional party lines. For example, right and far-right parties[97] mostly disagree, with the left[98] more often agreeing with the statement that DC developments should be banned. However, populist parties[99]—a considerable force in recent provincial politics—are strongly divided. Anti-migrant populist Partij voor de Vrijheid (PVV) mostly disagrees, except in the ESE corridor provinces where migrant labour issues dominate local politics. Agro-business populist Boer Burger Beweging (BBB) agrees because the 'landscape of the countryside is being destroyed by large distribution centres'.

In the provinces where the logistics discourse is most fierce, such as Limburg, more exceptions to the common left-right positions and polarisation occur. Limburg appears at the agreeing flank eight times and on the disagreeing flank six times. Other ESE corridor provinces such as Zuid-Holland and Gelderland present a similar polarisation in the diagram. As an illustration, the Socialist Party (SP) in Zuid-Holland stated the following[100]:

'There is little employment in distribution centres and lots of exploitation of workers. All distribution centres degrade the landscape. Landscape degradation weighs heavier than a few jobs.'

JA21, a conservative party, states in Zuid-Holland:

'Logistics centres are crucial for the economy and companies in Zuid-Holland. They provide employment.'

Some parties appear to have a strong national consensus on DCs, whilst other such as the green liberal party Democraten66 (D66) takes opposing stances across logistics-heavy provinces. For example, this is their stance in Limburg:

97 Volkspartij voor Vrijheid en Democratie, JA21, Forum voor Democratie, Belang van Nederland, Partij voor de Vrijheid, Boer-Burger Beweging.

98 GroenLinks, Partij van de Dieren, Socialistische Partij, Partij van de Arbeid, ChristenUnie, DENK.

99 Forum voor Democratie, Boer-Burger Beweging, Partij voor de Vrijheid.

100 Quotes from KiesKompas, translated by the author.

'D66 wants to create a shift from volume to value in the economy by emphasising added value and the social responsibility of companies in their environment. D66 bans further "boxification" of the landscape by XXL distribution centres that contribute little to the local economy. Workers, accessibility and air quality are not unlimited.'

In Gelderland, D66 stated the following:

'Distribution centres fulfil many of our daily needs: the products in the supermarket, shops and online are handled via distribution centres. Therefore, they are an important part of our lives and economy.'

At the provincial level, the spatial justice argumentation used in the media discourse, listed in Table 6.1, also appears to have played a role. The argumentation on KiesKompas mentions landscape degradation, space for SMEs, economic growth and importance of logistics for e-commerce, migrant labour issues and various types of nuisance.

Some provinces have made or requested advisory reports or made formal restrictive policies on DC development in the years prior to this election. For example, the spatial quality adviser of Noord-Holland published a report (Slabbers, 2021) on the negative landscape effects of XXL DCs, considering the need to also plan for some DC clusters. Drenthe, Gelderland, Noord-Brabant, Overijssel, Zeeland and Zuid-Holland are preparing regulations to allow DC developments larger than 20000 square metres on dedicated sites only. 'Utrecht wants developers to use existing business estates more efficiently because of the scarce space required for housing, energy and nature.' (Van der Borst et al., 2022)

Months before the election, Noord-Brabant province already formalised significant policy changes designating industrial areas where XXL DCs may be developed, whereas in all other sites, this is no longer possible. Besides containing logistics sprawl, the main argument is that SMEs in many urban areas are facing fierce competition for space by large logistics developers (Provinciale Staten Noord-Brabant, 2023). The launch of this new policy is arguably the reason why the province did not employ the statement above on the KiesKompas website. Notably, 3 years before that policy formally started, eight advocacy groups in the province sent a letter to the politicians (Rijnart et al., 2020), asking to put new XXL DC developments on hold, revitalise existing business estates instead and make sound trade-offs between economic, social, landscape and nature aspects. These arguments are consistent with those used in the media discourse (Table 6.1).

The results from the two local development cases and the provincial election analysis point to ample use of spatial justice arguments in the planning discourse, and to the significant influence of such arguments in local and regional decision-making. However, great variability exists across regions and even within political parties. In the next section, a possible explanation for this is provided.

6.4.2 Spatial justice arguments in the regional media discourse on logistics

The persuasive arguments in the media discourse on DC development are organised in Table 6.1. Some of the articles present only gain or pain arguments, with the latter usually from the side of citizens[101]:

'Neighbouring inhabitants are not impressed. They feel like victims of the economy' (De Limburger, 10-03-2020); 'Soon I'll be looking at incredibly high walls. The sheer scale annoys me. And for whom is all this logistics? The benefits are certainly not for the people living in this region.' (Brabants Dagblad, 2020-12-12).

However, many articles attempted to reflect the trade-off that politicians need to make:

'Wijkevoort […] is really, really, the last piece of rural land being transformed into an industrial estate. It was difficult; not for nothing, the debate took 20 years. But you have to decide; the city also wants to grow. […] I can't deny that Wijkevoort has opened up several lines of conflict. […] What's more important is that the development of Wijkevoort makes the conservation of [the other proposed site] Zwaluwenbunders possible, as a green buffer […]. That is a package deal.' (Alderwoman Lahlah in Brabants Dagblad 11-03-2022)

Most gain arguments mention the generation of employment and the creation of space for either sustainable energy production or local scale-up companies. Most pain arguments emphasise the loss of agricultural land and landscape quality, as well as nuisance in the form of pollution and congestion. In Brabants Dagblad, the frequency of gain and pain arguments is slightly more balanced than in De Limburger.

101 Translation of quotes by the author.

TOC

TABLE 6.1 Frequency of arguments used in 56 regional media articles prior to 21 May 2022.

GAINS	Brabants Dagblad	De Limburger	Total freq.
employment growth	7	7	14
space for sustainable solar and wind energy / energy hub / circular production	3	5	8
creating space for local scale-up companies or residential developments	6	1	7
economic development	5	1	6
enabling e-commerce	1	5	6
compensatory development of ecological corridors and recreational green structures	4	1	5
innovation, value-added logistics activities	3	2	5
municipal land sale profits	2	1	3
TOTAL arguments	**31**	**23**	**54**
PAINS	**Brabants Dagblad**	**De Limburger**	**Total freq.**
transformation, dissapearance and deterioration of agricultural landscape and biodiversity	17	16	33
noise and air pollution	5	3	8
lack of space for local small-medium enterprises	3	5	8
road congestion	1	6	7
competition over scarce personnel	1	5	6
jobs not suited for local employees, but rather attracting more migrant workers	1	5	6
heat stress	5	0	5
nitrogen emissions, damaging nearby nature areas	4	1	5
risk of economic monoculture of logistics / lack of economic diversity / low added value	4	1	5
blocking of view	2	3	5
housing issues regarding migrant workers	2	2	4
possible future vacancy of warehouses	2	1	3
loss of recreational area for nearby inhabitants	2	0	2
precedent for further developments	1	0	1
TOTAL arguments	**50**	**48**	**98**

6.4.3 Spatial justice arguments in local decision-making on logistics

The city council reports[102] containing municipal decisions and coordinative/justificatory statements regarding both developments are presented in Tables 6.2 and 6.3. These go back a few years until reaching a clear picture of the approval process in 2021/2022. Expert reports have served a role in the decision process, most importantly regarding the employment and environmental effects of the development. The decisions regarding Klaver 7 and Wijkevoort followed a similar overall path, leading from the approval of a preliminary master plan or vision for the area, after which discussions emerged, with decisions being made in 2021/2022. Klaver 7 is postponed until new development scenarios are developed, whilst Wijkevoort is approved with increased standards. These elevated standards—including higher spatial quality and local added value—are explicitly part of the political negotiations in the council meetings, as can be found in the reports, and evidently influenced by the arguments used in the media discourse.

TABLE 6.2 Municipal council decisions on Klaver 7 in Horst aan de Maas. Source: https://horstaandemaas.raadsinformatie.nl/.

Date	Decision Horst aan de Maas
2019-07-03	Establish municipal right to purchase Klaver 7 land
2020-01-01	Consider put Klaver 7 on hold
2020-11-10	Take into account citizen view on Klaver 7 development, safeguarding aspects of traffic, nature compensation and accessibility; approve updated structuurvisie
2021-01-01	Agrofood and manufacturing aim for Klaver 7, instead of logistics services
2021-06-24	Make land use plan and impact study for Klaver 7
2021-08-09	Permit given for housing migrant workers
2021-11-23	Freeze logistics developments, not approving new sites including Klaver 7 for time being
2021-11-23	Municipality to keep strictly to discussed standards concerning spatial quality instead of quantity of land development, including nature and landscape development, measures to ensure livability of inhabitants. Synchronize policy with status of development, only then can development continue.
2022-01-02	No new permits given for housing of migrant workers, verification of quality of existing housing sites, freeze klaver 7 development until the various involved municipalities take responsibility in housing of migrant workers, landscape and traffic issues are solved, and accepted motions are executed
2022-03-25	Reassess land use plan for Klaver 7, to accommodate less XXL logistics and more space for local small-medium enterprises
2022-05-10	Consider freezing large logistics developments klaver 7, only approving a landuse plan for Klaver 7 focusing on innovative (high)tech firms, with maximum plot size of 3ha, with citizen participation in landscape integration plan
2022-07-12	**Adopt: development of alternative scenarios for Klaver 7. Including full development, cancellation, smaller parcel structure and a mix of small parcels with nature and sustainable energy**

102 All analysed reports are available in the repository.

TOC

TABLE 6.3 Municipal council decisions on Wijkevoort in Tilburg. Source: https://bis.tilburg.nl/.

Date	Decision Tilburg
2018-02-05	Adopt the masterplan for development process of Wijkevoort
2021-01-01	Frame Wijkevoort development in context of knowledge intensive industry stimulation in Tilburg
2021-02-01	Allow smaller companies that do not meet the minimum space requirements of Wijkevoort, to pool together in the development
2021-05-01	Frame Wijkevoort development in context of growing freight traffic, industrial site developments, housing of migrant workers and inner city redevelopment.
2021-05-01	Frame Wijkevoort development in context of creating space for large and middle-size companies in Tilburg, in a sustainable setting
2021-06-14	Establish municipal preference to purchase the Wijkevoort land
2021-06-14	Propose land use plan 2020 for Wijkevoort
2021-08-03	Not organize referendum on Wijkevoort development, having evaluated 27 written protests and regarded these invalid
2021-08-03	Change in plan phases, decision to invest 0.5 million in green structure up front
2021-09-01	Budget decision to realize landscape park Pauwels, Stadsbos 013 and work landscape Wijkevoort, according to economic and landscape ambitions of Tilburg
2021-09-07	Participation in pilot Circulair Wijkevoort
2021-11-09	Establish development guidelines and evaluation process to guarantee the quality of the Wijkevoort development, in social economic, landscape and ecological terms.
2021-11-15	Change sustainable design standards (Breeam) to highest (outstanding), and if not possible the minimum is excellent; higher standards in several spatial quality aspects; minimum of 50% external experts in Quality Team
2021-11-15	Adopt the land use plan and development guidelines of Wijkevoort; declaring not valid the ca. 500 written protests
2021-11-15	**Adopt: amendment to improve landscape integration and façade design standards of Wijkevoort; amendment to add health expertise to Quality Team; amendment to act on light pollution; motions to empower the council with procedures to control the developments when they start; motions to dedicate more parcels to local small-medium companies and allow pooling of small companies**

Horst aan de Maas municipality decided to postpone the development, reassess it and first develop alternative scenarios—including one with smaller parcels for SMEs and more space for nature (Raadsbesluit July 12th 2022):

'Klaver 7 is the last part [of Greenport] that we develop. Here, we accommodate high-end manufacturing and not logistics service providers. We chose a phased process with a preference for local small companies. The agreements on nature development, landscape […] and traffic are prerequisites for the further development of Klaver 7. The same goes for agreements on proportional housing of labour migrants in the Greenport municipalities. […] Considering that provinces other than Limburg are becoming reluctant in attracting logistics centres.'

The decision clearly cites several gains and pains arguments (see Table 6.1). Furthermore, it mentions an increasingly critical stance in other provinces to justify the need for higher development standards in logistics areas and the feasibility of raising these. However, this remains a matter of negotiation. The commercial director[103] of Greenport Venlo Development Company, Christian Heerings, stated the following:

'If Horst cancels the plan, it will also lose the profits and other benefits, such as new business estates where local scale-up companies can relocate.'

On 15 November 2021, the decision by Tilburg to adopt the Wijkevoort land use plan and development guidelines with additional criteria clearly demonstrates the influence of spatial justice argumentation (Table 6.1) in the policymaking process (Tilburg, 2017, 2021). The guidelines include a strict selection procedure for companies that can build in Wijkevoort—involving a board of external experts, as well as proof of regional added value and innovation, landscape and ecological criteria, the wellbeing and health of workers and residents, climate adaptation, accessibility and traffic safety, circularity, water management, renewable energy and the housing of migrant labourers. In particular, current XXL logistics service providers are unlikely to pass the first criteria of regional added value and innovation.

A remarkable decision made was to abandon a solicited Wijkevoort referendum on procedural grounds, a decision that may have saved the local political coalition at a time of increased criticism related to the development; however, this certainly increased the protests. Shortly before the decisive council meeting in November 2021, a talk show was planned in Tilburg with experts (including the author of this paper). It was cancelled after complaints in Brabants Dagblad (2021-10-06) that key protest groups had not been personally invited. Alderman Van der Pol[104] stated the following: *'The very people demanding openness of affairs around Wijkevoort ended up shutting down the debate.'* Whilst local activism, supported by expert advice, appears to have enabled a more just local trade-off regarding hinterland logistics, its more radicalised and NIMBY branches seem to have hampered the public debate.

103 For the paper, an interview was held with the commercial director of the development company, of which Horst aan de Maas is a shareholder.

104 For the paper, an interview was held with the alderman responsible for the adaptation and approval of the plan, in May 2022.

Despite the similar institutional context, the varying outcomes of the two cases can be explained by two factors: the level of ownership of the development—or 'skin in the game'—and path dependence. First, since Klaver 7 is part of the much greater development of Greenport Venlo, Horst aan de Maas owns merely 8.3% of the shares in the development company, which allows the council to view the negative aspects of, for instance, the XXL warehouses and related migrant workers—as an external threat. On the other hand, Tilburg has political and financial ownership regarding Wijkevoort, with no one else to blame. The municipality had the difficult task of approving either this development or another one—Zwaluwenbunders—located in a large and delicate cultural landscape area north of the city centre—Park Pauwels.

Secondly, as often happens (Hein & Schubert, 2021), path dependence in both municipalities influenced the political discourse. Horst aan de Maas entered the Greenport project to strengthen its local agri-food sector whilst simultaneously realising nature areas (Nefs & Daamen, 2022). As it became clear that Greenport did not attract the desired companies, but rather XXL distribution centres, the municipality became more critical when the development approached its territory. Tilburg feels the pressure of maintaining a logistics hotspot, the fruit of its former policies since 2000, since it employs many of its inhabitants. Another long-term policy choice, to realise Park Pauwels, conflicted with the development of the Zwaluwenbunders logistics site, thus making Wijkevoort the only available option.

6.5 Towards a framework of spatial justice trade-offs

The planning discourse analysed above clearly illustrates that hinterland logistics in the Netherlands is being discussed as an issue of distributive spatial justice. The media and political discourses, as well as the local decision-making process, reflect the conflicts of interests and the constant trade-offs between different kinds of gains and pains related to varying areas and stakeholders at various spatial scales. However, there is no evidence of the deliberate outsourcing of nuisance to vulnerable social groups in the hinterland, as seems to be the case in the LA region (De Lara in P. V. Hall & Hesse, 2012; Yuan, 2019). Tilburg and Horst aan de Maas are generally not regarded as the periphery of the Port of Rotterdam, and rather as related logistics growth poles with strategies and trade-offs of their own. Nevertheless, the relevant discourse highlights how difficult the trade-off between regional—or (inter) national—gains vs local pains is, both locally and regionally.

NIMBYism also seems to play a role (e.g. inhabitants attempting to avoid the blocking of their view or the arrival of migrant worker facilities near their homes). The way in which DCs and temporary housing facilities are typically designed—big boxes and stacked portacabins—tends to stimulate NIMBYism. However, NIMBYism does not seem to dominate the media reports or decision-making processes. The logistics sector opinion appears throughout the media discourse, whereas the corporate lobby is less easy to identify since it influences political positions through backchannels.

The question remains how the large variability of political positions can be explained across regions, as well as across and within political parties. If the DC development trade-off simply involved striking a balance between a vital economy and the quality of the environment (or quality of life), one would expect a political deal with only moderate variation among provinces—perhaps slightly favouring the economy in the busy ESE corridor and the landscape in other areas. However, the trade-off appears to be far more complex. The argumentation analysed above allows a more detailed understanding of spatial justice trade-offs in hinterland logistics development, which contains at least five distinct layers visualised in the proposed framework (see Figure 6.6) that are organised from broad to specific trade-offs.

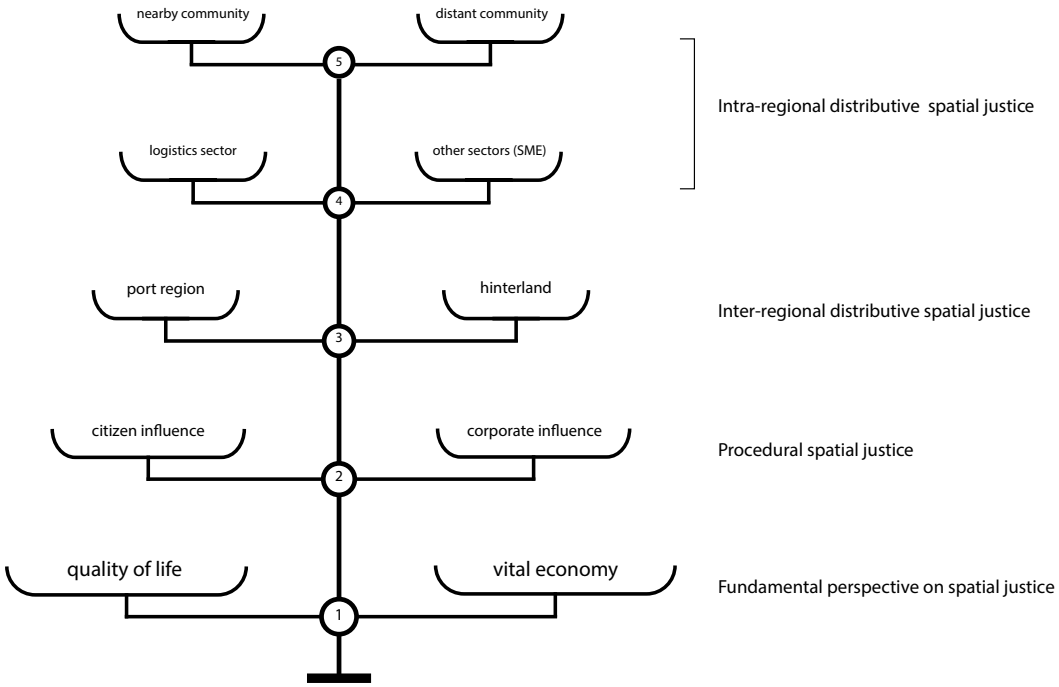


FIG. 6.6 Framework of spatial justice trade-offs observed in the planning of hinterland logistics developments.

The most fundamental perspective on spatial justice in logistics developments concerns the trade-off between the quality of life and economic development of a region. Whilst these aspects do not necessarily contradict, there often exist more concrete political tensions and spatial conflicts between them. It is in this rather abstract realm that compromises can more easily be found, and visions can be aligned. For example, companies may increase their 'licence to operate' by realising part of the ecological and recreational infrastructure in and around the developments, whilst government strategies may attempt to stimulate economic activities that improve the landscape and take measures to improve quality of life, which is crucial for knowledge-intensive firms (Luttik et al., 2008; Luttik & Veer, 2010; Nefs, 2016).

A second layer in the framework pertains to procedural justice. The spatial justice trade-offs between citizens and companies are by far the most entrenched—and at times even cynical—part of the discourse. They are characterised by protests (often involving NIMBYism) against developers and local authorities allowing a development; by free riders—opponents of local logistics developments who eagerly use delivery services anyway; as well as by companies refusing to give up old business models or significantly reduce their impact. As mentioned in several of the analysed media and council reports as well as the interviews, what seems to be particularly problematic for citizens and civil servants are the lobby and backroom deals between local politicians and large corporations. Better-designed and more transparent procedures in planning can help to avoid these issues.

A third level concerns inter-regional justice. The distribution of gains and pains among regions, as either a just equilibrium or problematic disbalance, is part of the traditional spatial justice discourse. Even when there is no centre-periphery issue like in LA, a logistical hinterland region performs tasks—enabling e-commerce, for example—that benefit metropolitan centres and other regions (Santos, 2006). Thus, it is important to understand how hinterland regions can sufficiently capture the economic development gains—including employment and investments in green areas and sustainable energy—in return.

The fourth and fifth levels are part of intra-regional justice, separated by trade-offs between different economic sectors and social groups. The discourses in both analysed local cases address the increasing dependence on a single sector (logistics) in the regional economy, demanding more personnel than the region can supply, as well as multinational investors acquiring land for large DC developments whilst local SMEs struggle to find space and personnel to maintain or scale up their businesses. This last aspect is taken very seriously by the media and politicians in both cases, as well as in the provincial elections. Multilevel planning including several provinces and possibly the national government could serve an important role here (Nefs, 2023a).

The distribution of logistics gains and pains across social groups within regions poses another difficult trade-off in terms of employment and nuisance. Many low-skilled workers in the area depend on DCs for their livelihood. However, the dominant way of contracting migrant workers from Eastern Europe has led to problematic working and housing conditions in the Netherlands. According to the literature, the sector has also made the functioning of worker unions difficult (Bergeijk, 2019; Coe & Hess, 2013). The perspective of the migrant worker is rarely considered in logistics planning. It can be argued that, for them, it would be better to have such employment opportunities closer to home (e.g. in Poland) or to have temporary housing integrated in the urban areas instead of in segregated facilities.

Furthermore, DC-stimulating regions appear to become vulnerable to economic lock-ins, harming the regional economy as a whole (Nefs, van Haaren, et al., 2023). The often-mentioned gain of facilitating e-commerce seems to be a non-transferable good from which everyone benefits (Moroni, 2020), yet groups with a high consumption pattern—usually located far from DCs—benefit more, whilst the environmental impacts (air pollution, noise, congestion) of DCs are felt more strongly by nearby communities. However, mitigating measures can locally contribute to this issue.

Finally, hinterland logistics have become such a highly contentious issue that debates become rather simplistic. Political trade-offs in the planning discourse are often formulated with extreme bluntness and bias. Take the following KiesKompas statement as an example: *'Distribution centre developments should be banned, even at the cost of jobs.'* It suggests a trade-off between more DCs in the landscape and decreasing employment. Not building DCs would arguably impede the increase of logistics jobs, instead of decreasing existing employment—jobs often held by temporary migrant workers instead of residents. Additionally, alternative land uses might increase employment in other sectors (Kuipers et al., 2018; Rli, 2016). Sufficient information on and understanding of the proposed development, including its positive and negative effects on various levels and actors, thus seems to be crucial in a just planning process.

6.6 Conclusion

This paper analysed the local and regional planning discourse on logistics developments, particularly involving XXL DCs. The analysis identified ample use of gain and pain arguments in persuasive, coordinative and justificatory discourses (Healey, 1999) in the media and politics. Therefore, it can be affirmed that logistics developments in the hinterland of The Netherlands are perceived as a spatial justice issue. The arguments of the discourse have directly influenced municipal council decisions in the studied cases as well as policymaking at the provincial level. Both local cases show a similar decision for higher development standards due to the spatial justice arguments. Minor differences between the two cases can be explained by the amount of (political and financial) ownership, as well as path dependence. Although decision-making has considered quantitative and qualitative research (e.g. regarding employment and environmental effects), the final trade-off between all gains and pains was instead the result of a media-influenced political debate including balanced argumentation but also framing and bias.

At the regional scale, political stances concerning DC development are fragmented and only partly divided along the expected right-left lines that have been used to understand and form political coalitions. Additionally, there is great regional variation within the same parties. This can partly be explained by the rise of populist parties using the topic of logistics to gain influence. The variation appears to be linked to complex multilevel trade-offs, which differentiate the provincial and national party stances on employment, migration, entrepreneurial and landscape effects, as well as the distribution of nuisance related to DC development. The framework presented in this paper structures these trade-offs, from fundamental and procedural to inter-regional and intra-regional justice. However, some trade-offs can hardly be made at the local level alone, such as the gain of enabling e-commerce for a large region versus the local noise and air pollution.

Further research might further disentangle the decision-making process regarding the described trade-off levels. A better understanding is needed of how hinterland regions can sufficiently capture the economic development gains—including employment and investments in green areas and sustainable energy—in return. Longitudinal monitoring and the analysis of long-term spatial outcomes of DC development in relation to local and regional planning discourse development can improve the understanding of spatial justice in its distributive and procedural forms.

Planners dealing with hinterland logistics issues are recommended to address trade-offs at all aforementioned levels of spatial justice by stimulating economic activities that improve the landscape and quality of life by enhancing multilevel planning including several provinces and possibly the national government, enabling local mitigating measures and creating a transparent planning process based on information from independent experts. The polarised regional discourse demonstrates the need for clear national decision-making to create a level playing field for regional logistics developments across the country.

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TOC

7 Applying a logistics cluster typology in spatial planning for circularity

Lessons from a Dutch policy lab

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ABSTRACT The spatial planning of logistics is an emerging topic due to scarcity of land, environmental impacts and the transition to a circular economy. This paper proposes a policy information tool for these issues, including a new logistics cluster typology applied in suitability maps. The validity and applicability of this tool are tested in a Dutch policy lab. The analysis reveals two stakeholder views: one emphasising an informed multilevel dialogue and the other pointing to local freedom of decision making. Applicability can be improved by training, updating and deciding on a clear status of the tool in the policy process.

KEYWORDS logistics typology; spatial planning; circular economy; policy tool; policy lab

7.1 Introduction to the spatial planning issue of logistics

In spatial planning—occurring in the Netherlands, other European countries and the US—logistics clusters have become a key topic due to their increasing spatial footprint, employment conditions, nuisance and the 'landscape boxification' debate (Aljohani & Thompson, 2016; CRa et al., 2019; Heitz et al., 2017; Hesse, 2020; Krzysztofik et al., 2019; Strale, 2020; Woudsma et al., 2016; Yuan, 2019). Nevertheless, spatial planning remains a crucial facilitator of logistics through zoning and infrastructure planning.

Recent research has highlighted three urgencies in the practice of planning logistics clusters: (i) multilevel planning appears to be necessary to achieve logistics developments of sufficient quality and adequate quantity with regard to location choice and landscape integration (Nefs & Daamen, 2022); (ii) the use of detailed typologies—while considering location characteristics and the socio-economic context of logistics activities—is deemed necessary for accurate spatial planning (Heitz et al., 2019; Sakai et al., 2020); (iii) the new economic paradigm of the circular economy (CE) will change the spatial requirements of the logistics system and are not yet part of planning practice (Akkerman et al., 2019; Rood et al., 2019). Logistics is traditionally seen as an enabler of what is called the linear economy, predominantly distributing products in extensive global supply chains. More recently, the logistics sector has been seen as a key factor in the transition to the circular economy since the handling of goods and materials facilitates recycling and remanufacturing activities (Bucci Ancapi et al., 2022; Kębłowski et al., 2020; Rli, 2013, 2015; Van Buren et al., 2016).

Although providing information on these topics in the policy-making process seems crucial, there remains limited knowledge of how this can be done with sufficient validity and applicability. This paper contributes to this issue by proposing an information tool for the spatial planning of logistics from a CE perspective. Policy tools or instruments have been categorised in many ways, ranging from restrictive (sticks), to procedural to stimulating (carrots) to strategic (Acciai & Capano, 2021; Stead, 2021; Van Nispen, 2011). The proposed tool falls in the category of information tools, which join and communicate information to influence policy. It is based on four new logistics cluster types, which were elaborated from present typologies in the literature.

The present study tests the validity and applicability of the tool in a Dutch policy lab in 2022/2023. In a policy lab—an organisational form increasingly used in countries such as the UK—knowledge from research, peer institutions and experts is applied, thereby bridging 'the gap between what we know and what we do', to develop policies and test and adapt these without going through the implementation process (Lee & Ma, 2020; Whicher, 2021). In this lab, the typology is operationalised in suitability maps for each logistics cluster type. These maps are based on parameters and mechanisms found in the literature and data sources, after which they were adapted several times after feedback from stakeholders. Nevertheless, it is important to remember that maps are never a full representation of the territory; instead, they are a social construct of selected norms and issues that are part of a discourse regarding that territory (Zonneveld, 2021). This explains the fact that maps are both common and inflammatory items in policymaking. The use of map tools as planning support systems is often suboptimal since these tend to focus on the digital system and spatial elements and too little on the stakeholder context (Pelzer et al., 2015). In this context, there are often groups with varying views on policy problems, goals and solutions (Veselý, 2021), as well as varying interests and knowledge levels. Furthermore, the better a tool strengthens the existing features of the policy context, the sooner it is selected (A Bressers, 1998). By analysing the policy lab, the present study aims to answer the following question:

How are the validity and applicability of logistics cluster typologies for the CE, as well as related information tools, perceived by Dutch planners and policymakers?

The next section proposes a cluster typology based on the recent logistics and CE literature. The third section introduces the Dutch policy lab, in which the typology is applied as a map tool. It also introduces the Q-methodology used to assess different stakeholder views on the typology as a policy tool of spatial planning. Section 7.4 presents the results, whilst section 7.5 discusses the implications for the interdisciplinary spatial planning discourse and provides directions for further research.

7.2 A logistics cluster typology for spatial planning in the CE

How do existing definitions of logistics location types relate to the emerging CE, and how can they be used in spatial planning? A CE, or circular (city) region, is generally understood as a system that strongly reduces the intake of primary resources and energy, as well as environmental impacts such as waste and emissions (Bucci Ancapi et al., 2022). Although CE is a normative, emerging and not (yet) uniformly defined concept, researchers have argued that CE activities have direct implications for logistics activities and land use. For example, decreasing material consumption, increasing reuse, the repair and refurbishing of products, as well as changing scales of production chains and cycles are argued to be necessary to transition towards a CE (Hanemaaijer et al., 2021; PBL, 2022; Warringa, Juijn, Van Heest, & Hagens et al., 2022). The core activities of a CE, such as recycling (Burger et al., 2017), are indeed hardly imaginable without logistics. Recent CE policy instruments have varied broadly from green import tariffs and green innovative production incentives (Bauwens et al., 2020; Rodrik, 2018, p. 262) to spatial policies prioritising CE companies in spatial developments, such as the Port of Antwerp project BlueGate. No matter how the CE develops, it appears unavoidable that it will require more space than the current economy (PBL, 2022). Researchers have argued that, besides the changing production chains, a more comprehensive approach to wellbeing is also part of the CE. Planning should therefore also aim to decrease environmental impacts and spatial injustice regarding logistics (deSouza et al., 2022; Strale, 2019; Yuan, 2018).

7.2.1 Existing typologies

Logistics location typologies in the literature have generally focused on these parameters:

1 The logistical function of individual facilities, such as ports, inland terminals or transport companies (Sakai et al., 2020; BCI, 2021), as well as specialised value-adding activities including customs clearance, warehousing, postponed manufacturing and third-party logistics services (Bowen, 2008; Hsuan Mikkola & Skjøtt-Larsen, 2004; Meza-Peralta et al., 2020). A comprehensive overview of these functional aspects is shown in the typology by (Buldeo Rai et al., 2022).

TOC

2 A business-to-client (B2C) or business-to-business (B2B) orientation, as well as a geographical range, which can be regional, national or international (Buldeo Rai et al., 2022; CRa et al., 2019; Rodrigue, 2020).

3 Market segments such as food, agro bulk, manufacturing components, consumer goods, parcels and express shipments, and returned purchases (Heitz et al., 2019; Meza-Peralta et al., 2020).

4 The distance to urban centres and the population density of their surroundings, building footprints and the number of employees (Boudouin, 2012; Cidell, 2010; Dablanc et al., 2014; Ducruet in Geerlings et al., 2018, p. 92; Heitz et al., 2019; Rodrigue, 2020).

5 Socio-economic context, distinguishing urban and suburban wholesale trade, logistics nodes, suburban logistics, as well as low-logistics areas in either a suburban high-income context or a rural low-income context (Dablanc et al., 2014; Strale, 2020).

The literature also highlights a rapidly growing number of logistics services that are relevant for a typology based on CE, such as reverse logistics—handling returned goods for reuse or recycling—and the supply of spare parts in repairs or remanufacturing (Coe & Hess, 2013; Rushton & Walker, 2007). It appears that for a logistics typology to be effective in spatial planning with regard to the CE, it must extend beyond the mere operational functions of a single terminal or warehouse in the logistics network (e.g. transhipment or storage). What needs to be included is the economic function of logistics facilities in their spatial contexts, discerning at least the urban/suburban position, roughly the types of services that are provided and the orientation towards either (re)manufacturing processes or consumers. Since these aspects often transcend a single building and involve a larger area, what seems to be required is a logistics cluster area typology rather than a logistics company location typology.[105]

105 The spatial planning debate on logistics in The Netherlands also moves in that direction (CRa et al., 2019) since the fragmentation caused by single warehouse projects is considered damaging to the landscape.

7.2.2 Role of logistics in the circular economy

What are the logistical requirements of the CE, following the circular ambitions of governments and companies? At a minimum, reverse logistics—the upstream movement of goods back from consumers to distributors and producers with the purpose of dealing with purchase mistakes, the recycling of materials as well as the remanufacturing and refurbishing of products—is part of such requirements (Hawks, 2006; Korhonen , Honkasalo, & Seppäläet al., 2018; Bucci Ancapi et al., 2022). Recent economic policies and business strategies, such as near-sourcing and reshoring of industries, can also be important steps towards the CE (Adrian, Hill, & Warden et al., 2018; Geerlings et al., 2018, p. 275). Logistics networks, clustering and the co-agglomeration of interdependent industries are mentioned in these strategies as means to decrease transportation and the importation of raw materials (Van Buren et al., 2016).

The economic activities that shape the CE in cities and regions are an emerging field of study (Burger et al., 2017; Ekins et al., 2019; Kishna et al., 2019; Smit et al., 2014; Williams, 2019). Many studies have labelled these activities by order of impact in the so-called R-strategies, ranging from refuse (R0) via repair (R4) to recovering energy from waste incineration (R9) (Kirchherr, Reike, & Hekkert et al., 2017; Potting, Hekkert, Worrell, & Hanemaaijer et al., 2017). Another way of distinguishing CE activities is between core and enabling activities. The core (R3–R9) requires specific logistics cluster locations, featuring bulk transport hubs, warehouses and the possibility of producing nuisance, while the enablers (R0–R2, including design, engineering, digitalisation and supply chain management) are often found in urban offices. Thus, for the development of a logistics cluster typology, the core CE activities are most relevant. In many logistics locations, the CE will likely face competition for space due to other autonomous trends that drive demand for warehouses, such as e-commerce and the de-risking of supply chains (Nefs & Daamen, 2022).

However, for a logistics cluster typology, this paper focuses on the qualitative spatial characteristics derived from expected activities in the CE of the Netherlands, as recently assessed by Van Buren et al. (2016, p. 8), PBL (2022) and (Warringa et al. (2022, pp. 5,9), following the aforementioned R-strategies. Several assumptions are made regarding the possible spatial impacts of CE activities on logistics clusters in the Netherlands in Table 7.1. Notably, three patterns stood out. First, the increase in spatial demand seems to be more impactful than the possible reduction in spatial demand in the CE. Second, various CE activities in the R-strategies appear to have similar spatial requirements. Third, medium-sized warehouse facilities in urban areas close to consumers are required, as well as (extra) large facilities in high-nuisance peripheral locations.

TABLE 7.1 Assessed potential spatial requirements of logistics in the CE, by the author. Based on the R-strategies (Kirchherr et al., 2017), PBL (2022), Warringa et al. (2022) and Van Buren et al. (2016).

R-Strategy definition	Assessment of activities (literature)	Assessment of spatial requirements (author)
0. Refuse **1. Rethink** **2. Reduce** (Product function replaced by alternative; sharing or other intensive use; manufacture with less resources)	Less consumption of products; Extended life cycles of products; Minimising of unnecessary transportation of goods.	Reduced demand for extra-large (reexport, retail and e-commerce) warehouses; Reduced demand for transport capacity related to global supply chains. Increased demand for consolidation of freight flows in intermodal hubs; Spatial clustering of interdependent industries, possibly near such hubs.
3. Reuse **4. Repair** **5. Refurbish** (Product in good condition used by other consumer; maintenance of defective product; restoring and updating products)	Increased regional flows of existing products for temporary storage before reuse, repair services, and refurbishing; Shortening of certain chains and cycles.	Increased demand for medium-sized warehouses with specialization in certain niche markets and services, near the consumers; Increased demand for (extra)large warehouses for more common flows of used products, including platform-based services (Amazon, Alibaba etc.)
6. Remanufacture **7. Repurpose** (Using part of discarded product in new product with same or different function)	Not explicitly mentioned	Arguably the same spatial requirements as R3-R5, with possibly more nuisance.
8. Recycle (Processing materials to obtain same or lower quality)	Collection, storage, separation, processing, and packaging of materials.	Increased demand for medium-sized warehouses for collection near the consumers; Increased demand for (extra)large warehouses and exterior spaces in clustered nuisance-permitting locations with bulk-transport capacity for effective handling and storage of collected and processed material.
9. Recover (Incineration of material with energy recovery)	Not explicitly mentioned	Demand for high-nuisance permitting locations with bulk-transport capacity.

In summary, the following variables appear to be key in a logistics cluster typology within the CE and applicable to spatial planning:

1. Urban/suburban position, with regard to proximity and nuisance.
2. Provided services.
3. Orientation on manufacturing (B2B) or consumption (B2C).
4. Regional/global flows of goods.
5. Size of logistics facilities.
6. Grouping—vertical or horizontal clustering—of CE activities.

7.2.3 New typology for logistics clusters

The aforementioned variables are used to build a new typology of logistics clusters aimed at spatial planning and the CE, following the following argumentation. The first variable in practice is a result of the chosen market orientation and range (variables 3 and 4), whilst the second variable has too many different and changing options for a simple typology (it also seems highly dependent on variables 3 and 4). In contrast, variables 5 and 6 are not distinguishing enough for four meaningful quadrants in a typology. Variables 3 and 4, the orientation on manufacturing versus consumption and the enabling of regional versus global flows, thus appear to be determining variables from which the others can largely be explained. Therefore, these form the main axes of the typology (Figure 1), whilst the other variables are used in the detailed description of the four resulting quadrants: *materials and energy, (re)manufacturing, (inter)national distribution* and *city logistics clusters*. The assumption for each type is that in the CE and spatial planning[106], logistics is spatially more combined with other productive or consumptive functions.

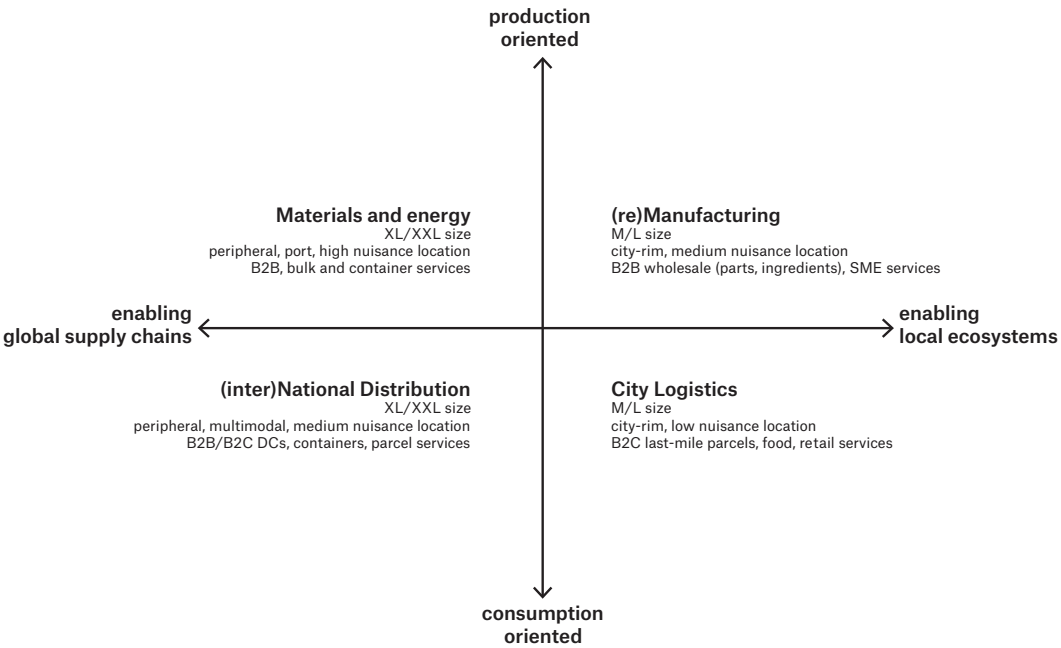

FIG. 7.1 New logistics cluster typology, by the author.

106 See the recent spatial planning principles of The Netherlands (BZK, 2020, p. 73). The combination of functions is stimulated rather than monofunctional areas.

TOC

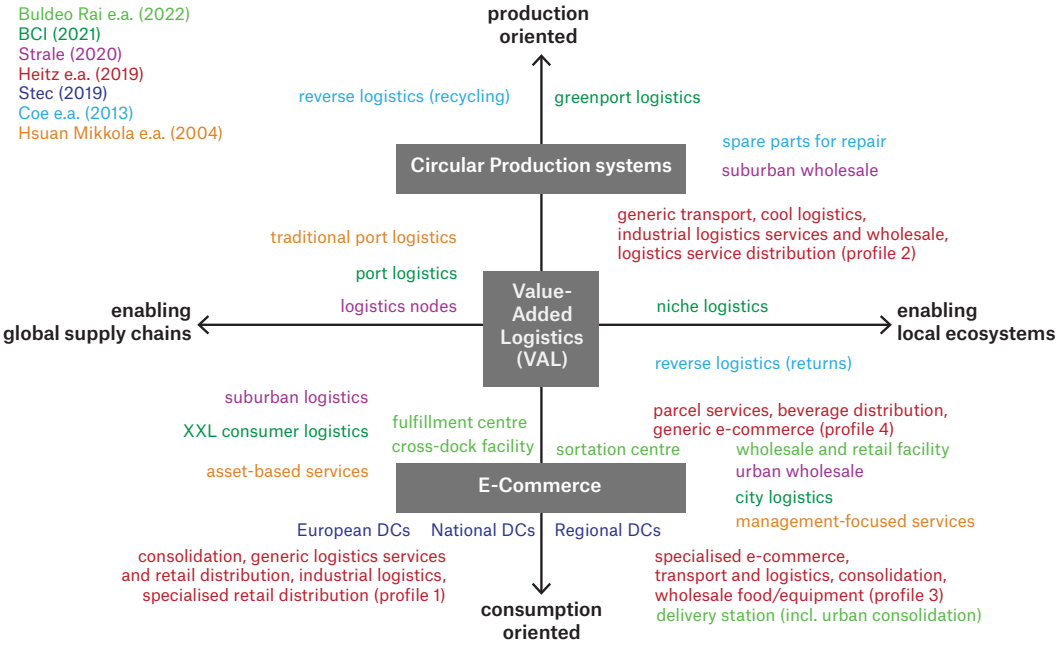

FIG. 7.2 New logistics cluster typology, populated with existing typologies by Heitz e.a. (2019), Coe e.a. (2013), Strale (2020), Hsuan Mikkola e.a. (2004), Buldeo Rai e.a. (2022), Stec Groep in CRa et al. (2019) and BCI (2021).

The level of suburbanisation and warehouse size varies per logistics cluster type: the types in the left part of the new typology (Figure 7.1) are likely to be located in peripheral areas and contain (X)XL buildings, whereas the types on the right are located near urban centres and contain M/L buildings, in line with (Buldeo Rai et al., 2022; Heitz et al., 2019). Although the spatial typology differs from the existing—mostly functional—ones, the location types of the discussed references can be quite clearly accommodated. To verify the relationships with the existing typologies, Figure 7.2 superposes these, along with three large groups of activities that came up in the policy lab discussions but do not fit strictly within one of the quadrants: value-added logistics, (circular) manufacturing and e-commerce.

7.3 Implementation and assessment of the new typology

7.3.1 Policy lab focusing on large logistics buildings

The Netherlands provides a critical spatial planning case for the application of such a typology (Flyvbjerg, 2011) because the country has concrete policy goals of transitioning to a CE[107] by 2050 (BZK, 2020; IenW & EZK, 2016; VNO-NCW and MKB-Nederland et al., 2017) whilst maintaining its logistical position as a gateway to Europe (BZK, 2020; Nefs et al., 2022). With its large freight infrastructure and strategic position in Europe, the Netherlands can arguably serve a significant role in the CE, such as with regard to plastics (CE Delft, 2021). Estimates in the Netherlands suggest that the spatial impact is large since circular port activities in Amsterdam and Rotterdam would take up 30% more than the current space (Peters, 2018; Rienstra, 2022; Warringa et al., 2022). However, in practice, the co-agglomeration of (re)manufacturing and logistics in the Netherlands remains scarce (Nefs, van Haaren, et al., 2023).

The Dutch national government has recently initiated a programme called Grip[108] to increase the clustering of logistics development in appropriate locations until 2050. Four important issues in achieving that goal include the following: (i) national direction or restriction on certain locations or location types; (ii) organising a level playing field of land scarcity and quality criteria among provinces to temper the 'waterbed effect' of logistics developments; (iii) stimulating the more intensive use of existing sites and infrastructure, such as by promoting function mix and densification; (iv) stimulating brownfield redevelopment without excluding local small and medium-sized enterprises (SMEs) from such areas.

107 Since 2021, there has been an EU-wide policy for circularity in 2050, with binding 2030 targets for material use and consumption, as well as an EU Green Deal in 2022 (https://www.europarl.europa.eu/news/en/headlines/society/20210128STO96607/how-the-eu-wants-to-achieve-a-circular-economy-by-2050).

108 The Grip programme (in Dutch and in full: Grip op Grootschalige Bedrijfsvestigingen) focuses on large commercial buildings. In practice, these mostly pertain to logistics developments (more information on available at https://denationaleomgevingsvisie.nl/mooi+nl/nieuws+mooi+nl/2454074.aspx).

The spatial impact of logistics buildings on landscapes, known as 'boxification', has become more prominent in the national policy debate. A parliamentary motion forcing the government to control logistics sprawl (Bontenbal, 2022) has increased the political urgency of the Grip programme. In its setup, the programme fits the definition of a policy lab (Lee & Ma, 2020). It has been led since 2019 by the ministry responsible for spatial planning and integrates two other ministries—responsible for economic affairs and infrastructure—with the participation of the 12 Dutch provinces and other stakeholders (in total ca. 45), as well as ca. 15 external experts. The ca. 60 participants have mostly a policy making or advisory role (not political or operational), while they have a varying knowledge level on logistics—some having responsibilities in spatial planning and others in infrastructure or economic policy. It aims to apply knowledge from research, the participating stakeholders and experts to develop spatial policies for logistics. The political urgency and the ambition of a coherent policy framework—across all provinces and national government—make it necessary to develop, test and adapt these policies without going through implementation. The programme was to deliver planning guidelines for large developments by the beginning of 2023; however, this has been delayed due to provincial elections in March 2023, which changed the political stance on the issue considerably in some provinces.

Part of the lab's activities concern spatial planning research in 2022/2023, focusing on the application of the above typology in a policy information tool and learning from it (Nefs, 2023a). The policy tool consists of an online map tool[109] to visualise the potential of locations regarding each of the four logistics cluster types.

The main hypothesis driving the analysis is that groups of stakeholders in the lab have different perceptions of the application of the typology in the map due to the following reasons: (i) diverging views on how multilevel governance should be organised (e.g. top-down[110] versus bottom-up use of the map); (ii) diverging views on the validity of the typology and maps (e.g. its representation of the CE and location factors); (iii) diverging views on the applicability of the typology and maps in policy making.

109 https://mertennefs.eu/landscapes-of-trade/grip/

110 In the Netherlands, this would mean national government steering the decisions at the provincial level, with provinces steering municipal decisions.

An additional hypothesis concerns the variation per province. In the policy lab, some provinces tend towards restrictive policy, especially logistics-concentrating provinces that are dealing with public protests. Some are willing to accept certain logistics developments, but only if they are of sufficient regional benefit. Others are ambitious in attracting such developments for reasons of employment and available space. These contrasting interests were frequently verbalised throughout the policy lab: 'We ordered cake from the local bakery to celebrate that a large fashion distributor chose another province.' It may also be expected that provinces view the issue differently from national government and experts.

The following parts of the paper analyse stakeholder views regarding the validity and applicability of the aforementioned typology, implemented as multicriteria suitability maps in the policy lab. The main structure of the analysis is presented in Figure 7.3. In the discussion and conclusion section, the results are generalised to the broader planning discussion regarding different views on the use of typologies and map tools. In the paragraphs that follow, the suitability maps and Q-method are introduced.

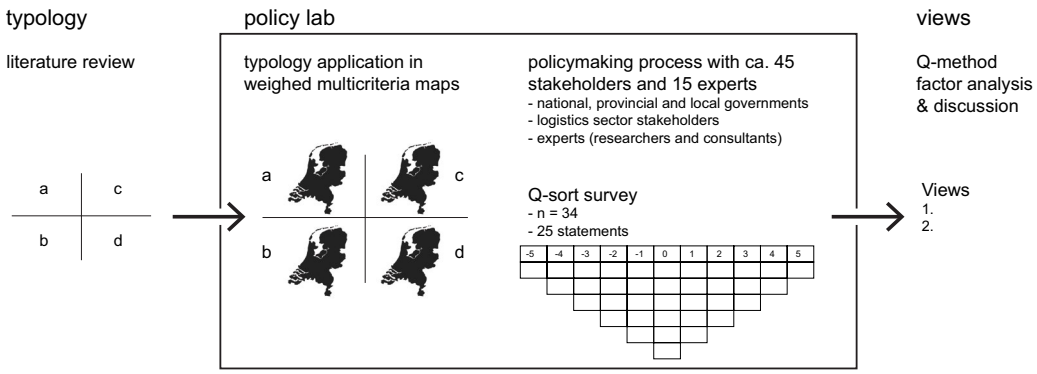

FIG. 7.3 Structure of the analysis.

TOC

7.3.2 Multicriteria suitability maps

The typology discussed above is implemented as four suitability maps—one for each logistics cluster type—by using a GIS-based weighted multicriteria analysis (WMCA) covering the entire Netherlands in 500 x 500 m grid cells. The criteria consist of 22 location pull and push factors for logistics suitability, weighted differently for each type (Figure 7.4). The selection of location factors and their weights were based on existing literature where possible. Researchers have shown the importance of proximity to (i) linear infrastructure and transport nodes, (ii) to consumer and labour markets, and (iii) to production facilities (Flämig & Hesse, 2011; Hesse, 2020; Onstein, 2021; Sakai et al., 2020; Tare et al., 2021; Verhetsel et al., 2015). Rents are mentioned as well, although these tend to reflect the aforementioned factors (De Oliveira et al., 2020; He et al., 2018). Researchers also mention proximity to communities or ecological reserves that are likely to be impacted by traffic and emissions of the logistics cluster (Aljohani & Thompson, 2016; Wagner, 2010; Yuan, 2021). From a landscape perspective there are ecological, heritage, soil aspects that play a role (BZK, 2020). Since the literature does not offer a comprehensive set of weights and factors, the list was complemented and validated by several stakeholder feedback sessions in the policy lab, as well as expert opinions outside the lab. The same was done regarding the factors of environmental suitability, some of which are no-go areas: Natura2000 European nature reserves as well as UNESCO world heritage sites and national heritage sites in rural areas (these generate blank areas on the map). Provincial nature and heritage zones may also create limitations in practice or require additional landscape integration efforts for logistics developments. They are not indicated as no-go areas a priori, but rather weighted as negative factors.[111] The resulting suitability maps (Figure 7.5) became more refined during the reiterative process of adding factors, tuning weights and discussing the outcomes in the policy lab.

111 More detailed argumentation on the weights, areas of influence and other parameters used in mapping the factors, as well as the data sources, are available in the repository. DOI: 10.4121/9fc68331-a857-4775-8cd0-cb562a64fc51

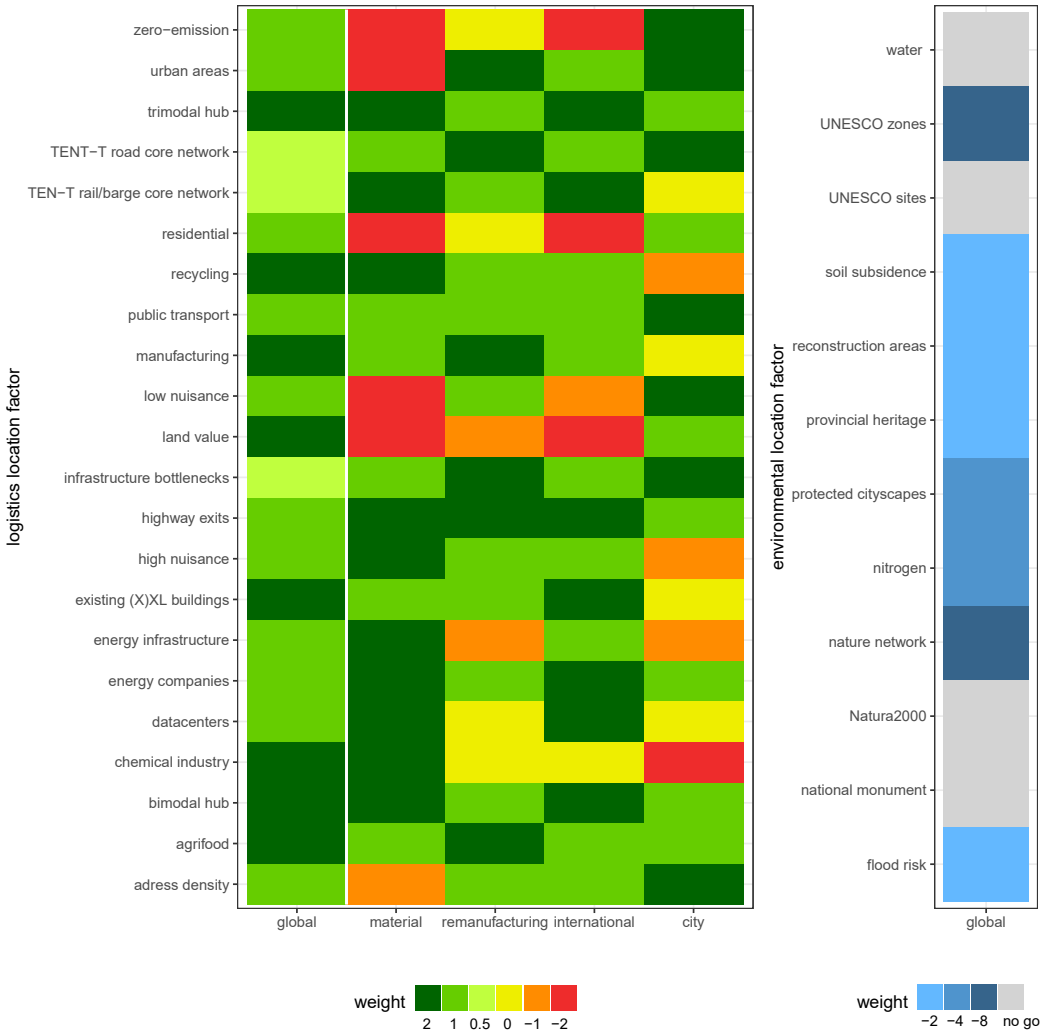

FIG. 7.4 Location factors weighted for the multicriteria suitability maps. Logistical suitability is weighted globally and per logistics cluster type, whilst environmental suitability is only weighted globally.

TOC

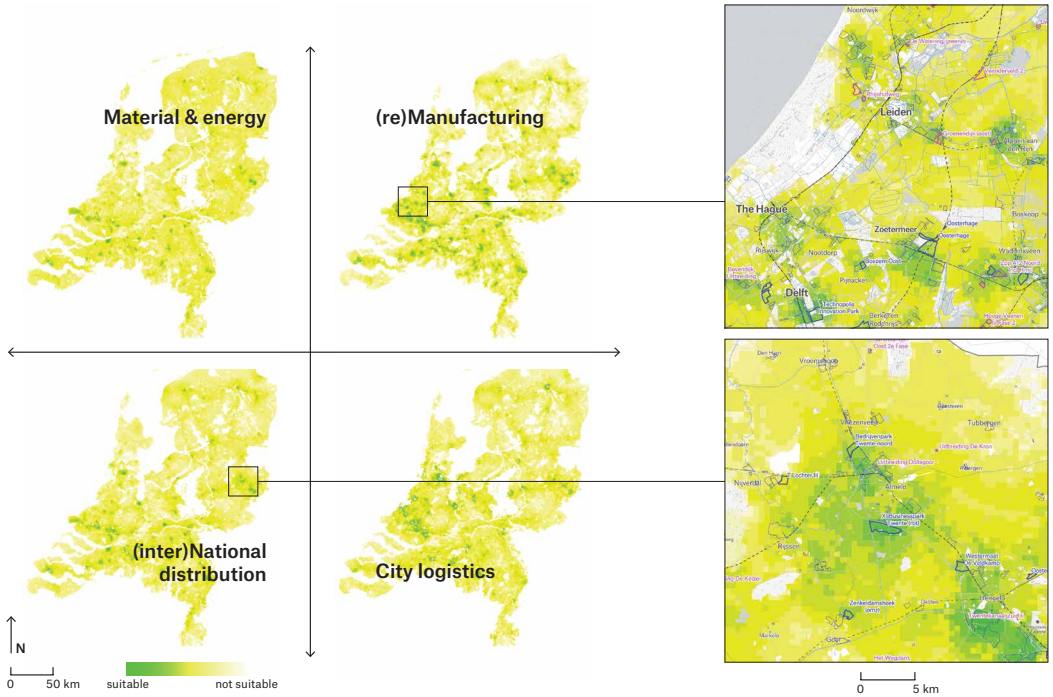

FIG. 7.5 Weighted multicriteria suitability maps (the greener the more suitable). Left: clean maps. Right: details of the zoomable online viewer showing suitability in 500m grid cells and existing (blue) or planned (pink) business estates.

There is large variation and some overlap among the four resulting maps. Generally, suitable locations for the *material and energy* clusters are scarce and concentrated around the (inland) ports with bulk terminals, where nuisance regulations permit such activities. In contrast, *city logistics* clusters are possible in and near most population centres. Suitable sites for *inter(national) distribution* clusters are found mainly along the major infrastructure corridors. Moreover, *(re)manufacturing* clusters are more suitable near the existing urban-industrial centres with a high potential availability of skilled labour. The maps are presented in a report with informative labels, legends, interpretations and a link to an online zoomable map viewer.[112]

112 To facilitate the evaluation of spatial policies, the viewer features a layer of existing and planned business estates. https://mertennefs.eu/landscapes-of-trade/grip/

TOC

7.3.3 Q-method

From the research activities in the lab, the main arguments of the discourse were already known. Therefore, interviews would not yield much new information, nor the quantified data required for an unbiased statistical grouping of individuals structured by their opinions. The advantage of the Q-method (Coogan & Herrington, 2011) compared to other survey types is that it is specifically developed for the analysis of views in a discourse. The Q-method maps opinions in great detail; not just agree-disagree, but many points in between. On top of this data, participants can add qualitative remarks to enrich the analysis.

To analyse stakeholder views on the typology and maps, the Q-method executed four steps. First, 25 statements are formulated regarding governance preferences (s1–s4), as well as the validity and applicability of the typology (s5–s9) and map tool (s10–s25), representing as completely as possible the 'concourse' of existing views on the topic gathered from stakeholder sessions and documents of the policy lab. Second, the 25 statements are assessed by the participants in the online Q-sort[113] interface over two stages. In the initial stage, one divides the statements into three bins (disagree, neutral, agree). In the final stage, one refines the division into nine bins, ranging from strongly disagree to strongly agree (see Figure 7.3). Third, the resulting Q-sorts of the participants are used to load factors in factor analysis and identify different views on the topic using a dedicated Q-method statistics package (Zabala, 2014). Fourth, the resulting views are discussed, combining statistical results with the qualitative information of the statements and remarks made by the stakeholders. Overall, 34 of the ca. 60 stakeholders and experts in the policy lab completed the survey. Four provincial stakeholders explicitly refused to participate in the survey, citing the delicate policy process and concerns about the outcomes leading to unwanted top-down steering.

The choice of generating two factors (i.e. two views on the topic) was made by the author, based on test runs using two, three and four factors. Notably, two factors provided the most significant outcome: the lowest number of factors to describe (2) with similar sizes (18 and 15 respondents), the lowest number of respondents that cannot be statistically included in one of the factors (only 1), combined with high reliability (98 and 99%) and low standard errors of the difference between the factors (0.17). In the online Q-sort interface, additional data are collected from each participant before they perform the assessment: their role (government official at

113 https://qsortware.net/

TOC

the national, provincial or local level, company or non-profit) and their self-reported level of knowledge regarding the typology, map and policy lab (high, medium, low). Directly after performing the assessment, remarks are collected from the participants. These additional quantitative and qualitative data are used to describe the results in the next section.

7.4 Two views on the applied logistics typology

In this section, the results of the factor analysis are presented, starting with the numeric outcomes and followed by the qualitative interpretation of the two views (factors) on the topic. The outcomes of the analysis indicate that the two views have a similar size: *view 1* includes 18 respondents and *view 2* includes 15. Some statements are more instrumental in distinguishing the views (see the top of Figure 7.6). Consensus (bottom rows of Figure 7.6) is moderate regarding most governance statements (s1–s4) about dialogue and steering between government levels. There is reasonable consensus on the design and quality of the typology and map tool (s5, s10). Both views agree that the tool is not applicable for the selective sale of land to certain companies in existing business sites (s9). Also, regarding the tool's ability to assess the future potential of locations (s23), there is consensus. Both views have a rather neutral opinion on how the CE is represented in the typology and map tool (s6). Statements about the map generate more distinguished opinions than the typology.

The first view has a relatively large share of national government stakeholders, whereas the second includes more provinces. The only local government stakeholder participating in the survey is in *view 1*. Furthermore, companies and non-profits are rather evenly distributed. The three different types of provinces discussed in the former section are not separated clearly in the views. In the description of the two views below, the more distinguishing statements are used. Knowledge levels varied across both factors: respondents in the first view studied the report and map better (by their own account, on average) than those in the second view.

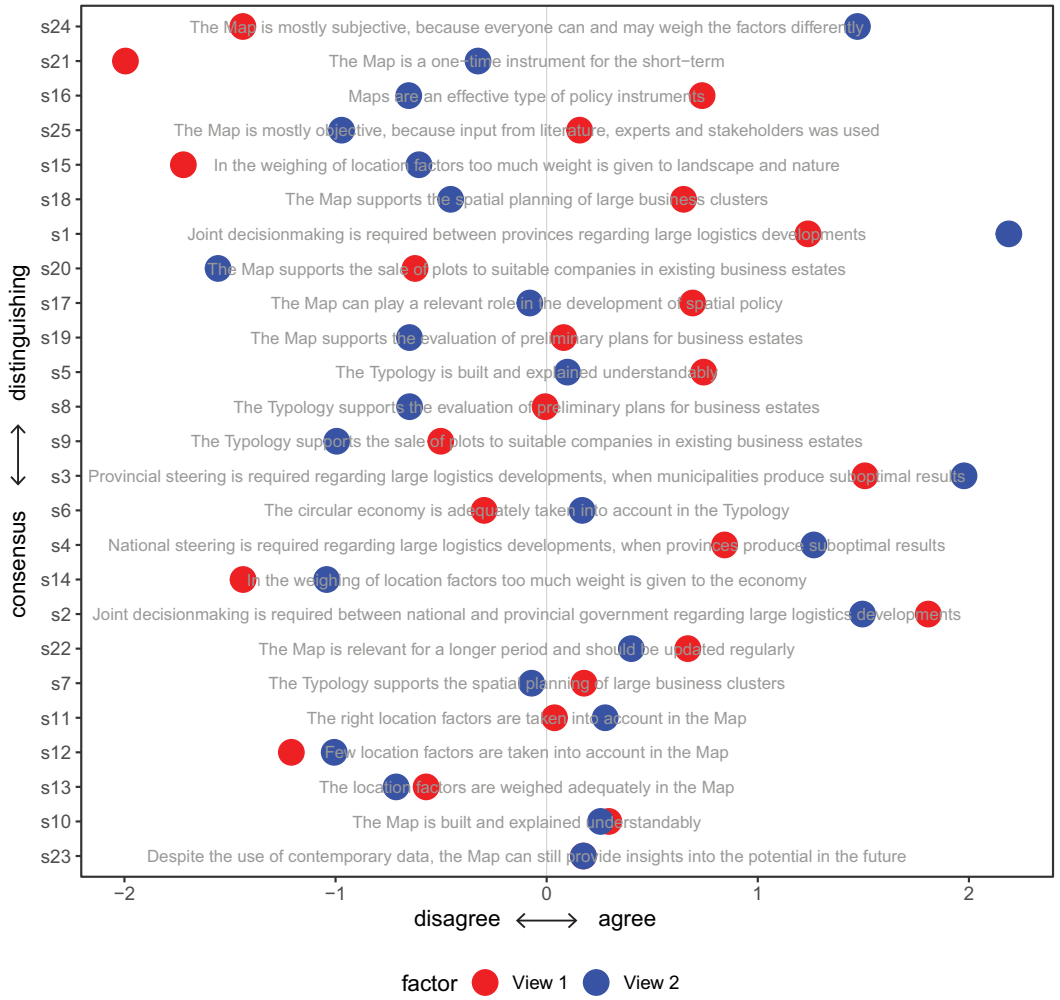

FIG. 7.6 Q-sort statements, translated from Dutch and ranked by their distinguishing effects among the factors. The greater the distance between the scores (disagree-agree) of both views, the more distinguishing the statement.

TOC

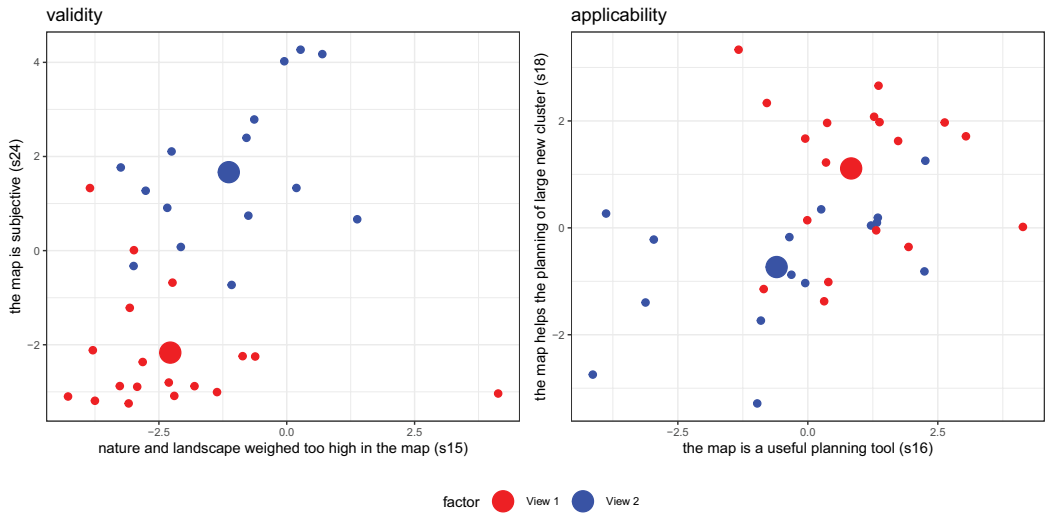

FIG. 7.7 Individual respondent distribution regarding two distinguishing criteria. Left: validity. Right: applicability. Large dots represent the mean of each view.

Figure 7.7 presents the distribution of the individual respondents in both views across the most distinguishing statements regarding the validity (left) and applicability (right) of the map tool. The plots[114] show that validity and applicability generate a similar contrast between both views. While the distributions of both views sometimes overlap, their averages are located distinctly apart, especially regarding the subjectivity of the map (s24).

114 The individual dots directly correspond with the response for the two plotted statements, causing them to overlap on whole numbers. Therefore, a jitter plot was used, which randomly redistributes the dots to avoid overlap. The mean values are plotted at their exact values.

7.4.1 View 1: Information-based multilevel decision-making

This view is shared by 18 respondents: 5 from national government, 3 from a provincial government, 1 from a local government, 4 from companies and 5 from non-profits.

Concerning governance, this view is strongly committed to multilevel decision-making. Participants with this view highly value dialogue between the national and provincial levels (s2). They have more moderate stances than the other view concerning inter-provincial dialogue (s1) and top-down steering (s3 and s4), leaving room for local decision-making based on more specific information. One participant noted the following: 'The typology is, in principle, a good division in types of companies. For effective local location policy, however, knowledge from individual companies might be necessary.'

View 1 presents high trust in the validity of the typology and map (s24 and s25 for objectivity, s5 for understandable design). Additionally, the view envisions their long-term use as policy tools (s21). The participants see a relevant role for such a typology and map tool in spatial policymaking, especially in the case of large-scale logistics developments (s16, s17, s18). One participant noted the following: 'The map is a supporting tool for which the underlying arguments and information should be available. The map is most applicable for "soft" plans [not yet confirmed in local legislation]. To adapt "hard" plans and the selective sale of land in such areas, more information is needed, mostly about the companies.' They believe that it may be necessary to increase the landscape and nature weight (s15). One participant noted the following:

'I am very enthusiastic about the Grip approach, but I hope the following steps will make clearer choices. The maps still show ample location options. The environmental factors of landscape perception and lack of urban green areas could be added. […] Infrastructure investments for heavy international transport should be a hard policy choice, excluding other locations for international logistics. XXL logistics asks for national steering in dialogue with provinces. Updating the map should be part of the monitoring and development of the policy.'

Even though the proximity of a potential labour force (urban density) is considered in the maps, one participant believed that actual availability could be valuable additional information because 'this is a critical factor for the location choice of companies.'

7.4.2 View 2: Freedom of negotiation and adaptation of priorities

This view is shared by 15 respondents: 2 from national government, 6 from provincial governments, 4 from companies and 3 from non-profits.

View 2 highly emphasises the need to avoid an overly decisive role of the information tool to maintain freedom of regional and local negotiations and the adaptation of priorities in an area when local actors believe that this is necessary. This is how it has worked in practice over the last couple of decades. The participants value inter-provincial dialogue (s1) very highly, whilst they are more moderate than the first view on multilevel dialogue (s2). In contrast, *view 2* believes more in top-down steering from the national and provincial levels (s3, s4). Uncertainty regarding the use of the map in the policy process worried several participants: 'Are the maps to be used as inspiration or to inform the dialogue, or will they be used top-down to enforce decisions? I need to know before I can give any reaction.' Participants with this view are also strict on the definition of the typology and map, not as an 'instrument' but as an 'information tool', in an attempt to avoid the formal status of the tool. One participant noted the following: 'With regard to the scoring of statements about the map, I fear that maps can very easily gain a life of their own out there, despite the useful applications they can have in practice.'

The view sees the typology and map tool as a subjective yet reasonable outcome (s11, s12). Still, participants believe that it is more useful for the short term (s21). This view finds limited applicability of the tool for the planning of large logistics clusters and spatial planning in general (s16, s17, s18). A logistics sector participant took a defensive stance, seemingly without having read the report: 'The map and typology feel subjective. How is it decided how a project scores on which factors? For me, the study lacks the urgency of creating more space for business estates. These are the heart of our economy and the logistical artery of society.' Another participant summarised *view 2* very well:

'The map is really an information tool and not a policy instrument. In the allocation of functions in an area, many trade-offs play a role. The context in which decisions are made is very relevant. Is a community willing to house a certain function? How much of it is already there? Is there a lot of opposition? How important is it to accommodate the function? One factor can have so much weight that the others become irrelevant. If it is argued that logistics is needed, a place must be found that presents the most advantages and least disadvantages. Sometimes that goes against the logic of the map. Naturally, that can happen—but therefore it is important to call it an information tool and not an instrument. Mitigating policy with regard to the decision can change the trade-off completely once again, making developments acceptable after all.'

7.5 Discussion and conclusion

This paper proposed a typology of logistics clusters for spatial planning in the (emerging) CE based on existing typologies in the literature. The typology was applied as an information tool in a Dutch policy lab, where the validity and applicability were analysed using the Q-method. This method also gathered information on governance preferences, roles and knowledge levels. Combined with qualitative remarks by the respondents, the analysis yielded two views on the subject: (1) information-based multilevel decision-making; (2) freedom of negotiation and adaptation of priorities. The first view emphasises the benefits of the typology and map application in a policy setting of dialogue between government levels and moderate top-down steering. It highlights the information advantage of multilevel dialogue in spatial planning in the long run. The second view recognises the strength—but simultaneously the fallibility—of such tools and emphasises possible conflicts with traditional policy making based on dialogue between and within provinces, especially the opportunity to make deals if decision-makers find this necessary. How can these views be explained, and which insights do they provide for the general spatial planning debate and further research?

7.5.1 Validity and applicability of the typology and map tool

The hypothesis in the paper was that stakeholders of the policy lab would present diverging views on the validity and applicability of the logistics cluster typology and its implementation in maps, which is in line with the observations of Veselý (2021) in other applications of policy tools. This is clearly the case, but less so because of diverging views on the policy goals and solutions. Instead, such divergence is due to diverging governance styles and government levels. National government officials are mostly concentrated in *view 1* (information-based multilevel decision-making), whereas provincial governments are found more in *view 2* (freedom of negotiation and adaptation of priorities). Companies and non-profit experts are spread rather evenly among the two views. It was further hypothesised that these differences would occur along the lines of different province's attitudes towards logistics. This does not appear to be the case, which may be an indication of the independence of personal beliefs with regard to the opinions in the survey, low policy bias of the typology and maps, or both.

Based on the above, it can be argued that with any tool, there will always be a more adopting and more sceptical group of stakeholders. However, other research (Bressers, 1998; Pelzer et al., 2015) suggests that the acceptance of the tool might improve if it fits better to the structure of the policy network—in this case, multilevel with varying governance styles.

In general, several factors appear to be important in the use of typologies in maps by policymakers. First, the perceived benefits of insights provided by such maps are perceived to come at the cost of a loss of freedom to make local deals—as has been the modus operandi in the Dutch spatial planning of business estates. Even though the cost of this restriction highly depends on the status of the maps (regulatory, restrictive, directive, informative), their mere existence worries several stakeholders. They would need to argue better to propose developments in locations that have a low suitability score on the map. Second, the varying knowledge level with regard to the typology and its application in the weighted multicriteria maps serves an important role in the views on their validity and applicability. Although the development process of the tool was transparent and involved input and feedback from the policy lab participants, not all users had a similar understanding due to the time they spent reading the report and using the map tool. *View 1* has a higher knowledge level than the second, and also clearly has a higher appreciation of the typology and map tool. Third, the practical use and interpretation of the typology and maps requires trust in the other actors involved in the policymaking process to respect and understand each other's interests. As an illustration, a logistics sector lobbyist worried about the separation of the interconnected logistics complex into four types since this might stimulate policymakers to favour certain types and ban unpopular ones (e.g. XXL distribution centres). Simultaneously, a landscape expert from the national government perceived risk in the large amounts (in her view) of suitable (green) areas for such distribution centres on the map, which might stimulate a gold rush by investors and developers.

In short, the effective application of informative map tools in spatial planning depends less on their perceived validity and more on their information benefits (insight) and costs (decreasing freedom to make deals that conflict with the information), as well as the perceived trust among stakeholders. A wider group of policy makers appears to be inclined to use the tool when training and updates are provided, and when the tool's status is well-defined. Depending on the tool this may be difficult to do in advance. In the analysed policy lab, a joint decision was made between the participants, when the tool was already developed. The choice of an information tool reflects the negotiation between the two views, ending up with the middle ground between a regulatory and inspirational status.

7.5.2 Further planning and research

The validity of the typology of logistics clusters is perceived as reasonably good among the stakeholders in the Dutch policy lab. It would be interesting to apply such typological information tools in other countries and compare the resulting stakeholder views. Given the standardization of logistics practices worldwide and the diverse planning systems across countries, both similarities and differences would be expected to occur. Additionally, following the use and adaptation of the map tool by the stakeholders, a longitudinal study may provide insights into its long-term applicability and points of improvement. Particularly, training efforts and participatory updating of the tool by the user group in the policy context are needed to balance the need for structured, data-driven approaches with the flexibility required in local and regional decision-making contexts.

There was a broad consensus in the policy lab that the emerging CE should be facilitated by the supply of the appropriate quantity and quality of space for logistics in planning at all levels of government. The translation of the CE characteristics in the typology did not generate highly distinguished opinions, possibly due to a lack of information on what the CE might entail. During policy lab discussions, the conservation of (inland) port areas for CE activities was an important point of consensus. Despite recent studies (Becker & Kuipers, 2018; Van den Berghe et al., 2023), more insights are needed into which types of scarce water-bound business estates need to be preserved and enhanced to facilitate the CE. Nevertheless, possible top-down planning and restrictions on the transformation of such areas (usually to housing) were not agreed upon. Additional research on defining and applying spatial typologies for logistics including CE characteristics, building on earlier works, e.g. Heitz et al. (2019), Sakai et al. (2020) and Buldeo Rai et al. (2022), appears to be necessary. The practical question of how a new typology relates to the existing legal planning terminology of industrial sites also remains. The proposed typology and map appear to be helpful in the qualitative aspects of planning logistics—especially in new sites and extensions of existing sites. Additionally, it needs to connect to other tools that can assess the quantitative aspects—primarily the demand and supply in each of the types. One challenge may be that this part also remains under development and is often performed by market consultants, without the usual academic transparency and methods.

Finally, the policy context around such spatial information tools, including stakeholder group dynamics and the possible relation to other non-spatial policy measures, provides a relevant angle for further research. For example, how does this context influence the application and performance of the tool, and what types of decision-making can (not) be informed by these tools, e.g. top-down central planning, product- or service-oriented policy goals, or an incremental approach to the CE?

Acknowledgements

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TOC

8 Conclusion

This thesis analysed the logistics complex and its spatial planning, particularly the various dynamics that explain its development in the Netherlands. An emerging phenomenon in this multi-dimensional apparatus—including physical structures as well as actors and institutions—is the XXL distribution centre (DC), which has fuelled a fierce academic and political debate in the country since ca. 2018. In this thesis, I argue that large DCs that cannot be effectively integrated in existing landscapes into the hinterland of large seaports are generating a new landscape type: **Landscapes of Trade**. Assumptions regarding the necessity of these developments, as well as the economic benefits and environmental burdens of logistics, are key features in the planning discourse on DCs. Stakeholder interests and rhetoric from companies, inhabitants, and NGOs have been at the forefront of that opinionated discourse rather than empirical insights into the spatial-economic effects of DCs.

8.1 Aim and questions of the thesis

This thesis aimed to generate multi-disciplinary insights into the emerging landscapes of trade in the Netherlands by combining various perspectives and methods in its empirical approach. In doing so, it contributes to a more profound understanding of the evolving spatial pattern of logistics and its interaction with the co-evolving planning system. This understanding may inform the societal discourse, further multi- or interdisciplinary research, and efforts towards (more) sustainable logistics developments in practice. The overarching question behind the research presented in this thesis is:

What historical, economic, and institutional dynamics shape the rampant expansion of the logistics complex in the Netherlands?

Although the Netherlands is a critical case for the issue of the spatial planning of logistics (see Section 1.4), it is in many ways comparable to other densely populated regions of the world with a heavy logistics complex, such as California, the greater Paris region, Belgium, and parts of Germany. However, policies in these regions vary significantly. The main parts of the research zoomed in on the East-Southeast Freight Corridor (ESE corridor), situated between the port of Rotterdam and the German hinterland, as well as specific developments in that corridor in the cities of Roosendaal, Tilburg, and Venlo.

The chapters in the research address six sub-questions pertaining to the aforementioned aspects. **Chapter 2** addresses the question **How has the spatial pattern of DCs in the Netherlands changed over time?** It presents an atlas of the Dutch logistics complex, to show and discuss the spatial pattern of DCs and set the scene for the following analytical chapters. **Chapter 3** addresses the question **On what assumptions was the Gateway to Europe policy narrative (1980–2020) in the Netherlands based?** It seeks to answer this question by analysing the sources, advocacy coalitions and policy theories underlying the narrative, through a systematic literature review. **Chapter 4** addresses the question **What actor-institutional forces shape the spatial outcomes of local XXL DC transactions?** It analyses how spatial decisions are made in the actor-institutional dynamics behind the planning and development of DCs, through in-depth interviews and document analysis. **Chapter 5** addresses the question **What are the regional employment effects of XXL DCs?** It does so by analysing the effects of DCs by using company microdata in a threefold spatial-economic approach including direct, indirect and agglomeration effects. **Chapter 6** addresses the question **What role does spatial justice argumentation serve in the provincial and local planning discourse and decision-making on hinterland logistics?** It analyses the argumentation used in the planning discourse on DCs whilst focusing on the just distribution of the gains and pains of logistics. **Chapter 7** addresses the question **How are the validity and applicability of logistics cluster typologies and related information tools perceived by Dutch planners and policy makers?** It answers this question by analysing the outcomes of a Q-sort survey of the user experience of spatial typologies and data-driven maps in the recent policy process of planning logistics clusters.

The research activities were performed in parallel to the elaboration of practice-oriented policy advice reports on logistics planning, involvement in debates, and publications in the professional media (see Appendices). This concluding chapter draws conclusions from the various parts of the research to answer the overarching research question (see Section 8.2). Furthermore, it points to urgent foci of further research (Section 8.3) and provides recommendations for planning practitioners (Section 8.4).

8.2 Dynamics shaping logistics expansion

The scientific contributions of the present research consist of the answers to the six research sub-questions based on the methods and results, as discussed in the previous chapters. The *comprehensive detailed overview of logistics buildings* in the Netherlands, presented in **Chapter 2**, fills an urgent knowledge gap in research, education, and practice, regarding the changing spatial pattern of logistics. Soon after the open-access publication of the data (Nefs, 2022b), students, researchers, designers, planners, policy makers, research journalists and citizens started using it. Some of these applications are listed in the Appendices. At the time of writing the data repository shows about 2,500 downloads and 4,000 views.[115] An accompanying online map viewer, showing the rampant expansion of the logistics complex since 1980, had more than 5,000 unique views since 2019.[116] The gathering and treatment method of the data itself is also a contribution to the research field (Nefs, forthcoming). **Chapters 3–7** present analytical results that contribute to the understanding of the expansion of the logistics complex. When taken together, the results of all chapters provide three general answers to the overarching question: **What historical, economic, and institutional dynamics shape the rampant expansion of the logistics complex in the Netherlands?** The following sections address each of these dynamics by drawing from the outcomes of the various chapters and extrapolating these strategically to possible future developments.

8.2.1 Historical dynamics

The expansion of the logistics complex since the 1980s has occurred in the **historical** context of long-term trends and major shocks—geopolitical, macroeconomic, and technological. This thesis has shown that several of these historical aspects have been pivotal in the development of the infrastructure and distribution centres that form the logistics complex. This is arguably the case for the Netherlands as well as for other countries in Europe and elsewhere. Simultaneously, the trends and

115 Total of the initial repository of 2020 featuring only the ESE corridor, and the new repository of 2022 featuring the entire Netherlands.

116 In 2023, approximately one-third of the more than 1.500 unique page views refer to the Grip map (see Chapter 7).

shocks influenced the spatial-economic policies stimulating such developments in the Netherlands. In the recent planning discourse, the expanding logistics complex is often related to the growing population and increased wealth. Whilst this most certainly had an influence, **Chapters 1 and 2** show that the expansion of (especially) XXL DCs cannot be understood without another structural trend, increased trade flowing through the country (showing 800% growth since 1980), as well as the rise of e-commerce—an activity of which the Netherlands is an early adopter in Europe. These factors also largely explain the changing spatial pattern of DCs, concentrating along the hinterland infrastructure of the Port of Rotterdam and near large population centres, featuring heterogeneous areas of growth as well as decline. The maps presented in **Chapter 2** indicate that the gravity point of recent logistics developments within the ESE corridor lies 30 km more to the east than in the 1980s. This points to congestion and scarcity of development space in the west of the country, emerging logistics hotspot locations in the east, and the growing orientation towards other European markets and flows of goods arriving from China via rail. The most recent developments demonstrate a 'waterbed effect' of developments shifting to the north, where development space can still be found.

The timeline presented in **Chapter 3** contributes to understanding the relations of the *Gateway to Europe* policy narrative, as well as its subsequent policies, to large macroeconomic events. These include the unemployment crisis of the 1980s following the oil crisis and the globalisation of trade—including the integration of the European internal market in 1992, the foundation of the World Trade Organisation in 1995, and the ubiquitous use of the shipping container. Although this may seem obvious in hindsight, the policy narrative at the time skilfully captured this emerging potential and was able to generate large-scale infrastructure investments and fiscal measures in a time of public budget shortages. The credit crisis of 2008–2014—and more recently the COVID-19 pandemic and Brexit—disrupted the retail sector and supply chains, accelerating the expansion of XXL DCs as companies increased their stock to mitigate risks and serve online clients.

Likewise, the future of the logistics complex will also be influenced by the trends and shocks occurring from now on, whatever those will be. At the time of writing, geopolitical shocks such as armed conflict and intercontinental trade conflicts continue to cause instability in supply chains and the deglobalisation of markets. The resulting strategy of many companies and policy makers is to diversify global chains and increase autonomy by reshoring and near-sourcing some activities, thus creating larger stocks and production facilities in Europe; however, this is

happening quite slowly.[117] On the other hand, the main trends in climate change and the ageing population in Europe suggest that the continuation of the observed rampant expansion of the logistics complex will not be possible in the future due to limitations in carbon emissions, greenfield development space[118] (on No-Net Land-take also see Decoville & Feltgen, 2023), and the availability of personnel. Although these conditions must present business opportunities, there is currently not a widely embraced policy narrative—like in the 1980s—that captures the potential of this future situation.

8.2.2 Economic dynamics

The expansion of the logistics complex has also been strongly shaped by **economic** processes and transformations. This thesis identified several of these as crucial in the analysed cases. **Chapters 2 and 4** identified and mapped profound changes in the development of the logistics complex. Particularly over the last decade, there has been a significant shift from the medium-sized DC used by trading companies and retailers to XXL DCs for logistics services operated by third parties (3PL). This shift to and expansion of XXL warehouses can be explained by the rise of e-commerce platforms, which generally require (up to three times) more space than traditional retailers due to the principle of *just-in-case* availability instead of *just-in-time* inventory management.

Another factor is the increased financialisation and internationalisation of DC development. The interviews presented in **Chapter 4** explain how the convergence of low interest rates, the high availability of capital flowing from a struggling hotel and retail market during the pandemic, and the necessity of the long-term risk management of investment funds led to a construction boom of extra-large, well-located DCs with generic floorplans developed largely from a real estate investor perspective. Whilst logistics operations were the central driver of DC development before 1990, usually initiated by the user or a local investor, this is only of secondary importance in the current generation of increasingly generic DCs. Much of the scattered spatial pattern of DCs—in suboptimal locations, as the interviews in

117 See this company survey by the ECB: https://www.ecb.europa.eu/pub/economic-bulletin/focus/2023/html/ecb.ebbox202307_01~2a0bcf0b48.en.html?utm_source=pocket_saves

118 Flanders is implementing this in the Bouwshift 2040 policy (https://omgeving.vlaanderen.be/nl/beleidsplan-ruimte-vlaanderen) with special attention to large DCs, whilst the Dutch and French governments are also deliberating on such policies.

Chapter 4 suggest—can be attributed to 'quick flips' by private equity investors or deals by local developers.

The generation of jobs has been a key economic argument behind the national policy narrative stimulating the logistics complex, as well as local DC developments, from the 1980s until now. **Chapter 5** demonstrates in detail how direct employment in DCs indeed increases. Despite the persisting image of a ubiquitous and footloose sector, there is great spatial heterogeneity in logistics employment, with a particularly large variance between regions in the ESE corridor that have policies stimulating DC development and those that do not. However, the regional added value of this employment is increasingly doubtful, since each additional square metre of warehouse yields fewer jobs due to automation, and the created jobs are increasingly performed by international workers who are pressurising the already overheated regional housing market and tensions about migration. Beneficial indirect employment effects in suppliers and manufacturing turn out to be much less pronounced than claimed by researchers, policy makers and companies, with manufacturing even correlating slightly negatively with logistics. One methodological contribution of **Chapter 5** is an evaluation diagram to assess how a region specialises both economically and spatially in a sector over time. The rise of large monofunctional logistics-based regional business ecosystems—successful as these may be from their operational and real estate perspectives—comes at the cost of declining agrifood, manufacturing, and service sectors in the region, and thus with a significant risk of a regional spatial-economic lock-in. Strategies that aimed to strengthen the local manufacturing and agrifood economies via logistics developments also did not bear fruit in the cases studied in **Chapter 6**.

In the coming years, European sustainability policies and a lack of personnel will arguably drive economic transformations towards higher levels of automation as well as the more efficient use of space, thus contributing to circularity. For logistical chains, these transformations will likely have varying effects. On the one hand, automated DCs are improving spatial and energy efficiencies whilst increasing higher labour productivity. However, for the time being, the rapid growth of delivery services and e-commerce is still increasing the demand for warehousing and personnel. On the other hand, when the circular handling of products and materials—such as reuse, repair, remanufacturing, and recycling—becomes mainstream, this will likely increase the demand for space and (practically skilled) personnel. Furthermore, upcoming zero-emission zones in Dutch and European cities will raise the demand for small- and medium-sized logistics hubs in cities, which still need to be planned and developed in most cases. In this context it is necessary to look beyond the XXL warehouses that have recently dominated the discourse and to become more aware of the largest part of the logistics complex pertaining to small- and medium-

sized buildings, as was shown in **Chapter 2**. This focus is consistent with the recent scenarios by the Environmental Assessment Agency (PBL) on the circular economy (Rood & Evenhuis, 2023).

8.2.3 Institutional dynamics

Institutional dynamics have been of great influence in the expansion of the logistics complex in the Netherlands. This thesis analysed several cases of the spatial planning processes of logistics on various scales. **Chapter 4** demonstrated that the decentralisation of spatial planning and the resulting fragmentation of spatial decision-making are particularly crucial factors in explaining the heterogeneity and sprawl of the logistics complex since the 2000s. In this context, large industrial land developments in the ESE corridor after 2015 happened to coincide with the rapid rise of e-commerce and became poles of XXL DCs rather unexpectedly. However, spatial planning was not the only institutional stimulus behind DC development. Financial incentives (local land price discounts, logistics employment and education programmes, etc.), a favourable national fiscal/labour policy (delayed payment of VAT for reexport activities, rather cheap night-shifts), and international marketing and knowledge programmes (NFIA, Logistics Topsector, and TKI Dinalog; see **Chapter 3**) helped to create an attractive climate for investments in logistics.

As demonstrated in **Chapter 3**, the negative impacts of the expanding logistics complex have been part of the planning discourse since the 1980s. However, alternative views at the national level were consistently restrained by ignoring critical reports in policy making and using imbalanced stakeholder influence favouring logistics over the environment. There has also been a strong belief in silver bullets (i.e. technological fixes that would reduce the spatial and environmental footprint of logistics) and unfounded win-win situations in spatial policy (e.g. that the expansion of logistics can go hand in hand with nature and landscape improvements and lower public spending if left to local authorities). These beliefs and several perverse incentives in the planning-development system of DCs (described in **Chapter 4**) explain the difficulty of steering spatial quality of DC developments since the 2000s. A key issue here is the unequal dissemination of knowledge in the actor network behind the planning and development of DCs, concerning both transferable information and personal expertise. On the one hand, semi-public development companies operate without public accountability, keeping key information out of the public domain to speed up the development process. On the other hand, there are asymmetrical information positions between—usually but not exclusively—well-

informed developers and inexperienced local governments, thereby facilitating the proliferation of unfounded claims

Politicians at the national, regional, and local levels who have recently become keen on steering sustainable DC development have several ways to achieve this. Two factors with a positive influence on the spatial features of DCs (location, geometry, and landscape integration) stand out in the cases presented in **Chapter 4**: *multi-level government competencies* and *development standards upheld by multinational investors*. However, to enhance and use these two factors it is key to establish a policy goal and quality level that is both ambitious enough in the long term and realistic enough for developments in the here and now. This thesis provides insights into how these requirements are being explored in the professional and public discourse.

The professional *Grip programme* of the Ministry of Internal Affairs in the Netherlands involves the elaboration of a multi-level collaboration procedure, design principles based on best practices, and a typological information tool (see **Chapter 7**). The proposed typology of logistics clusters combines logistics functions and spatial parameters whilst introducing activities of the circular economy that were lacking in most existing typologies. An analysis of the use of this typology and the related online map tool in practice highlights that there is a divergence between government levels. National government officials in the Grip programme generally favour information-based multi-level decision-making, whereas most provincial governments are more sceptical and prefer to have freedom of negotiation and adaptation of priorities instead, depending on the local political context. Companies and non-profit experts were found to be spread rather evenly among these two views. Higher (self-reported) knowledge levels regarding the typology and maps, is found to increase the preference for the tool. Although the literature suggests that some users will always be sceptical (see Section 7.1), the analysis indicates that most users would potentially use the tool under the following conditions: trust among the stakeholders is increased by determining a clear status of the tool (restrictive, directive, stimulating, or informative); the tool is regularly updated; and knowledge on the tool is improved by providing training and background information.

Simultaneously, the public discourse on logistics planning is also changing regional and local institutional dynamics. Local governments are increasingly forced to make trade-offs on many spatial claims for climate adaptation (water buffering, nature development), housing, and other land uses. This forces them to make sharper choices and combine functions if possible. The provincial election data and newspaper articles analysed in **Chapter 6** reveal that spatial justice arguments regarding the benefits and burdens for certain groups have played a significant

role in the regional DC development discourse over the last few years. The highly fragmented and polarised stances of political parties on this topic—by party and often also by province—suggest that the topic will continue to raise regional controversy. What also appears evident is that varying local and regional political coalitions will have diverse effects on DC developments in the Netherlands, unless a level playing field across regions is established through effective national politics or interregional collaboration. There are already restrictions imposed on XXL DC development in the provinces of the ESE corridor, particularly Noord-Brabant, Limburg and Zuid-Holland. Other provinces are currently deciding on their course of action. The discourse on the gains and pains of logistics effectively resulted in adapted regional policy, as well as in more stringent design and selection criteria for local developments in the case of Tilburg Wijkevoort and the postponement of the planning process in Klaver 7 (Horst aan de Maas), until such higher standards could be met (**Chapter 6**). A highly unequal and perverse situation in which the benefits and burdens of logistics are concentrated in different areas—as discussed by Yuan (2021) in California—was thus not observed in the Dutch cases. There seem to be legal difficulties, however, to intervene in existing land use plans permitting DCs in the Netherlands. Fuelled by similar public criticism and European agreements on land take and circularity, efforts to make effective national and provincial DC planning policies are also underway in nearby countries such as Belgium and France.[119]

On the side of the private sector, certain changes are also occurring. In 2023, an association of logistics and industrial companies and investors was formed[120] to counter the immanent lack of development space mentioned above via a communication strategy, including counter-arguments and good practices. In the future, initiatives such as these might lead to enhanced international standards in the market.

119 The Flemish government is studying measures to stop additional land take by 2040, with a special focus on logistics (see Bouwshift 2040, Departement Omgeving Vlaams Gewest). The Economic Affairs Committee of the French National Assembly created a temporary working group in 2023 to study the impacts of large-scale logistics warehouses, headed by MP Charles Fournier.

120 Dutch Industrial & Logistics Association (www.dilas.nl).

8.2.4 Changed conditions

This thesis argues that the **dynamic conditions** that shaped the expansion of the logistics complex in the 1980s and 1990s have changed significantly during the research period. This concerns five main aspects:

1 Instead of an expected rise of global supply chains in the 1980s, there are now many geopolitical crises and trade conflicts that increase the risk of such chains.

2 In the 1980s, European collaboration was still emergent. However, there are now far-reaching international agreements and policy programmes on the circular economy, reshoring of key industries, no-net land take and the Paris Climate Accord. Although the effects of these policies are largely unknown, they have the potential to reduce the length of some value chains, change the use of the logistics complex to either manage reverse logistics flows or perform remanufacturing tasks, and limit spatial development opportunities. Non-compliance with these international agreements would have long-term consequences nonetheless, which would arguably lead to more sudden shocks and policy measures to mitigate them.

3 Instead of the urgent unemployment problem present throughout the 1980s, the Netherlands and Europe are now facing structural shortage of both practically and technically skilled personnel—a situation that is only worsened by the expanding logistics complex and anti-migration sentiment in many EU member states. The economic cycles and (absence of) unemployment are found to be crucial in forming the public opinion on the logistics complex (Koppenol, 2017).

4 Instead of a broad consensus on removing barriers to large-scale commercial activities and stimulating them, the current political landscape is more focused on other normative dimensions, such as spatial justice, increasing local quality of life and comprehensive well-being[121] by mitigating the negative effects of economic activity and protecting the livelihood of local SMEs. This does not mean that international competition and the stimulation of key sectors in the Netherlands are off the agenda. Nevertheless, sectors that require a large part of the available labour, space and emission quota are viewed more critically in the public discourse today than in the 1980s.

121 In Dutch: brede welvaart.

TOC

5 National infrastructure investments and fiscal policies have strengthened the position of Dutch logistics in global value chains since the end of the 1980s. Meanwhile, attracted by these favourable conditions, foreign investment banking has gained a strong position in the transformation of Dutch land use by DC developments over the last two decades in the absence of an updated national planning policy.[122] Both positions, inside-out and outside-in, are now a reality and hold potential for sustainable logistics planning.

In summary, the necessary institutional elements for sustainable planning and development of the logistics complex from now on appear to be present in the Netherlands: the re-centralising of some of the spatial planning responsibilities, a more empirically informed planning process, a livelier regional and local planning discourse, a better-organised logistics sector as well as the elements for a broadly embraced policy narrative. To follow up on the *Gateway to Europe* concept, the next logistics policy narrative is necessarily grounded in the altered dynamics mentioned above. For such a new narrative to be plausible and effective, it must also be based on insights from further research regarding these dynamics and on adapted planning practices that can effectively use these to pursue the new policy goals.

122 In 2020, after 10 years without a planning ministry, spatial planning returned on the national policy agenda. An effective spatial policy document, Nota Ruimte, is expected in 2024, although this timeline has become uncertain due to changes in parliament.

8.3 Angles for further research on the spatial planning of logistics

Three main angles for further study have come to the fore:

1 international perspectives;
2 more detailed information on DCs;
3 in-depth insights into spatial planning options.

8.3.1 International perspectives

First, a more **international perspective** is needed. This thesis generated insights into the dynamics shaping the expansion of the Dutch logistics complex, which are arguably applicable in many aspects to similar heavy complexes undergoing profound changes in areas such as Belgium, the Czech Republic, Poland, France, the Hamburg and Rhine-Ruhr regions in Germany, and southern California and the Bos-Wash corridor in the USA. Logistics is evidently a transnational activity, as are its spatial patterns and underlying real estate investments. In Section 8.2 we have seen that European legislation is becoming increasingly relevant for DC development. To understand the functioning of the logistics complex in a larger area such as the *Eurodelta*—the area including Flanders, North-Rhine Westphalia and the Netherlands—as well as the possible benefits of integrated planning on this scale, further research is needed with an international scope. That research should focus on the expanding spatial pattern of various logistics activities and building types across borders, for example in hinterland (dry)ports, as well as how borders between countries—separating planning regimes, as well as real estate, consumer, and labour markets—influence this pattern. Specific issues that deserve international attention in research are listed as follows:

A A consistent and detailed cross-border mapping of the logistics complex, possibly building on the definitions and methods of mapping DCs elaborated in **Chapter 2**.

B A comparison between the spatial-economic effects of different governance models and policy narratives **(Chapters 3 and 4)** regarding the large logistics complexes of the aforementioned countries.

C An assessment of the need and possibilities for progressive[123] European DC construction standards (see **Chapter 4**) combining legal and financial frameworks with the state of the art in circular building technology, and building on existing certification systems such as BREEAM, LEED, WELL and ISO14000.

D international data gathering, sharing and standards on defining activities in DCs, as elaborated in the point below.

8.3.2 Detailed insights

Second, besides a wider scope, more **detailed insights into the logistics complex** are also needed concerning functionalities and impacts. For example, this thesis was able to distinguish types of logistics buildings based on the existing Dutch Standard Business Categories (SBI) of transport and logistics, as well as trade, import and export. Under these categories, however, there are many types of value-adding tasks being performed within DCs, such as assembly, packaging, testing, and refurbishing. In the circular economy such tasks will arguably increase and diversify. Yet, these tasks remain invisible in the available (micro)data (see **Chapter 5**). Moreover, they are sometimes not even categorisable in the outdated SBI sector categories[124] of 2008. Knowledge of this exact functionality of DCs is key to enabling the circular economy and providing the necessary scarce labour for such activities. A related issue that remains unclear is the extent to which the operations of a DC are serving domestic or foreign trade. Ongoing research at Tilburg University is shedding light on this issue through company surveys, and has estimated a 50-50 division, which is quite consistent with the findings of this thesis (see **Chapter 2**) and a whitepaper by Stec & Denc (Acocella et al., 2024; Stec Group & Denc, 2022). Additionally, analysis of yearly input-output tables of the economy[125] may further increase the understanding of this aspect. Other countries, such as the US and France, already appear to be able to organise the availability of such data more effectively.

123 In setting the standards, it is important to be aware of the inertia of spatial developments. Since these can take 20 years to materialise, quality criteria should be adapted to the world 20 years from now instead of being copied from existing best practices to avoid projects being delivered with the standards from 40 years earlier.

124 Developed by National Statistics (CBS), to be updated in 2024.

125 See CBS (https://www.cbs.nl/en-gb/custom/2023/27/national-accounts-2022-tables)

The thesis discussed and demonstrated several spatial-economic impacts of DC development at the regional and local levels. The regional employment effects shown in **Chapter 5** raise additional questions regarding the risks of economic monocultures and even lock-ins in certain areas, which deserve further in-depth study; for example, in line with the research of Tabak (2022). The shifting skill base in logistics is a relevant point of inquiry, since although automation seems to require more highly skilled personnel, at least until 2023, the lower-skilled labour force appears to have increased even more rapidly due to factors such as order-picking and the deliveries of e-commerce platforms (Azadeh et al., 2019; Chicchi et al., 2022). Despite environmental effects beyond land use and employment (e.g. road congestion, landscape degradation and air quality) falling outside of the scope of this thesis, the thesis shows the need to map these effects in detail. Additionally, societal cost-benefit-like analysis methods to effectively discuss the compound effects of all positive and negative impacts still require development.

8.3.3 Spatial policy options

Third, more in-depth insights are needed into the **spatial policy options for logistics** regarding the actor network and the validity and application of planning information tools. Since the fragmented actor network around DC planning and development presents perverse incentives (see **Chapter 4**), opportunities for improvement exist in this area. The network includes governmental stakeholders (national, regional, local), logistics operators, investors and developers, brokers, consultants, and semi-governmental organisations. Intermunicipal development companies and land banks, for example, are of great interest regarding their role in spatial developments of logistics, as are competing government departments (e.g. economic affairs versus spatial planning, and national versus local government), as well as state-owned enterprises such as port authorities.[126] The mapping of influence (see **Chapter 3**) and lobby networks can be valuable parts of such research. See the work by Koppenol (2017) on the 'lobby for land' in the Maasvlakte II port extension.

Besides the international comparison of governance models mentioned above, local, and regional practices also need to be studied in more detail. Longitudinal studies of cases, such as those described in **Chapter 6**, can shed light on the effectiveness of triple-helix and other economic policies, the negotiation processes of companies with local governments and their semi-governmental development organisations, as well

126 The ownership of Port of Rotterdam is shared between the municipality of Rotterdam (70%) and national government (30%).

TOC

as the participation methods of local SMEs and citizens in policymaking to improve the multi-level trade-offs between benefits and burdens of logistics.

As mentioned above, the further development and dissemination of knowledge in the planning process of DCs is important; for example, via typological suitability mapping tools such as those proposed and tested in **Chapter 7** (Buldeo Rai et al., 2022; Heitz et al., 2019; Sakai et al., 2020). An interesting methodological improvement of the validity of such typologies and maps could be the logistics application of the node-place model—commonly used in public transport research (Bertolini, 1999)—where freight throughput or available transport modes may count as the node value and DC value-adding activities and nearby customers count as place values (Geerlings et al., 2018, p. 9). The thesis has shown that it is worthwhile to evaluate and improve the applicability of this kind of participatory data-driven mapping and policy tools, and it confirmed that not only the validity of the tool itself but especially the procedural and social embedding of the tool in policymaking is crucial for its success.

8.4 Recommendations for the spatial planning of sustainable logistics in Europe

The improved understanding of the dynamics shaping the logistics complex can be used to make three main recommendations for the sustainable planning of logistics:

1. information provision in the logistics complex;
2. planning and design competencies;
3. the collaborative attitude required from public and private entities.

8.4.1 Information provision

First, the sustainable planning and development of the logistics complex requires open and centralised **information provision**. The logistics land market, if it is to be a free and well-functioning market, requires transparency through equally available information for all actors on the demand and supply sides (Voss, 2011).

This thesis has shown that unequal information positions and unfounded claims are instrumental in the occurrence of logistics sprawl and the existing bias in the policy narrative of logistics (**Chapters 3 and 4**). Therefore, it is crucial to introduce more centralised, independent, and open-access knowledge and information into the planning-development network. An informational level playing field would reveal good and bad practices, avoid undesirable 'quick flips', demystify rhetoric fuelled by 'not in my backyard' (NIMBY), lobbying, or other interests, and enable more conscious multi-level trade-offs. The national governments of Europe have the important task of commissioning and funding such a knowledge agenda, which may include topics such as those listed in Section 8.2 (e.g. via existing EU programmes). In the Netherlands a network of organisations is available, including TKI Dinalog, Logistics Topsector, NWA, Stimuleringsfonds and the ministries responsible for spatial planning, economy and infrastructure.

The thesis has also shown that given the detailed availability of information, relevant insights and information tools can be provided for planning and development. It is up to local and regional governments, as well as policy advisers, planners, designers, and developers, to apply this information in practice and help update it by providing feedback and sharing practical experiences. For example, insights on the regional employment structure (**Chapter 5**) and the suitability of locations for types of logistics (**Chapter 7**) place a city or region in the bigger picture of the logistics complex. This is crucial to distinguish real potential from wishful thinking and avoid the mistake of applying a one-size-fits-all spatial-economic policy in regions. Information on future necessities is also key for policy makers. The optimal use of scarce industrial development space—reasoned from the future necessities and ambitions of a city or region (e.g. regarding the foundational and circular economy), and not merely from a land market demand perspective, is emerging in the policy agendas of several Dutch cities (Nefs, Vermeulen, et al., 2023). Additionally, more independent, tracible open-access information in the planning process would avoid the common political backlash alleging untransparent backroom deals that are not in the public interest. The cases in **Chapter 6** suggest that a transparent and thorough assessment of the regional costs and benefits of logistics development in the context of other space-demanding functions—such as SMEs, housing, and nature—would enable sharper and more widely supported trade-offs. New development cases in Tilburg (2021) and Antwerp[127] show that ambitious selection procedures for companies can filter out development projects with insufficient contributions to local employment and other aspects.

127 See Wijkevoort in Tilburg and Blue Gate in Antwerp (https://www.bluegateantwerp.eu/). In the case of brownfield development, legal issues arise with regard to selection procedures. As these issues occur in many places, these need to be tackled in national legislation.

8.4.2 Planning and design competencies

Second, **spatial planning and design competencies** regarding logistics need improvement in both the public and private sectors. Besides knowledge about the issues discussed above, specific interdisciplinary competencies are required to apply two promising yet lagging concepts in the planning discourse on sustainable logistics: the *physical internet* (PI) and clustering of logistics through intensive multifunctional land use.

The **PI paradigm** (Ballot et al., 2014; Crainic & Montreuil, 2016) envisions a highly optimised and standardised goods transport and handling system, operated by collaborating companies using shared vehicles, DCs and *white label hubs*. European projects and research[128] are stimulating the PI, especially regarding *synchromodality*, which involves the optimised use of large multimodal hubs (Geerlings et al., 2018, p. 31) and *consolidation hubs* enabling urban zero-emission zones. The present obstacles to PI include legal liability issues of shared warehousing and the reluctance of companies to voluntarily share data. More importantly, most PI research and pilots focus on logistics and lack a spatial component elaborating on suitable hub locations, the economic activities and urban functions around a hub and the planning and design parameters of PI hubs (beyond the internal logistics operating parameters). Therefore, the opportunities of PI for the sustainable planning of logistics are not yet captured on two key levels: the aforementioned urban zero-emission zones, as well as at the scale of the international logistics complex of the entire Eurodelta. In particular, the emerging European industrial reshoring programme[129]—focused on bringing the production of semiconductors, military equipment, pharmaceuticals, critical machine parts, and sustainable textiles, back to the continent—would need to be integrated with a spatial logistics strategy and the existing European infrastructure programme (Ten-T).[130] Such a cross-border spatial-economic strategy—using insights from **Chapters 3, 5 and 7**—might be an adequate European solution to the issue of how to turn a logistics complex geared toward the distribution of imported goods into a system

128 See the ALICE Roadmap to the Physical Internet (https://www.etp-logistics.eu/alice-physical-internet-roadmap-released/) and the DISCO Urban Logistics Program (https://www.polisnetwork.eu/news/disco-project-kicks-off-for-a-new-generation-of-urban-logistics/) or the Dutch Smartport initiative (https://smartport.nl/project/fysiek-internet-en-zelforganisatie/). Also see warehouse-as-a-service projects like Stockspots (https://www.stockspots.eu/).

129 https://www.interregeurope.eu/find-policy-solutions/stories/reshoring-and-nearshoring-for-stronger-european-value-chains and https://bciglobal.com/en/reshoring-production-back-to-europe-and-the-us-is-on-the-rise-particularly-for-critical-parts-and-final-production-processes.

130 High-tech manufacturing regions in South-Korea and the south of China also feature a tightly planned integration between the industrial and logistics complexes.

that can support increasing domestic production chains and the reverse logistics flows associated with circularity.[131]

This thesis (**Chapters 6 and 7**) has shown that in the planning discourse, the **clustering of logistics through intensive multifunctional land use** is promoted as part of the Dutch spatial planning strategy (BZK, 2020) that aims to mix functions and control the supply of land for logistics (BZK, 2023, p. 31). In mixed-use urban or industrial areas, the circular use of goods, materials and energy is thought to be more viable. This is known as horizontal clustering, in contrast with vertical clustering of similar companies. Mixing is seen as an inevitable way to combine the enormous societal ambitions in increasingly scarce space. Desired outcomes mentioned in the discourse include stacked DCs and DCs combined with other spatial functions[132] such as SMEs, housing and services, and climate-adaptive biodiverse or energy-producing DC (roof) landscapes. Despite these ambitions, none of them are currently being enforced in public policy or market standards.[133] On this topic one can learn from Paris, where mixed developments of zero-emission city logistics with other urban functions such as housing, education, sports, offices, and urban agriculture, are being developed, for example the logistics hotel Chapelle International. Along with public funding[134], the zero-emission zone regulations in Paris have enabled this and similar projects, as well as micro hubs and other innovative spatial-logistical concepts (Nefs, 2023b). Historical examples show that innovative integrations of logistics and urban developments have occurred since early on,[135] with design research projects[136] continuing to explore new possibilities (De Bonth et al., 2022; Defacto Urbanism & Vereniging Deltametropool, 2022; Rademacher & De Vries, 2023). Mixed logistics area developments remain very scarce in practice, since the policy, financial and regulatory frameworks are

131 This would also be a geopolitical answer to the US reshoring policy program: President Biden's Inflation Reduction Act (IRA) of 2022, which features large subsidies for companies to start production units in the country.

132 Also see the research of Nina Rappaport (https://www.verticalurbanfactory.org), and Hosoya & Schaefer (https://www.lars-mueller-publishers.com/industrious-city).

133 Several companies acknowledge such increasing design and location parameters for sustainable logistics hubs and DCs and attempt to integrate these in projects. For example, see a nature-inclusive design and stacked DC by Heembouw: https://www.heembouw.nl/artikelen/blog/natuurinclusief-ontwerpen-zo-logisch-eigenlijk-zou-het-niet-de-standaard-moeten-zijn/ and https://www.heembouw.nl/projecten/harbour-hub-utrecht/

134 Due to a delay in the start of the zero-emission zone, diesel trucks can still enter the central area of Paris, which is temporarily ruining the business case of such initiatives.

135 The underground delivery tunnels and vacuum tube system of Chicago, for example, were built around 1900 and are being researched by architect Clare Lyster for their future potential. Among other users, the vacuum tubes in Chicago were initially used by the pioneering post-order company Sears Roebuck.

136 An early example being a circular logistics hub in the Waalhaven Rotterdam by Van Bergen Kolpa Architects in 2007 (https://www.vanbergenkolpa.nl/onderzoek#economische-contextgoederenvervoer-en-overslag-is-een).

generally not ready (see **Chapter 4**). Therefore, room for experimentation must be created, both in the form of flexible building regulations and new business cases that are riskier than usual.[137] Places with high land prices, such as Singapore or Hong Kong, have a tradition of stacked DCs and factories.[138] More recently, London, Paris, Brussels and Switzerland have also shown mixed developments in logistics and industry.[139] The concept of mixed-use logistics developments suffers from the opposite problem of the PI: although the spatial design is at a sufficient level, there is a lack of logistics understanding among planners and designers to adequately integrate logistics activities in a complex urban environment or landscape. Despite several efforts—for example, a recent design-research project in Rotterdam by PosadMaxwan et al. (2023), work by Van der Zee (2023) and other ongoing efforts in the Grip programme, a considerable gap remains between the urban planning and logistics disciplines.

Competencies regarding both concepts (PI and mixed-use logistics) should be improved by stimulating interdisciplinary collaboration between spatial (urban) planning, spatial economics, and logistics (including supply chain management) as part of the curricula at universities (of applied sciences), in public subsidy calls, and in the public tendering of (re)development strategies and projects.

8.4.3 Collaborative attitude

Third, a **collaborative attitude** is urgently required to enable sustainable logistics planning in practice and construct a new broadly embraced narrative. The conditions have become very challenging for DC developments in the Dutch ESE corridor: scarce land with high land prices, congestion on the roads and the electricity grid, fierce opposition from residents, and issues of housing migrant labour, climate adaptation (peak rainfall), biodiversity, landscape, and nitrogen emissions. Only a coalition of the willing can continue the necessary logistics developments under these

137 Dutch investor Intospace has proposed projects of urban DCs combined with SMEs and housing units, as well as sports facilities on the roof. Existing local zoning laws do not foresee these kinds of mixed-use developments.

138 See Goodman Interlink in Hong Kong (https://hk.goodman.com/our-properties/properties-for-lease/goodman-interlink), and Shimei East Kitchen Singapore (https://www.jtc.gov.sg/find-space/shimei-east-kitchen).

139 See Industria in London by Haworth Tompkins (https://www.dezeen.com/2023/09/19/haworth-tompkins-industria-multi-storey-industrial-building-london/), Ikea in Vienna (https://design.fanpage.it/ikea-apre-a-vienna-il-suo-store-piu-innovativo-con-facciata-verde-e-senza-auto/), and Techcluster Zug by Hosoya Schaefer (https://techclusterzug.ch/).

conditions (see **Chapter 6**). Such a coalition would need to agree on a proposition or process that meets all sustainability requirements and demonstrate that this can be achieved. This would certainly involve public and private investments higher than in a business-as-usual situation. Above all, a significantly different attitude would be needed both at the public and private sides by committing to a joint narrative as was the case in the 1980s and 1990s (**Chapter 3**).

From the side of the national government, the following is required:

A Research and policy collaboration (instead of competition) on logistics across national borders, as well as clear positioning of the Netherlands and its key provinces in the logistics-industrial complex of the Eurodelta. This can help to mitigate undesired border effects and provide an overarching spatial-economic framework for DC developments.

B Unambiguous choices, in close collaboration with the provinces, regarding the economic sectors for which scarce space and human resources will be made available and for which this is not possible anymore.[140] This means constructing policy theories without unrealistic win-win situations and silver bullets, as discussed in this thesis.

C Nuanced and conditional[141] land supply measures established in close collaboration with the provinces and municipalities to decrease the ongoing 'waterbed effect' that pushes DC developments toward suboptimal locations.

D A legal helping hand for the many municipalities and companies who cannot use the available opportunities for desirable multifunctional logistics developments due to legal issues in land use plans requiring expertise. More space for experimentation is needed.

E Nuanced political communication on the possibilities, grounded in studies and negotiations, avoiding the recent polarised positions of either laissez-faire or a full construction ban.

140 For the close relationship between creating spatial conditions and the development of the economy in a small country, see 'De logistiek van morgen begint vandaag' (CRa, 2023), 'Niet alles kan overal' (Remkes, 2020), and an article by economics professor Hinloopen (UvA) on the atypical economic structure of the Netherlands (https://fd.nl/opinie/1497904/kies-voor-sectoren-die-minder-beslag-leggen-op-publieke-ruimte).

141 Good practices such as Bluegate Antwerp and Wijkevoort in Tilburg already use checklists of various values that must be generated by a project to be eligible for a parcel of land.

From the side of the logistics (real estate) sector, the following is required:

A Propositions that provide a proven regional added value—in terms of comprehensive wellbeing[142] and sustainability[143]—that is worth the environmental cost in terms of, for instance, landscape transformation and road congestion.

B Sharing of data to enable sustainable spatial-economic planning and optimisation programmes; for example, PI solutions such as a white label consolidation hub system.[144]

C Design responsibility for a healthy work environment, including daylight, safe leisure and transport facilities, and acceptable housing for temporary workers. Additionally, the exclusive use of employment agencies with a quality label may be required, as soon as that exists.

D Contributions from greenfield developments into a (national) brownfield redevelopment fund.[145]

E Communication moving away from the recent defensive position and toward a commitment to existing sustainability agreements. The sector is not merely a middleman and certainly not the underdog; it has influence in the production chains and the means to show that it can deliver on sustainability indicators.

To build a persuasive public-private narrative, based on research and balanced discourse coalitions (Hajer et al., 1993) that features explicit transparent policy theories solving urgent problems (Hoogerwerf, 1990), stakeholders need to move away from the 'abnormal discourse'. Throgmorton (1996, p. 168) used this term to describe a similar situation of distrust and polarising communication in the energy sector of the US. During the present research, attempts were made to sketch the outlines of such a national narrative; for example, in an opinion piece in a national newspaper (Nefs et al., 2021) and a narrative based on a series of multi-disciplinary expert sessions organised by the Board of Government Advisors (CRa, 2023; CRa et

142 This includes, besides contribution to regional employment and domestic product, also an attractive and healthy living environment, as well as biodiversity.

143 Some lobby groups have warned about increased costs for consumers to avoid landscape quality regulations. This is not a convincing argument since such measures amount to a small percentage of DC costs, whilst logistics amounts to only a small fraction (around 5%) of the costs of a product—a large share of which being the costs of the last mile.

144 For example, Pre-zero (https://prezero.nl/), Stadslogistiek (https://stadslogistiek.nl/), Hubbel (https://hubbel.nl/) and City Hub (https://cityhub.nl/)..

145 Already suggested by Stec (2020).

al., 2023). These attempts were grounded in major trends such as scarcity of space and personnel, as well as the emerging policy context focusing on comprehensive wellbeing and the transition to a circular economy. The commitment as well as defensive reactions regarding these attempts demonstrate the need for further deliberation and adjusting by public and private practitioners. In the new National Spatial Strategy (Nota Ruimte), which is being elaborated at the time of writing, the introduction of a clear narrative will be key, since in the recent preliminary version choices on the logistics complex are still not clearly made (BZK, 2023). As previously mentioned, when considering the common EU goals and policies combined with an increasingly uniform legal and fiscal structure, a narrative on the scale of the Eurodelta would be of great value.

Thus, commitment to a broad research agenda combined with improved information provision, higher planning and design competencies on the public and private sides, as well as constructive attitudes in strategic decision-making and communication, would enable a well-informed and broadly supported policy narrative on sustainable logistics—one that allows society to get the most out of each square metre in the **Landscapes of Trade**.

9 Reflection on the research process

In retrospect, a PhD research project can also serve as a case for a study on a personal scientific adventure. Two reflections come to the fore here: one concerning interdisciplinary research with combined methods, and another related to performing research on a large socio-technical apparatus that one is participating in.

9.1 Interdisciplinary research and combined methods

The research approach on the apparatus of the logistics complex combined empirical methods from the spatial planning and spatial economics disciplines. This section briefly reflects on the inherent benefits and difficulties that emerge from this combination. The overarching research question—**what historical, economic, and institutional dynamics shape the rampant expansion of the logistics complex in the Netherlands?**—seems to require primarily a qualitative approach, as does the nature of the apparatus, involving many interrelated artefacts and institutions. Since this field of study is still emerging, both descriptive and explanatory sub-questions had to be answered in **Chapters 2–7**. Before explaining anything, it was necessary to create a reliable big picture of the phenomenon by using quantified spatial and economic data. To achieve a comprehensive understanding of the mechanisms that explain and influence this spatial-economic pattern, actor behaviour and interpretations of the planning and development process of DCs needed to be studied. This was done through interviews, document analysis and other qualitative methods, in a situation where the researcher inevitably influences the subject being studied and vice versa.

The views on mixing—or combining—research methods vary. Gargani[146], although an enthusiastic user of mixed methods, avoids using this term in publications since the idea is still frowned upon in some circles. The underlying mix of a (post)positivist and interpretivist epistemology in mixing quantitative and qualitative methods is often regarded incompatible. In his book 'In defense of disciplines' Jacobs (2014) argued that interdisciplinarity often fails to deliver on its promise of more integrated research and that strong disciplines themselves are not impermeable silos. Nevertheless, mixed approaches are growing in number, particularly in the social sciences, and defended by well-known scholars such as Thomas Piketty. In the introduction of 'Capital in the 21st Century', Piketty (2017) emphasised the need for the economics discipline to look beyond the numerical models and once again become part of the social sciences. Additionally, he emphasised the need to gather better quantitative empirical data, to break free from the model focus. In the case of the logistics complex, these also seem to be valid points.

How should mixed research methods be applied? In the definition by Tashakkori & Creswell (2007) in their editorial for the first edition of the Journal of Mixed Methods Research, it concerns either a combination of qualitative and quantitative data or a combination of qualitative and quantitative approaches. According to Gargani, the first is always the case if one looks closely enough. The second is sometimes the result of an unlucky ideological compromise where, for example, insiders have more faith in qualitative methods while outsiders place more value on quantitative methods. Although the choice of the research methods in this thesis was ultimately made by the author, in the research context some stakeholders (economic policy makers and companies) appear to value quantitative methods slightly more, while others (spatial planning and landscape policy makers) often prefer qualitative methods. However, in the practice of spatial policymaking for logistics a lot of cherry-picking occurs from both qualitative and quantitative outcomes if these are more in line with one's own views and goals.

Gargani's interpretation of Tashakkori and Creswell's definition of sound mixed methods research, to 'establish in advance a design that explicitly lays out a thoughtful, strategic integration […]', was difficult to meet in a dynamic process such as the one addressed in this thesis. The initial research approach separated various elements in the logistics complex that could be observed: physical artefacts (DCs) and experienced landscapes, arguments, and narratives for decision-making (policy theories, counternarratives), economic patterns (regional, national) and effects

146 https://evalblog.com/2012/03/26/running-hot-and-cold-for-mixed-methods-jargon-jongar-and-code/

(employment, agglomeration), as well as governance structures. How these elements could be analysed in detail, focusing on which variables, with which type of data collection and processing, and with what type of output, could only be found out along the way in each paper.

Among mixed-methods enthusiasts, there remains a preference for separating research steps that are quantitative and qualitative, if possible. In this research, **Chapters 3 and 4** are fully qualitative, only referring to some external spatial and economic figures for context. **Chapters 2 and 5** are largely quantitative, with use of some qualitative elements. **Chapter 6** is qualitative in approach but uses quantified variables of the argumentation in regional DC-related politics and media coverage to illustrate these dynamics. **Chapter 7** is a hybrid because it relies on quantitative methods such as Q-method statistics and weighed multicriteria analysis, as well as on written remarks and documents of the planning discourse, to describe and explain different views. Besides yielding interesting results, which could often not have been obtained by using a singular approach, combining methods provides an opportunity for the triangulation of findings and validation of the research outcome. For example, some of the dynamics in the actor network behind DC planning and development—discussed in **Chapter 4** via in-depth interviews—could be identified again through the Q-method survey analysis presented in **Chapter 7**. Arguably, each chapter (and journal paper) will have its own (multi or mono) disciplinary audience.

Cross-disciplinary and mixed-methods research also has its limits. The broadness of a perspective on an issue always comes at the cost of depth. Choosing an interdisciplinary topic makes it virtually impossible to focus on only one general theory to expand and challenge. Furthermore, a research team or supervisory committee has the disciplinary coverage of its members. In this thesis, each member of the multi-disciplinary team of supervisors could stand out in their own discipline and take the role of critical outsider in other disciplines. In the methodological learning process of the PhD project, combining methods has steepened the learning curve. Additionally acquired skills during this project included surveys, semi-structured interviews, programming in R and performing various reproducible quantitative analyses (e.g. OLS and shift-share), as well as advanced spatial and numerical data visualisations. Still, it seems unavoidable that there is a trade-off for any individual researcher between broad and deep methodological skills, as well as between quantitative and qualitative experiences.

9.2 Studying apparatuses: A reflection using concepts by Latour

Studying apparatuses such as the logistics complex does not only involve assessing the many components and their interrelations whilst zooming in to framed case studies and zooming out to the whole again. It turns out that as a researcher, it is difficult to maintain a secure distance from this object of study. After all, we are all part of this apparatus as a consumer and voter, at least, and also as a professional at times. Knowledge of the logistics complex in the Netherlands has been in such high demand by policy makers, fellow researchers, citizens, and journalists that it became difficult and sometimes quite impossible to work on this topic in a social vacuum. Simultaneously, to obtain relevant inside information on the logistics sector, establishing relationships with companies was necessary. Some research projects (Frejlachová et al., 2020) opted out of developing such relations with the logistics sector and maintained a bystander view; despite being a critical view, this likely resulted in limited access to relevant information. Engaging in relationships with actors that are part of the object of research involves what anthropologists call the risk of going native, losing critical distance altogether. While that is a recognised point, it seems that an independent and investigative attitude of the researcher can overcome this risk. For example, Lovelock was able to develop his famous Gaia theory while under contract at the Shell oil company.[147] This thesis has attempted to mitigate this risk by adopting multiple perspectives (government, company, citizen etc.) and by maintaining transparency. For example, the author has been part of governmental, societal, and corporate discussion groups. For the sake of openness and impartiality all research background materials, data (as far as legally possible) and data processing scripts are shared in online repositories.[148]

Several philosophical concepts describe similar situations as the *apparatus*; for example, *urban assemblages* (Farias & Bender, 2010) and *foam* (Sloterdijk, 2009). The governance literature also mentions concepts like the *socio-technical system* and its policy subsystem (Edmondson et al., 2018). For this reflection, inspiration was taken from the *actor-network theory* (ANT). According to Latour (2005), we are

147 https://www.theguardian.com/theguardian/2008/mar/01/scienceofclimatechange.climatechange

148 DOI: 10.4121/b39208e8-3d54-421d-b453-ef0831e3b913

now part of a technologically interconnected heterogeneous and complex system. This also appears to apply to the logistics complex. Furthermore, Latour views science and society not as given entities, but rather as an ongoing process involving endless associations and connections between actors—both human and non-human.

In the ANT, human and non-human actors are equal players participating in social networks designed to achieve specific goals and ends, whilst society is a complex web of interlinked actor networks (Latour, 2005). In the case of the logistics complex, we can argue that the networks of infrastructure, DCs, as well as governmental and private sector stakeholders, are organised to achieve the basic societal goals one can expect from such a system, including goods deliveries and value added, generation of jobs and profits. However, some of the driving forces behind the development of the logistics complex, as found and confirmed in this research, seem to pertain to dynamics beyond these basic goals. Some of these forces include financial risk management by investors and sometimes perverse incentives such as the 'quick flips' by private equity firms in rural municipalities with limited resources due to a lack of proper regulation and unequal access to information, and for a great deal path dependency. Since the 1980s and even earlier, choices have determined many of the systems' developments today. For policy makers, reassessing and redefining the basic societal goals of the apparatus is thus of key importance.

In his critical review of the ANT, Sismondo (2004) offered two plausible explanations for actor networks that do not seem to deliver their societal goals. First, the theory does not account for cultural practices within the network, particularly the presence of trust and views on (ir)rationality. This is clearly the case in the discourse about the logistics complex. Trust is low in this network (see Chapter 7), in which corporate information is seldom shared for fear of competition in a situation of small profit margins, and where government regulation is often perceived as threatening and volatile—potentially moving from a laissez-faire situation straight to a full moratorium on DC construction. Views on rationality are diverse in the planning discourse. There are strong normative positions about the need to reform the system top-down to enable the circular economy. At times, these positions are strongly deterministic from a market perspective, assuming that the system per definition does what it is supposed to do and if circular supply chains were necessary, clients would be asking for them.[149]

149 These positions were part of several discussions with planning experts and logistics (development) companies, organized by CRa and the Deltametropolis Association in 2022–2023 (see Appendix 3).

Second, ANT focuses on successful networks—not suppressed ones. Latour used the successful example of Pasteur developing penicillin using microbes in his Paris lab as a case. But what about zero-emission logistics, a broadly accepted goal that has not become a reality yet for several reasons? An explanation might be that the network of actors simply needs more time. There are technical challenges to be solved, such as affordable electric vehicles with sufficient range, organisational challenges such as shared city logistics hubs, and (spatial) policy challenges such as the effective introduction of zero-emission zones and regulations. Still, these obstacles are difficult to identify conceptually, in the words of Latour, as 'related actors' in the existing network.

Latour's view on the scientific process itself also applies to this research. In 'Science in Action' (1987) Latour opens the 'black box of Pandora', revealing science as a messy social process of acquiring knowledge, not purely the rationality and methods one would expect. Also see the work of Kuhn (1962) on paradigm changes. Latour extensively studied the laboratory, 'the place where scientists work', identifying a scientific race between competing 'counter-laboratories' with increasingly complex equipment. However, in studying the apparatus of the logistics complex, rather than competing researchers tied to large institutions and massive amounts of funding like in nanotechnology, there is a quite collaborative group of researchers at play. This group does not depend on capital-intensive labs or equipment— except for costly proprietary datasets. The research focus is often on making sense of a messy network of stakeholders, private and public, each with their own interests, powers, tactics and strategy—or lack thereof. In the social sciences, and certainly in the case of the logistics complex, the laboratory inevitably overlaps with the object being studied. With both a lack of competition and the government commissioning of academic research in the current context of the spatial planning of logistics, this field of study seems difficult to enhance very quickly.

Here, Latour's concept of *translation* is relevant to explain the reshuffling of interests and goals in a scientific process, as well as the drifting away from the original interest of the research (Latour, 1987, p. 113). Also in this thesis, several actors saw an urgency for research, but in different scopes and directions. For example, the national government became particularly interested in countering the 'boxification' of the landscape through clustering and more selective planning of DCs due to political pressure in parliament (Bontenbal, 2022; Bruinsma & Amhaouch, 2019). The logistics developers and investors saw a need for research emphasising the societal need for and added value of logistics, to legitimise additional land use by the sector. Research into best practices of spatial developments and multifunctional and landscape-integrated design of DCs was an interest promoted by several other

actors, excluding a group of more traditional developers who thought these new models were unrealistic and too expensive.

Amongst academic actors, there are more practically oriented research groups focusing on ports, city logistics, the PI, supply chain management, the architecture of logistics and other related topics. These groups have frequently influenced each other. An example of research influencing the societal discussion has been the collaboration between the author of this thesis, the Deltametropolis Association, the Board of Government Advisors (CRa) and a group of progressive DC developers.[150] Three jointly organised public debates were held on the topic, in 2019, 2022 and 2023 (see Appendix 3). The research outcome of Chapter 3 highlighted the importance of building new policy narratives regarding logistics in the Netherlands. The organisers of the debates acknowledged that need and outlined such a new narrative, based on several expert sessions with governmental, NGO and logistics sector representatives (CRa, 2023; CRa et al., 2023). Even though not all stakeholders fully agreed with the resulting text compromise, from their respective positions as independent researchers or dedicated lobbyists, they collectively participated in the thought process of developing a new narrative.

Finally, Latour (2003, 2005) described five phases in the political life of a research object:

1. Political discovery of the issue.
2. Claiming of the issue by stakeholders.
3. Institutionalised discussion of the issue (forums, arenas, tribunals).
4. Negotiation and problem solving.
5. Bureaucratisation of the issue (politically dormant).

Judging by the media coverage, it can be estimated that when the proposal for this thesis was being developed in 2018–2019 the issue in Dutch politics was positioned somewhere between phases 1 and 2, and during the 5-year PhD project, phase 3 has occurred—although there are still fierce discussions. Phase 4 was also initiated, and it is still ongoing. Phase 4 will arguably not conclude in the near future due to political unrest at the provincial level (a shift in the election outcomes of March 2023) and national level (the Rutte IV administration suddenly resigned in July 2023).

150 DILAS (www.dilas.nl) gathers logistics developers that are susceptible to critique on logistics developments. Similarly, Societeit Vastgoed, VOGON and other real estate business groups have recently become active in the debate.

In such a volatile context, it is difficult to read the correct trends. For example, the DC real estate bonanza that was clearly visible in documents and interviews in the 2019–2021 period evaporated quickly in 2022 with rising interest rates, decreasing yields and ever-scarcer land for developments. In this case, a long-term view is necessary to identify research pitfalls (Kahneman, 2012). These include *red herrings*: a specific policy decision or interest rate hiccup can appear as game-changing events in DC development in the short term, whilst they are sometimes irrelevant when viewed in the long term. Similarly, the statistical phenomenon of *regression to the mean* can shift the focus to certain exceptional locations, where DC development is booming due to recently changed circumstances in the market or policymaking; however, when viewed in the long term, such locations can appear more average.

As such, there lies a great task for researchers to provide evidence and concepts to finish phase 3, the institutionalised discussion, in a satisfactory manner and undergo the subsequent negotiation and problem-solving phases in the issue of the **Landscapes of Trade**. For the time being, the issue seems far from bureaucratised or politically dormant.

Appendix

Data treatment method Dutch distribution centres

The compilation and maintenance of a detailed dataset of distribution centres (DCs) is challenging because of both the availability and the reliability of the data. The data introduced in **Chapter 2** is further explained in this appendix. The compilation makes use of several sources (see flowchart in Figure APP. 1):

1 Open StreetMap (OSM) is the most frequently updated open-access source of building geometry in high detail. Therefore, it is used as the basis for the building footprints at the starting point in the compilation. The categorization of the buildings in OSM (residential, industrial, etc.) however, is not reliable enough to use in the compilation.

2 Company microdata of the Netherlands (2020 and 2017) can fill this functional gap. These proprietary data are not open-access and could be used for this research through an arrangement of the Erasmus University Rotterdam with Stichting LISA. The data provide a highly detailed overview of firm locations and their respective economic (sub)sector as well as employment numbers. Sometimes several (logistics) companies are registered in a single building. In such cases, the data is aggregated on the building level, summing up the employment level and taking the function attribute of the larger company.

3 Business estates in the Netherlands are documented in the Ibis dataset. It is an open-access source, yearly updated with information supplied by the provinces. It includes existing and planned sites. As updates are performed on a yearly basis, there is some delay in for instance the number of hectares in the estate that are still available for development. It is a useful foundation for the compilation of the dataset, because it provides delineation and names of the business estates. Limiting the dataset to such estates was a key choice to keep it clean, since small firms (freelancers) located in residential areas are excluded in this way. It is possible, however, that by doing this small storage locations of city logistics are excluded as well. The research focuses on the regional and national level.

4 The building administration data of the Netherlands (BAG) is largely similar to OSM, but updated less frequently, at least until 2021. A great advantage of the newer versions of BAG is that it includes construction years of the buildings. By joining this information to the data, it becomes possible to demonstrate the growth and growth pattern over longer periods of time. The small number of missing construction years was manually filled in using georeferenced historical maps.[151]

The documentation on the repository provides more detailed information on the dataset (Nefs, 2022b). The step-by-step process of data compilation is shown in 3, a flow chart describing the steps from the source data in the top to the resulting data in the bottom. First, the buildings are selected from the OSM data, when these are larger than 500 sqm and located on an Ibis business estate. Second, logistics companies are selected from the LISA data, following a list of SBI codes available in the repository. Selecting the buildings from the first step that spatially match the logistics companies provides the largest part of the resulting objects. For an overview of the selected SBI sector codes, see Table APP.1.1.

An important step in the process is the inclusion of missing DCs that are not findable in the company microdata but are clearly visible in reality and on aerial pictures. The missing DCs, about a fifth of the data including many recent XXL DCs, are selected by searching for buildings on business estates larger than 2.500 sqm—to maintain a workable number for manual verification—that do not have a LISA entry. This selection is manually validated by using Google Earth and Streetview. Loading docks and google company location information indicate logistics in many cases. Often piles of construction materials or scrap, as well as Google company information, indicate that a building is used for other purposes, such as a construction or recycling company. Possible explanations for the lacking data are very recent constructions that have not been processed yet in the annual update, and the practice of leasing DCs from a third party or registering a DC at another company location.

151 www.topotijdreis.nl

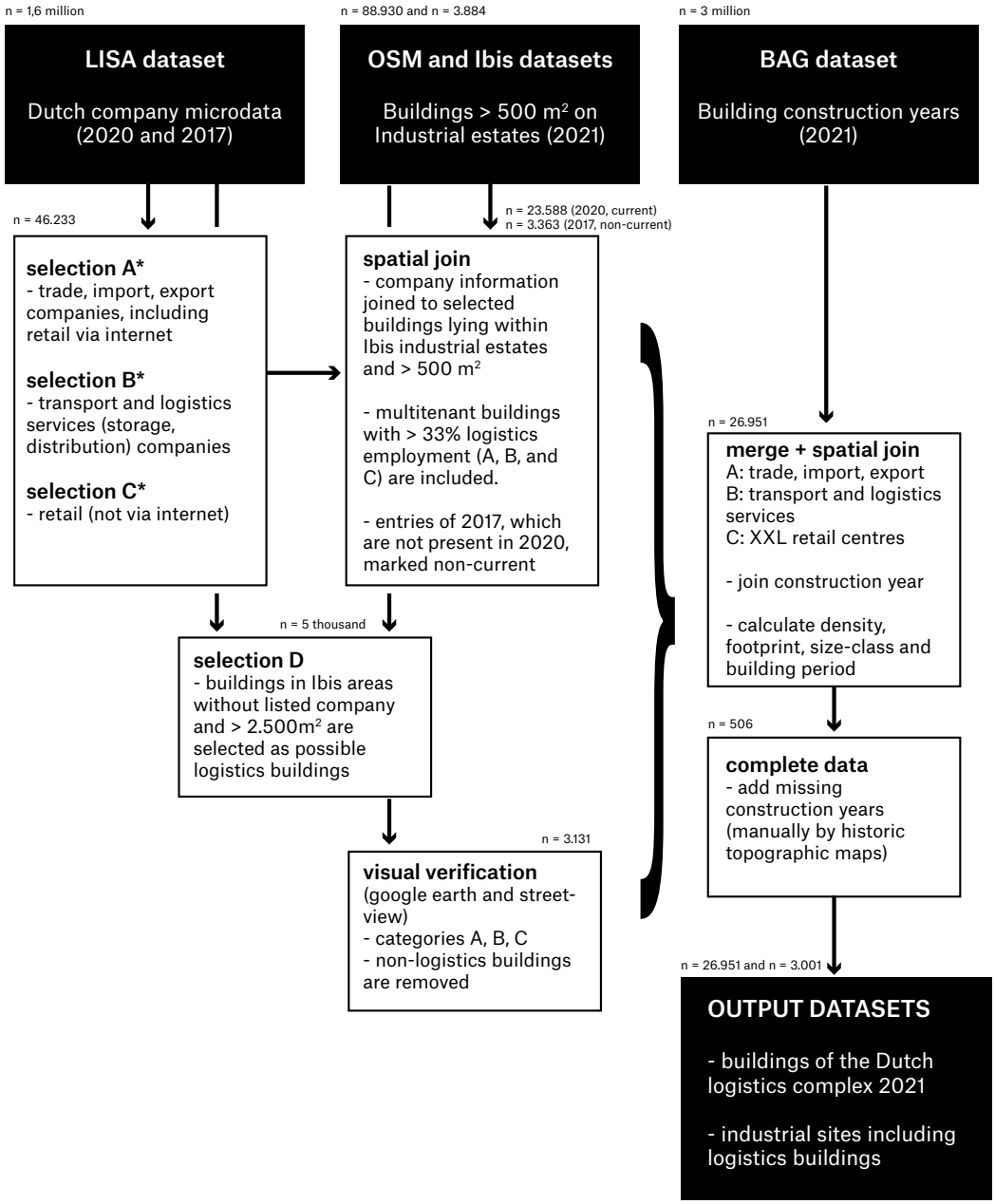

FIG. APP.1.1 Flow chart of data treatment.

TOC

TABLE APP.1.1 List of SBI sector codes included in the broad definition of logistics in the dataset (see selection groups A and B in flowchart), as well as XL retail centers (selection C).

SBI-2012 sector code (2-5 digits)	Dutch	English	Selection group (see flowchart) & Function in dataset
45.11.1	Import van nieuwe personenauto's en lichte bedrijfsauto's	Import of new personal automobiles and light business automobiles	A: Trade, import, export
45.19.1	Import van nieuwe bedrijfsauto's	Import of new business automobiles	A: Trade, import, export
45.31	Groothandel en handelsbemiddeling in auto-onderdelen en -accessoires	Wholesale and trading in automobile parts and accessories	A: Trade, import, export
45.40.1	Groothandel en handelsbemiddeling in motorfietsen en onderdelen daarvan	Wholesale and trading in motorbikes and parts	A: Trade, import, export
46.2	Groothandel in landbouwproducten en levende dieren	Wholesale in agricultural products and livestock	A: Trade, import, export
46.3	Groothandel in voedings- en genotmiddelen	Wholesale in food, drinks and tobacco	A: Trade, import, export
46.4	Groothandel in consumentenartikelen (non-food)	Wholesale in consumer goods (non-food)	A: Trade, import, export
46.5	Groothandel in ICT-apparatuur	Wholesale in ICT equipment	A: Trade, import, export
46.6	Groothandel in machines, apparaten en toebehoren voor industrie en handel	Wholesale in machines, equipment and accessories for industry and trade	A: Trade, import, export
46.7	Overige gespecialiseerde groothandel	Other specialized wholesale	A: Trade, import, export
46.9	Niet-gespecialiseerde groothandel	Non-specialized wholesale	A: Trade, import, export
47	Detailhandel	Retail	C: XL retail center (ONLY IF located on business estate AND > 500 sqm)
47.91	Detailhandel via postorder en internet	Retail via postal order and internet	A: Trade, import, export
49.20	Goederenvervoer per spoor	Goods transport via rail	B: Transport and logistics services
49.41	Goederenvervoer over de weg (geen verhuizingen)	Goods transport via road (excluding relocations)	B: Transport and logistics services
50.2	Zee- en kustvaart (vracht-, tank- en sleepvaart)	Maritime and coastal navigation (freight, tanker and towage)	B: Transport and logistics services
50.4	Binnenvaart (vracht-, tank- en sleepvaart)	Inland navigation (freight, tanker and towage)	B: Transport and logistics services
51.2	Goederenvervoer door de lucht	Goods transport via air	B: Transport and logistics services
52	Opslag en dienstverlening voor vervoer	Storage and services for transportation	B: Transport and logistics services
53	Post en koeriers	Post and couriers	B: Transport and logistics services

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About the author

Merten Nefs grew up in the Dutch province of Zeeland. He obtained a master-degree in Architecture in Delft in 2003. From 2003-2009 he lived in Brazil, where he did research at the University of São Paulo and worked as practitioner in the field of architecture and urban planning. In the period 2010-2022, he organized research programmes, events and publications at the Deltametropolis Association, a spatial planning NGO based in Rotterdam, where he started Landscapes of Trade as an external PhD project in 2019. From 2023, he works at the Erasmus Centre for Urban, Port & Transport Economics (UPT), part of the Erasmus University Rotterdam. Merten regularly teaches at universities and universities of applied sciences.

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Publications

Academic publications

Part of this thesis

- Nefs, Merten (2024) Applying a logistics cluster typology in spatial planning for circularity: lessons from a Dutch policy lab. Journal of Planning Practice & Research, https://doi.org/10.1080/02697459.2024.2315399

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TOC

Events and presentations

Public events

- Roundtable: 'Geography of Logistics'. AESOP conference, Paris, July 2024.
- Presentation and discussion: ‘Het Juiste Bedrijf op de Juiste Plek’. BT congres Rotterdam, 08-11-2023
- Debate: ‘Port City Atlas book launch’. TU Delft & Nieuwe Instituut 2023-10-05
- Expertmeeting: ‘De logistiek die we willen’. CRa & Deltametropolis Association 2023-02-23
- Debate: ‘Is er nog ruimte voor logistiek in Nederland?’. Dilas, CRa, Deltametropolis Association & Erasmus UPT, 2023-04-21, https://dilas.nl/events/vastgoeddebat/
- Debate: ‘Logistiek en huisvesting van arbeidsmigranten’. Limburg Filmfestival, 2023-06-02 https://limburgfilmfestival.nl/filming-logistics/
- Merel en Tracy praten door met Marie Wastiau en Merten Nefs: Verdozing van het Nederlandse landschap. De Architect Podcast 2023-03-02, https://open.spotify.com/episode/2h2Kj62xvWtbtAC1zEkETl
- Debate: ‘BESTELD – de logistiek die we willen’. Deltametropolis Association & CRa, 2022-11-29, https://deltametropool.nl/activiteit/besteld-de-logistiek-die-we-willen/
- Symposium: ‘Logistiek vastgoed en verdozing, hoe nu verder?’ VOGON, 2022-11-11, https://www.vogon.nl/vogon-events/item/106-vogon-symposium-2022?utm_source=www.startpage.com&utm_medium=referral&utm_content=/

- CRa (2022) Roundtable: ‘Agrologistiek en Vertikale Landbouw’. 2022-11-08

- Debate: ‘Koplopers: zonder verdozing’. De Balie, 2022-09-19, https://debalie.nl/programma/de-koplopers-zonder-verdozing-19-09-2022/

- Keynote: duurzaam ruimtegebruik en logistiek. Brabant Ontmoet video 2022, https://www.youtube.com/watch?v=LFMI42lycSk

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- Roundtable: Duurzaam logistiek vastgoed. Provada real-estate fair, 2021-10-27

- Keynote: Bedrijventerreinen van de toekomst. Dag van de Ruimtelijke Kwaliteit Noord-Holland, 2021-09-15

- Livecast: Duurzame economie en ruimte – de rol van ontwerpend onderzoek. Stimuleringsfonds Creatieve Industrie & Pakhuis de Zwijger, 2021-04-30, https://stimuleringsfonds.nl/nl/de_nieuwe_ruimte/30_apr_lancering_tweede_open_oproep_voucherregeling_ruimtelijk_ontwerp/

- Debate: Resultaten van Design Challenge ‘Out of the Box’. CAST, Deltametropolis Association & Omroep Tilburg, 2020-08-21, https://deltametropool.nl/activiteit/alternatieven-voor-verdozing/

- Debate: BEZORGD – debat over XXL logistiek. Deltametropolis Association & CRa, 2019-10-29, https://deltametropool.nl/activiteit/bezorgd/

- Lecture and discussion: Landscapes of Trade. Architecture Film Festival Tilburg (TIAFF), 2019-04-19, https://www.tiaff.nl/nl/the-lonely-battle-of-thomas-reid

Presentations and workshops (academic and professional)

- Kickoff: Stuurgroep Steden & Ruimte [Board Cities & Space]. TKI Dinalog, Utrecht, 2024-02-01
- Lecture & discussion: 'Logistics in urban development'. Fontys university of applied sciences, Tilburg, 2024-01-30
- Lecture & discussion: Logistics real estate. TIAS business school, Utrecht, 2023-12-19
- Workshop: 'The city as walk-in closet – how urban trends influence the use of personal storage space'. Research workshop with industry partner ALLSAFE, 2023-12-07
- Presentation: Port areas and the circular economy. Havennetwerk Fryslân, Harlingen, 2023-11-30
- Workshop: 'Physical Internet based sustainable city logistics', part of EU-funded project DISCO, in Barcelona, 2023-10-23
- Masterclass: 'Sustainable city logistics', part of Interreg meeting of the Zero Carbon Infrastructures (ZCI) project, in Cork, Ireland, 2023-10-17
- Expert focus group: 'Logistiek vastgoed in de Bouwshift'. Vlaams Gewest, departement Omgeving & IDEA Consult, 2023-09-28
- Challenge 'Zero-emission Logistics' for teams of logistics students and stakeholders in the Netherlands, organized at Erasmus UPT and funded by Topsector Logistiek, June-November 2023
- Expertmeeting: 'Stel dat atelier Economie'. Ministry of BZK, Generation Energy & Deltametropolis Association, 2023-07-03
- Expertmeeting: Visie Bedrijventerrein Lage Weide. Utrecht, 2023-06-28
- Rbanism symposium: Reproducibility Challenge, 2nd prize for research paper repository. TUDelft, 2023-06-08

- Expertmeeting: Intensivering bedrijventerreinen Utrecht en Tilburg. Tilburg, 2023-06-26

- Presentation & discussion: Gebiedsmanifest Toekomstbestendig Loven. Tilburg & BTT, 2023-04-17

- Paper presentation: AESOP 2022 Conference in Tartu, Estonia. 'Beyond global gains and local pains - spatial inequality of hinterland logistics', July 2022

- Lecture: City Logistics and Area Development. Master City Developer (MCD), Erasmus University, 2022-10-11

- Lecture: Logistical networks. Delivery Society, a design studio at TUDelft, 2022-05-17

- Conference session: Grip op grote bedrijfsvestigingen. NOVI conference, Ministry of BZK & Deltametropolis Association, 2022-05-18

- Lecture & discussion: Logistiek vastgoed. TIAS business school, Utrecht, 2021-11-18

- Symposium presentation: Landscapes of Trade. Next generation podium Eurodelta, 2021-05-20, https://deltametropool.nl/activiteit/next-generation-podium-for-eurodelta/

- Logistical developments in real-estate. Holland Property Plaza, 2020-11-18, https://www.hollandpropertyplaza.eu/logistiek-en-de-worsteling-met-duurzaamheid/

- Lecture & discussion: Logistiek vastgoed, TIAS business school, Utrecht, 2020-11-13

- Panel discussion: Verdozing en logistiek. Summit Logistieke Hotspots, 2020-11-10, https://www.logistieke-hotspots.nl/?vakmedianet-approve-cookies=1&io_source=https%3A%2F%2Fwww.startpage.com%2F

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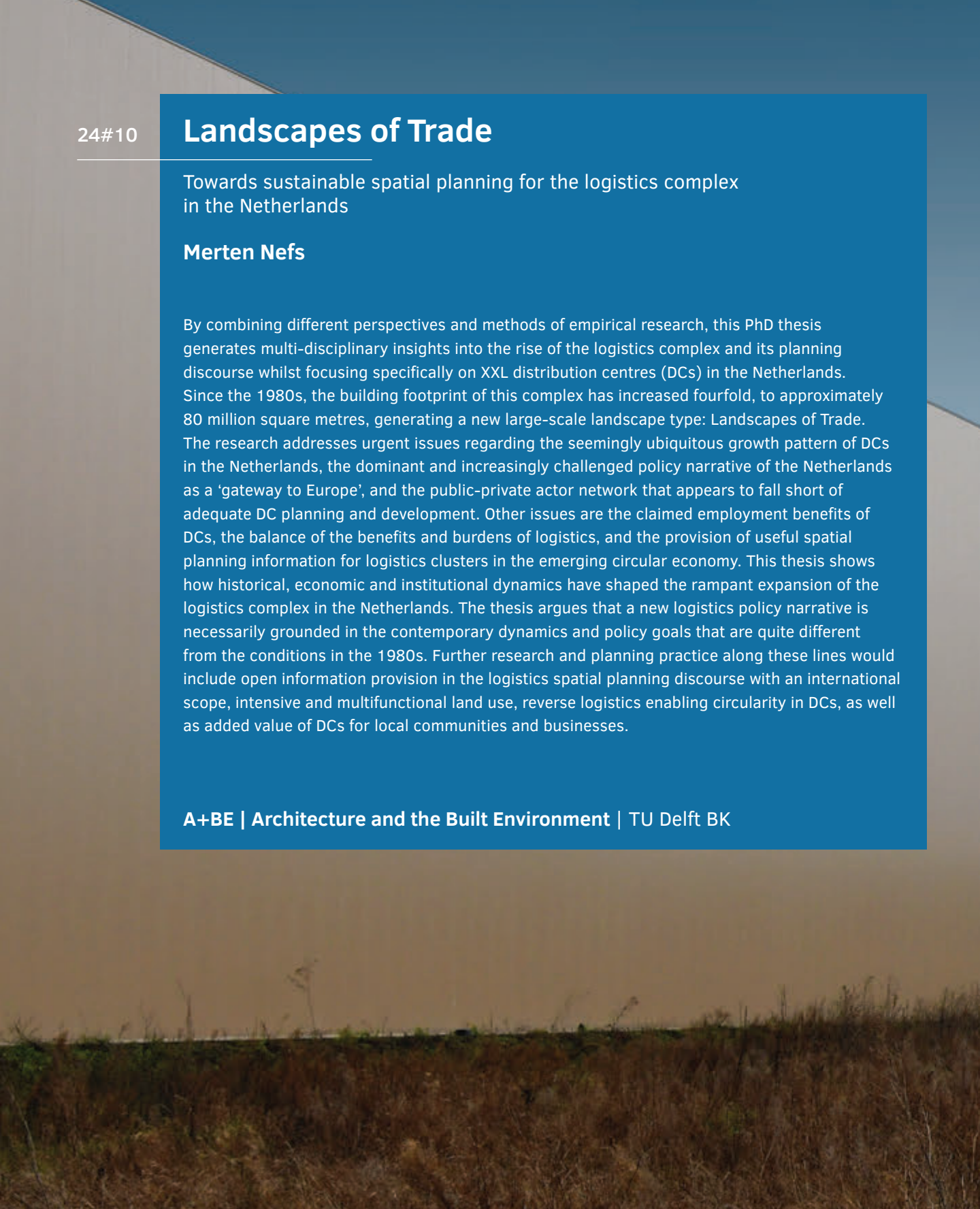
- Expert opinion: Plannen logistiek bedrijventerrein Wijkevoort. Gemeenteraad Tilburg, 2019-08-19 (in combination with XXL logistics field trip by CAST, 2019-08-23)

- Symposium: PhD day. Delft University of Technology, 2019-06-04

- Symposium paper presentation: 'Handelslandschappen', PlanDag 2019, Turnhout, 2019-05-23

TOC



24#10

Landscapes of Trade

Towards sustainable spatial planning for the logistics complex in the Netherlands

Merten Nefs

By combining different perspectives and methods of empirical research, this PhD thesis generates multi-disciplinary insights into the rise of the logistics complex and its planning discourse whilst focusing specifically on XXL distribution centres (DCs) in the Netherlands. Since the 1980s, the building footprint of this complex has increased fourfold, to approximately 80 million square metres, generating a new large-scale landscape type: Landscapes of Trade. The research addresses urgent issues regarding the seemingly ubiquitous growth pattern of DCs in the Netherlands, the dominant and increasingly challenged policy narrative of the Netherlands as a 'gateway to Europe', and the public-private actor network that appears to fall short of adequate DC planning and development. Other issues are the claimed employment benefits of DCs, the balance of the benefits and burdens of logistics, and the provision of useful spatial planning information for logistics clusters in the emerging circular economy. This thesis shows how historical, economic and institutional dynamics have shaped the rampant expansion of the logistics complex in the Netherlands. The thesis argues that a new logistics policy narrative is necessarily grounded in the contemporary dynamics and policy goals that are quite different from the conditions in the 1980s. Further research and planning practice along these lines would include open information provision in the logistics spatial planning discourse with an international scope, intensive and multifunctional land use, reverse logistics enabling circularity in DCs, as well as added value of DCs for local communities and businesses.

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