Cities of Making: CityReport

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Cities
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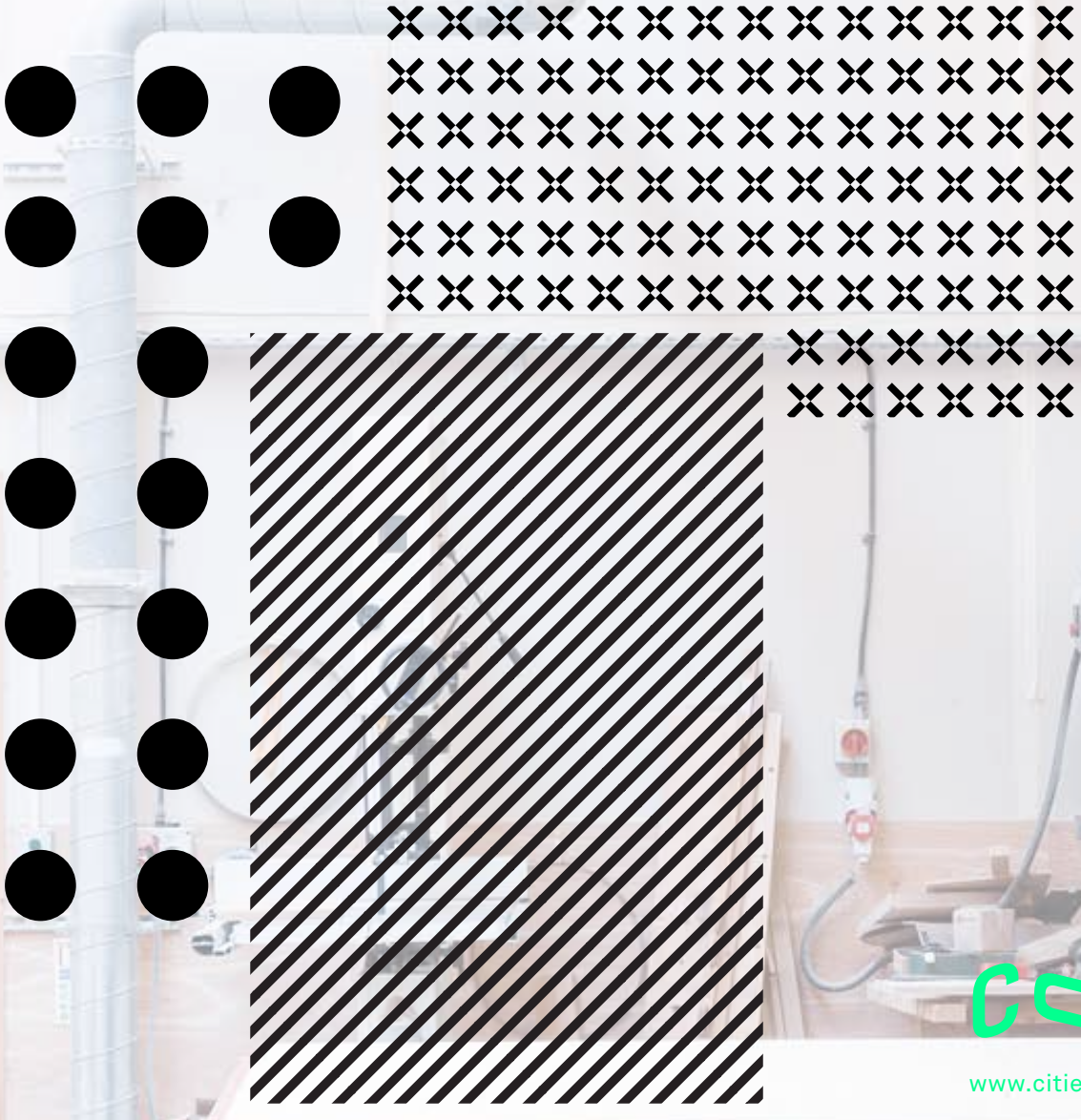
Cities Report



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RDM Rotterdam
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NL

Stedelijke productie, kortweg geïnterpreteerd als de fabricage van verhandelbare goederen op grote schaal in steden, is een misbegrepen aspect van stedelijke gebieden dat vaak over het hoofd wordt gezien in de stedelijke planning. Na jaren van achteruitgang en offshoring bevinden Europese steden zich nu potentieel op een keerpunt. Ten eerste zijn jobs in de industrie snel verschoven naar de dienstensector, en zijn zo grote gaten in de arbeidsmarkt ontstaan. Ten tweede worden concepten zoals circulaire economie voor het eerst echt serieus genomen door steden. Tot slot zijn er nieuwe technologieën in opkomst waardoor de industrie stiller en discreter kan worden. Moeten de steden in de 21ste eeuw producten blijven fabriceren? Zo ja, wat moet dan gemaakt worden en waar?

Cities of Making is een Europees onderzoeksproject dat gedurende twee en half jaar onderzoek verricht naar stedelijke productie vanuit het perspectief van drie Europese steden: Brussel, Londen en Rotterdam. Elke stad heeft een belangrijke industriële geschiedenis en een heel andere toekomst in het vooruitzicht. Ondanks de onderlinge verschillen bevindt elk van deze steden zich op hetzelfde kruispunt: zal de industrie een sterkere plaats innemen in de stedelijke economie of zal ze gewoonweg verdwijnen en vervangen worden door een meer hedendaagse vraag naar stedelijke ruimte en banen?

Deze eerste analysefase heeft aangetoond dat stedelijke productie zowel een sentimentele als belangrijke plaats in stedelijke gebieden heeft, maar nog steeds slecht gedefinieerd en begrepen wordt binnen de stedelijke economie. In de afgelopen tien jaar zijn er grassroots initiatieven ontstaan die lokale productie nieuw leven hebben ingeblazen door het te verbinden met kwaliteit en waardecreatie. Aan de andere kant van het spectrum is er nog nooit een tijd geweest waarin technologie zo toegankelijk was. Evenzo, in deze geglobaliseerde wereld met bijna verwaarloosbare transportkosten, hebben overheden nog nooit zo strategisch moeten handelen in het aantrekken en ondersteunen van de industrieën die de lokale economie dienen, en tegelijk te investeren in de noodzakelijke infrastructuur om dit te ondersteunen. Dit kan een positieve uitkomst voor de steden hebben - met bedrijven die hun goederen en technologie afstemmen op de lokale markten en behoeften, terwijl ze lokale grond- en reststoffen gebruiken.

Het is nu het moment om te beslissen of we een decennialange trend willen voortzetten om productie uit steden te verdrijven, ofwel te omarmen in de lokale economie.

FR

‘Urban manufacturing’, vu simplement comme la production dans les villes de biens échangeables à grande échelle, est un aspect mal compris dans le contexte urbain, qui est rarement pris en compte dans la planification urbaine. Après des années de déclin et de délocalisation, les villes européennes doivent remettre en question le rôle de leur industrie urbaine. Premièrement, les emplois dans le secteur manufacturier ont cédé la place à des emplois dans le secteur des services et ont créé d’importantes lacunes sur le marché de l’emploi. Deuxièmement, des concepts tels que l’économie circulaire sont désormais pris au sérieux par les villes. Enfin, de nouvelles technologies émergent permettant à l’industrie d’être plus discrète et moins impactante de tous les points de vue. Les villes du 21ème siècle devraient-elles continuer à fabriquer des biens matériels? Si oui, alors qu’est-ce qui devrait être produit et où?

Cities of Making est un projet de recherche européen d’une durée de deux ans et demi, étudiant l’industrie urbaine dans le contexte de trois les villes européens: Bruxelles, Londres et Rotterdam. Chaque ville a eu un passé industriel important, et un avenir très différent se profile. Indépendamment des différences, chaque ville se trouve à la croisée des chemins où le secteur manufacturier pourrait soit renforcer sa position dans l’économie urbaine, soit simplement disparaître, remplacé par des nouveaux besoins en espaces urbains et emplois.

Cette première phase d’analyse a permis de constater que l’industrie manufacturière occupe toujours une place importante dans les zones urbaines, mais qu’elle reste mal définie et mal comprise dans l’économie urbaine. Au cours de la dernière décennie, des initiatives locales ont émergé, ravivant l’intérêt pour les produits locaux, synonymes de qualité et de valeur. D’un autre côté, jamais la technologie n’a été aussi accessible. De même, dans un marché mondialisé avec des coûts de transport presque négligeables, les pouvoirs publics doivent plus que jamais attirer et soutenir les industries qui servent leurs économies locales, tout en investissant dans les infrastructures nécessaires pour leur développement. Ceci pourrait s’avérer positif pour les villes, l’industrie urbaine aidant à personnaliser les biens et les technologies en fonction de leurs marchés et de leurs besoins tout en gérant les ressources et les déchets.

Il est maintenant temps de décider s’il faut poursuivre la tendance à expulser l’industrie urbaine de la ville ou de la réintégrer dans l’économie locale.

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Workshop East
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ABOUT THIS REPORT

The purpose of this report is to initiate and inform debate about the future of manufacturing in European cities. It does this by providing insight into the past, present and potential future roles of manufacturing in the cities of Brussels, London and Rotterdam. It sets this discussion into context through brief accounts of the role of manufacturing in Western European economies today, and of the global trends which look set to shape manufacturing's future.

It is intended primarily for an audience of policy makers and practitioners, and will be of particular interest to those in the fields of manufacturing and industry, spatial planning and urban design, environmental sustainability, and economic development. It may also be of interest to those involved in citizen engagement within those fields.

METHODOLOGY AND DEFINITIONS

Research for each city was undertaken by the local partner organisations. It was compiled through review of existing literature and through interviews and roundtable discussions conducted with stakeholders from private and public sector organisations. Details of interviewees for each city can be found in Appendix x.

DEFINITIONS

This research used principles to focus the study, rather than attempting to provide an exhaustive definition of what is or what is not urban manufacturing. With input from stakeholders, the partner organisations arrived at the following principles for what constitutes 'urban manufacturing':

1. Involves the transformation of physical materials
2. Employs labour, tools and/or machines
3. Results in a product
4. Involves 'making' at scale as part of a business model: This discounts the one-off production usually associated with the creation of art pieces or hobbyists making for themselves. However, it may involve a process which produces low volumes or highly bespoke products.

5. Is embedded in its urban context: The activity involves a web of supporting services, such as logistics, finance, design, and is linked to a market. These factors make it difficult for the activity to be disentangled from its urban context.

These principles encompass a range of activities, including those commonly considered to be manufacturing activity and identified as such in the Statistical Classification of Economic Activities in the European Community (NACE) industrial classification system. This system is used to record economic data in the European Union. These classifications, therefore, form the basis of the quantitative analysis of the manufacturing sectors of each city in this report.

However, when seeking to understand the role of manufacturing activity it is important to look wider than the sector as classified in NACE. Manufacturing activity, like other sectors, rarely fits neatly into discrete classifications, instead the lines between it and allied sectors are blurred. For example, the re-upholstery of furniture is classified in NACE within 'other services' (92.54) but the activity would be considered as 'making' and fall within the wider discussion of urban manufacturing. Logistics, recycling, waste processing, repair, craft, construction, design are some of the allied industries which are closely linked to manufacturing activities. Such allied industries are not the focus of this report but are recognised to form part of the ecosystem around manufacturing. As such these allied industries enter the discussion throughout.

LIMITATIONS

The report is designed to provide a sound basis for discussion but is not exhaustive in its exploration of the state of manufacturing in each city, nor on its exploration of the changing nature of urban manufacturing in western economies. There are several topics which are relevant to the subject but which fall outside the scope of this report.

Whilst employment figures for manufacturing are explored here, this report does not provide an in-depth account of employment in manufacturing or the potential changes to employment as a result of technological developments, such as artificial intelligence or automation. Not does it provide an in-depth account of the skills required by current manufacturing activities, or of those that may be required in future. It has not included a study of the role of education in cultivating these skills.

This report has not investigated the impact of economic instruments, such as taxes or subsidies, on the manufacturing base of the three cities. Nor does it explore in any depth the varying role of trade in manufactured goods across the three cities.

ABOUT THE AUTHORS: CITIES OF MAKING

The report is an interim output from Cities of Making, a programme exploring opportunities for strengthening urban based manufacturing in European cities. Based on research and engagement in Brussels, London and Rotterdam the programme aims to identify what works in supporting a resilient and innovative urban manufacturing bases, and to test those solutions within the three cities. It will result in ideas, practices and policies designed to help public authorities, and other stakeholders, to breathe new life into their local urban manufacturing sector.

Cities of Making is a 2.5 year JPI Urban Europe funded research project and involves seven partner organisations: Brussels Enterprises Commerce and Industry, Latitude Platform for Urban Research and Design, Technical University of Delft, RSA (Royal Society for the encouragement of Arts, Manufactures and Commerce), l'Université libre de Bruxelles, University College London, Vrije Universiteit Brussel. More information about these partner organisations can be found at the end of this report.

Further information and additional content is available at:
www.citiesofmaking.com

Investigating the role of urban manufacturing

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Photo, previous page: Workshop East

THE MAGNETISM OF MANUFACTURING

Manufacturing is a one-of-a-kind sector. No other industry captures the public imagination quite like it. From cars to steel, pharmaceuticals to clothing, there is a certain allure about the making of tangible objects that is hard to resist. Evoking images of skilled workers and bustling production lines, few people would disagree that manufacturing has an inherent worth. Indeed, barely a week passes without another opinion piece extolling the virtues of modern manufacturing, and there are no shortage of books analysing its next trajectory. Among them are Industries of the Future (Ross), The New Industrial Revolution (Marsh), and Makers (Anderson).[1]

The public enthusiasm for manufacturing has not been lost on politicians. In the US, President Trump's 'Make America Great Again' campaign put manufacturing squarely at the heart of his vision for the country, winning him many supporters in the process. The recent decision to impose import tariffs on foreign steel shows his Administration is willing to protect American manufacturing almost at any cost. In the UK, meanwhile, Prime Minister May has thrown her weight behind a new 'Industrial Strategy', aimed at positioning the UK once again as a workshop of the world.[2] At a supranational level, the European Commission has pledged to boost manufacturing to 20 percent of GDP by 2020, up from 15.1 percent in 2013.[3]

Not everyone agrees that manufacturing deserves to be held aloft as a special sector.

Not everyone agrees that manufacturing deserves to be held aloft as a special sector. The economist John Kay describes the fascination with manufacturing as a kind of 'fetishism', writing that 'for many people the role of manufacturing is an emotional, perhaps even a moral issue rather than an economic one'.[4] According to Kay and other economists like him, the developed world has lost its edge in manufacturing but this is no bad thing. Columbia University Professor Jagdish Bhagwati argues that the success of sectors such as telecommunications and financial services are evidence that technology-driven growth can be realised without making things.[5]

Yet these dissenting voices are more than drowned out by manufacturing's vocal proponents. Among them is Cambridge University Professor Ha-Joon Chang, who argues that the state of a country's manufacturing base is one of the most important factors in determining its prosperity.[6] The chief reason is that productivity gains are more likely to be realised within manufacturing than the service sectors, and that these productivity leaps can spur wage growth across an economy. Others say a healthy manufacturing sector helps to balance economies, making them more resilient and less prone to economic crashes. A further case can be made for manufacturing's contribution to trade and its potential to plug deficits in a country's balance of payments.

A NEW DAWN FOR URBAN MAKERS

Manufacturing will always have a pride of place in people's minds. But what about a literal place in our neighbourhoods, towns and cities? Curiously, the debate about the future of manufacturing has rarely transcended to a more grounded conversation about its role in local economies. Until now, urban and manufacturing have been jarring concepts, one associated with the future and the other with the past. Yet cities need manufacturing more than is often recognised – for a range jobs, for economic stability and resilience, and to sustain diversity. Equally, manufacturing needs cities – for easy access to markets, for large pools of talent, and for the cross-fertilisation of ideas.

It is concerning, then, that manufacturing has dwindled in Western cities. Beginning in the 1950s, a combination of forces served to push industry outside of urban enclaves, while those businesses that remained moved to the edge of town, to freeway junctions and cheaper wasteland. One cause was urban planning policy that sought to clamp down on noisy and polluting factories. Another was the rise of service sectors, particularly in the financial and technology industries, which began to compete for space alongside burgeoning populations of residents seeking affordable housing. By the 1980s, what industry had survived in cities was further rocked by the forces of globalisation and automation.

The state of a country's manufacturing base is one of the most important factors in determining its prosperity.

Today's urban manufacturing is of a qualitatively different kind to the one that preceded it. Whether it is Detroit or New York, London or Berlin, the composition of manufacturing may be different but the trajectory has been the same. Businesses have been clustered in industrial zones, often located out of sight from residents, and disconnected from the day-to-day bustle of cities. Functionally obsolete, intercity waterfronts, railway yards and warehouses now lie dormant or have changed function. Former factories have been converted into apartment blocks, while huge sites have been regenerated into new commercial districts, such as Canary Wharf in London and Kop van Zuid in Rotterdam.

The recent history of urban manufacturing has been one of neglect and decline. A paradox is that while the public, politicians and the media ache over the national fate of this industry, few seem to have noticed the struggling makers on their doorstep.

Yet the future does not have to be as bleak as the past. While forces combined in the 20th century to undermine the urban maker, trends in the 21st century may do the opposite. New

technologies including additive manufacturing techniques will allow for quieter production more suited to built-up environments. Circular economy ideals may encourage the making (and re-making) of goods closer to where they are consumed. While consumer trends like just-in-time production of clothing could bring manufacturing closer to home.

WHY IT ISN'T AS SIMPLE AS THE HEADLINES SUGGEST

The potential for manufacturing in cities becomes clearer with a more nuanced understanding of the sector and what it offers. This requires challenging common narratives which can polarise opinion of manufacturing.

The first being a narrative which says that manufacturing is in terminal decline. Stories of industrial decline have been repeated across many regions in Europe, from the closure of the steelworks of Sheffield in the UK to the car plants of Genk in Belgium. Whilst devastating for the communities involved, these reports can belie the true role of manufacturing in Europe and give the false appearance that the path for manufacturing trudges ever downwards.

In fact, Europe is a world leading manufacturing region. Seven of the top twenty countries by manufacturing output are within the EU (and Switzerland is an eighth)[7], and the sector is an important driver of growth within EU economies generating over €1.7 billion of GVA in 2014[8]. Its output made up 83 per cent of all EU exports in 2016[9] and these goods are traded with nations across the world. Whilst employment in the sector has declined in the EU10, it is still significant and employed almost 30 million people in 2014[11]. Declines in manufacturing employment are often a function of increased productivity within the sector, so changes to employment are but one part of the story. Manufacturing remains a vital part of the EU economy.

Seven of the top twenty countries by manufacturing output are within the EU, Switzerland is an eighth.

The second set of narratives to challenge are those which bemoan the loss of manufacturing and seek to return to a 'golden age'. Manufacturing has a clear value yet it is important to separate out the realities of the industry today from the nostalgia for some of the impacts it once had, particularly the scale and type of employment. Some discussions about the role of manufacturing stir emotions which go beyond the loss of jobs into loss of identity. The complexity of the macro economic impact of manufacturing is combined here with the localised impact of the sector. Many communities across the continent have suffered from deindustrialisation, and these real concerns need to be addressed. But manufacturing should be recognised for what it is today, and for its future potential, rather than

Gillette factory - a building between uses puts pressure on urban areas to avoid blight, fast solutions are often chosen.
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trying to recapture its past.

Just as taking a nostalgic view of manufacturing can be problematic, so too can the portrayal of modern urban manufacturing and 'making' as being fashionable. There has been a surge of interest in craft production of late, from ceramics to real ale. Perhaps in part a response to the ubiquity of mass produced goods and an increasingly digital world, there is an appeal in the slow and handmade. Makerspaces and open access workshops have also sprung up across Europe making accessible new technology, such as 3D printing as well as traditional activities, such as upholstery.

This movement and these spaces have attracted much attention from policy makers and commentators, epitomised in 2014 when President Obama held a Maker Faire at the White House. This rising trend embodies a spirit of innovation and entrepreneurialism which captures the imagination, and says much about people's desire to reconnect with the products around them. But there are risks in its portrayal as the face of new urban manufacturing. Firstly, this type of manufacturing forms only a segment of the sector as a whole. There are plenty of activities ongoing which do not hold the allure of either new technology or cutting edge design and it is important that these are not neglected or seen as less desirable. Secondly, it is important that this manufacturing and its outputs are not seen as the preserve of particular groups of people or particular districts. Finally, there is a danger that the in vogue manufacturers become victims of their own success. Examples of this can be seen when the hype which they create is used by others to brand or regenerate an area which then goes on to become unaffordable for the makers themselves. It is important that the spectrum of manufacturing comes into discussions about its future role in European cities.

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The story of manufacturing is more complicated than these narratives suggest. Their danger is in obscuring or polarising productive debate about the value of urban manufacturing.

WHY MANUFACTURING IS IMPORTANT (TO THE BIGGER ECONOMY)

Whilst economists don't always agree about the degree to which manufacturing is important for an economy, there are a number of ways in which it adds value to both countries and cities.

Manufacturing generally produces goods which are tradeable and can be exported to other regions of the same country or across borders. Services, on the other hand, are more likely to be offered and consumed locally, for example restaurant meals

or haircuts. Manufacturing therefore plays an important role in smoothing out a country's balance of payments. One reason for the superior tradability of goods over services is the location of consumption. For personal services such as social care and hairdressing, and physical services such as plumbing or decorating, consumption and production are necessarily in the same location. Even where communications technology has allowed some face to face services to be imported from overseas, the lack of cultural affinity and local knowledge has lowered quality of service. Following a wave of offshoring call centres to the Indian sub-continent in the 2000's, many UK service firms have since relocated their call centres to the UK as a result of customer complaints[12].

Strong productivity within a manufacturing sector can help drive further productivity and wage rises across an economy, even where other sectors have not experienced equivalent growth in productivity. This is known as the Baumol effect and is created in part because wages have to rise across the economy to prevent workers leaving their jobs for the lead sectors, and partly because workers in the lead sectors have greater spending power to channel elsewhere. It explains why the pay of teachers and hairdressers has risen throughout the post-war period, despite these professions teaching the same number of students or providing the same number of haircuts as before. Manufacturing is a key sector for capitalising on productivity driven by technological developments. From the electrification of factories to the development of big data analytics, the sector can often derive benefit from these developments more easily than other sectors like services. Growth in manufacturing productivity from emerging technologies will continue to benefit economies more widely.

Strong productivity within a manufacturing sector can help drive productivity and wage rises across an economy.

As manufacturing has become a globalised industry over the last half century, production has often been separated from other parts of the value chain, such as research and development. Developed economies have tended to retain elements of higher value, such as design, and the lower value production activities have moved to parts of the world with lower wage costs, such as China. The British technology company Dyson, for example, design and develop products in the UK and manufacture them in Malaysia[13]. However, as the importance of knowledge in value creation becomes more apparent there are those who contend that manufacturing production needs to be collocated with development in order for successful and ongoing

Dividing production from the rest of the value chain risks missing the transfer of important, tacit knowledge between business divisions and damages innovation prospects.

innovation. Shih and Pisano[14] argue that dividing production from the rest of the value chain risks missing the transfer of important, tacit knowledge between business divisions and damages innovation prospects.

They explain that this is particularly true of activities in which process is embedded in product innovation, such as high end garment making or advanced materials production. It is also the case for process-driven activities, such as nanotechnology, where the process is new or rapidly evolving. Manufacturing has an important role to play in innovation and colocation of production with the rest of the value chain can drive competitive advantage.

This begs the question of how much of a manufacturing base is required to keep technical skills and knowledge of manufacturing processes alive. Shih and Pisano refer to this collective foundational knowledge as the 'industrial commons' and argue that these supporting skills should be cultivated in order for an area to compete through innovation[15]. The advanced manufacturing campus in Sheffield is an example where a number of actors, from Boeing to McLaren, have clustered to form a high-end manufacturing eco-system that is supported by skills training and research and development.

FACING THE FUTURE

Technological developments have shaped urban manufacturing, and will continue to do so. A radical shift in the way goods are produced and consumed is on the horizon, driven by emerging technologies including 3D printing, the internet of things, cloud computing, and blockchain. This shift has been coined 'Industry 4.0' in recognition of its comparable significance to the three previous industrial revolutions: the first was driven by steam power which moved labour from the sweat of people and animals to the use of fossil fuel powered machinery; the second took place at the end of the 19th Century and moved to using electricity in the mass production of consumer goods; and the third revolution was in the post-war period, as computing technology enabled global communications and connectivity[16].

Manufacturing in cities provides an opportunity to reduce the environmental impact from goods travelling long distances.

These technologies are opening up new possibilities for manufacturing. Whereas previous revolutions centralised and standardised production, this one looks set to redistribute it and allow for 'mass customisation' - individually tailoring items at scale[17]. Businesses have already forayed into this territory, such as Nike with their customisable NIKEiD service. It is anticipated that this shift will also enable increased local production, as technologies like 3D printing make small scale making more

affordable. These changes offer great opportunities for manufacturing within cities, which possess large market opportunities but with limited space for industry.

Alongside technological change comes the serious imperative for society to become more environmentally sustainable. The booming material culture enabled by the industrial revolution and subsequent developments in manufacturing brought with it significant environmental damage. Today the challenge is to produce and use goods in ways which do not create harm for current or future generations. This will require dramatic shifts in manufacturing and in other areas of the value chain, especially waste and resource management. Manufacturing in cities provides an opportunity to reduce the environmental impact from goods travelling long distances, and are a rich source of valuable secondary materials which could be used in production.

These changes in manufacturing offer opportunity for social changes too. Distributed production has the potential for local ownership and involvement, something which large scale centralised production rarely does. Urban residents will have the ability to 'make' their city in a way which has not been possible before.

Manufacturing in European cities finds itself between two storms: the significant impacts of globalisation and the changes that deindustrialisation brought have been felt, but the full impact of the next wave of technological development is yet to be realised. Now is the time to take stock of the current state of urban manufacturing and to form a vision for its future, one which will enable Europe's cities to harness and capitalise on the next wave of disruption.

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Photo, previous page: RVB ©Fabio Vanin

«Places for making in the heart of a service oriented city-region.»

Brussels was one of the pioneering centres of the industrial revolution in mainland Europe while now claiming one the lowest levels of manufacturing for a European city. It is a city of two language groups, the seat of three capitals, it is perhaps Europe's most cosmopolitan regions with one of Europe's highest per capita incomes rates while also suffering some of the highest levels of unemployment for a major European city.

Until the 1960's, some 60% of jobs were associated with industrial activities - making Brussels one of the most industrial centres per capita in Europe. The city was home to a diverse manufacturing sector, specialising in metals, printing and vehicle production thanks to one of Europe's densest rail networks drawing in a vast pool of labor from the Flemish and Walloon hinterland. It was supported by stable coal supplies in the Ardennes, access to a large local consumer market in Belgium and beyond and its good location on the canal and a rail route connecting Paris to Cologne and Amsterdam.

However since the 1960's, the city experienced a radical transformation of its economy. The development of the service sector, and growth of its international functions and European institutions, have rendered Brussels one of the least industrial cities in Europe, with industrial jobs representing a modest 3% of total employment. The process of relocating Brussels' manufacturing continues. Industry and productive activities in general have been weakened by demands for housing and office space, focusing on the highly mixed inner-city workers' neighbourhoods which are being acquired by both private and public developers. Unemployment rates ranging from 20-40% are common in some neighbourhoods, putting pressure on politicians to look for replacements for lower skilled jobs that industry once offered.

Manufacturing activities are far from gone. Brussels is home to two major assembly plants (Audi and SABCA), a host of niche biotech firms and specialists in sensor based technology. Furthermore, with an ambitious regional circular economy plan, pioneering development in grass-roots social innovation and greater integration of socio-economic actors within the local economy, Brussels is positioning itself, albeit informally, as a hub for locally focused making.

Due to the region's bureaucratic complexity, much of this research is based on interviews and discussions with key public and private actors.

2.1 Brussels' manufacturing: a brief history

From being one of the first most industrial cities, with more than half of the city's jobs connected to industry, to now containing one of the lowest rates of urban manufacturing in any European city, Brussels has arrived at a new crossroads in its productive future.

FROM EARLY MANUFACTURING TO THE INDUSTRIAL REVOLUTION

Brussels' 'manufacturing spirit' can be traced to the region's infamous Flemish textile production from the 13th century[1]. In the 16th century, the Dukes of Brabant favoured the city over many others for their court, marking its economic and political role thereafter. Over various dynasties, the political power remained linked to the seat of the Duchy until the Belgian revolution of 1830 where Belgium was formed as a buffer state and Brussels was proclaimed capital. Saxon born King Leopold I, married the daughter of King George IV (of England), accepting the throne in 1831 and quickly brokered the first import of revolutionary rail and industrial technology that was pioneered in the UK. Brussels claims mainland Europe's the mainland's first railway.

The 18th century Charleroi Canal enabled coal to be brought in on a massive scale and the mechanisation of industry led to the appearance of foundries, engineering and metalworking companies along with the development of the railway network. The city also attracted administrative and higher class workers that represented both a valuable consumers and investor market, thus kickstarting local manufacturing. Manufacturing sectors included vehicle bodywork, printing and porcelain obtaining international reputation while the chemical processing expanded to supported related industries such as textiles.

During the 19th century, industry – and particularly the key-sector of metallurgy – grew with a reliable cheap source of coal in the Meuse Valley. Urban populations increased rapidly, Brussels growing from 210,000 in 1846 to almost a million a century later. Furthermore, Belgium laid out the continent's densest rail network

Brussels' abattoirs at the turn of the 20th century. Author unknown

that created one of the first intercity commuter workforce, linking the densely populated agricultural hinterland with the city. These factors turned the capital into the largest industrial centre in Belgium with the highest concentration of industrial workers: a title the city retained from 1890 until 1970[2]. The Canal area, in the lowest part of the city was most attractive for manufacturing as it was connected to train stations and raw materials supplied along the canal (such as coal) while forming a richly knit urban fabric of housing and manufacturing.

Whereas the larger (former) industrial areas are located along the canal zone such as Buda, on the northern fringe and Anderlecht-Forest on the southern one, small and medium-sized family businesses are located on either side of the central section of this axis. It was thanks to the emergence of new industries such as crockery production, carriage-making and printing (18th century) that a large number of factories were built just outside of the medieval walls, in places such as Anderlecht and Molenbeek which lined the canal. While manufacturers grew up along the central axis of the Senne valley, other small to medium activities spread within the very dense urban fabric, filling in the interior of housing blocks and replacing private gardens, adapting existing residential buildings or colonising vacant plots. That process has created highly mixed and unplanned manufacturing neighbourhoods that is still visible today in areas such as Cureghem, Saint Gilles, Evere and others that emerged in the city's rapid late 19th century growth period.

MANUFACTURING PEAK (1900-1960)

Industrial Brussels reached its climax during the early 20th century, focusing on high skilled labor and a conveniently high

Citroën Building, Brussels.
Source unknown.

concentration of clients living in the city. A diversity of small scale manufacturers were developing in Brussels especially thanks to production of machines (vehicles and engines) and consumption-oriented businesses.

After the Second World War, the economic structure of Brussels was still in good shape compared to other European cities. The Belgian capital was developing with a widening middle class, spurred by economic growth, public work plans and mass consumption[3]. The average size of companies significantly increased, with the investments of multinational organisations in Brussels' manufacturing[4]. The city managed to keep a wide range of activities. By the end of WWII the major manufacturing sectors included (by ascending order) construction of machines, clothing, agro-food, metallurgy, chemicals and printing/binding - directly employing some 166.000[5] people in 1960.

DEINDUSTRIALISATION, A BRUSSELS-CAPITAL REGION AND NEOLIBERALISM (1960-2010)

Since the second World War, urban manufacturing occupied large amounts of space while employing low qualified labor[6]. Post war economic development saw native Belgians shifting into the tertiary sector and thus demands for skilled workers attracted immigrants initially from Greece, Spain and Italy and later from Morocco, Turkey and the former African colonies - with certain assumption that these workers would later return back to the their countries of origin when the work dried up.

While the aftermath of the second world war was blowing life back into the industrial sector, a new industry emerged: the services sector. The arrival of European institutions in the 1960's and the large ecosystem of lobbies and services attached to it have taken over various former workers' neighbourhoods and industrial zones in the east of the city while bringing with it higher paid jobs. Furthermore the federalising of the country in the 1980's, resulted in a complex bureaucratic stew that would also be headquartered in the city and land largely on former industrial land or blue-collar neighbourhoods around the north and south train stations. Finally, the Brussels Capital Region (RBC) was created in 1989, drawing a 160km^2 island within the Flemish region, amassing 1,2 million people into almost a city state.

BRUSSELS AND MANUFACTURING TODAY

Brussels, despite a formidable place in Europe's industrial heritage, has now one of the smallest industrial sectors (as a percentage of the economy) while also having one of the highest GDPs per capita in a European city[7]. Industry accounts for around 6% of the regional economy[8], for which 3% can be attributed to manufacturing. The sector consists largely of the construction/assembly of vehicles (cars and plane parts), chemical refining, agro-food processing and a large number of smaller specialist businesses. Despite some four decades of steady decline in the industrial sector[9] the sector appears to have a minor but stable place in the larger economy[10]. Beyond pure manufacturing, there are a range of other sectors that have also an important role to play in terms of manufacturing such as the construction and recycling.

The region is a compact 160km^2 city-state while having a significantly larger daily urban network that depends on the city yet which the city has little influence over. The city attracts some 330,000 commuters per day[11] into the city (¼ of the resident population) that work largely in the services sector yet also place serious pressure on the mobility network in and out of the city. The industrial activity on the other side of the border is significantly higher (in the order of 10% of employment) and contains a range of manufacturing sites that depend on Brussels yet is largely ignored by regional planning. Due to this

regionalism and politicisation of territorial planning, some of the Region's planning agencies are attempting to avoid losing further productive space or manufacturing jobs.

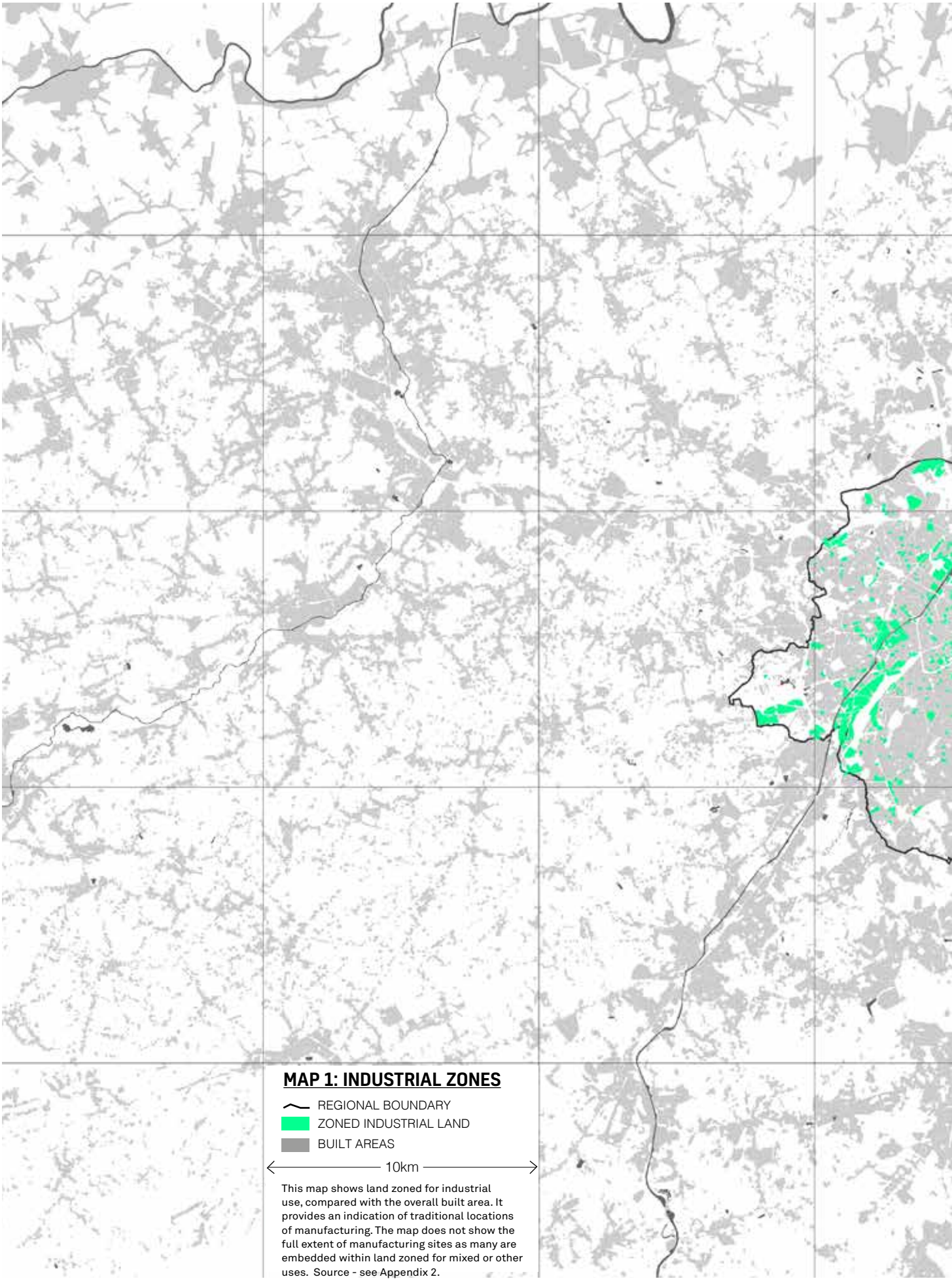
The shift from Brussels' industrial heritage to its largely services based economy has left a number of unanswered riddles. Firstly, much of the migrant population that arrived since the 1960's has remained and grown, yet some of the communities (and their families) have struggled to adapt to 21st century service oriented jobs and now are heavily represented in the city's 17% unemployment[12] (24% for youth). Secondly, unlike many other European cities, Brussels' inner neighbourhoods account for some of the poorest in the country made up predominantly of residents with immigrant heritage. These neighbourhoods (such as Anderlecht, Molenbeek and Schaerbeek) contain the most dynamic mixture of residential and industrial buildings, yet are under serious pressure from the real-estate market for gentrification. Finally, the fundamental narrative driven by the government (and supported by the real estate sector) is the need for housing without much foresight for the larger impact on the very informal local economies in these neighbourhoods (such as the second-hand car sales in Cureghem) or the types of housing that will be built (currently the market is focused on middle class housing).

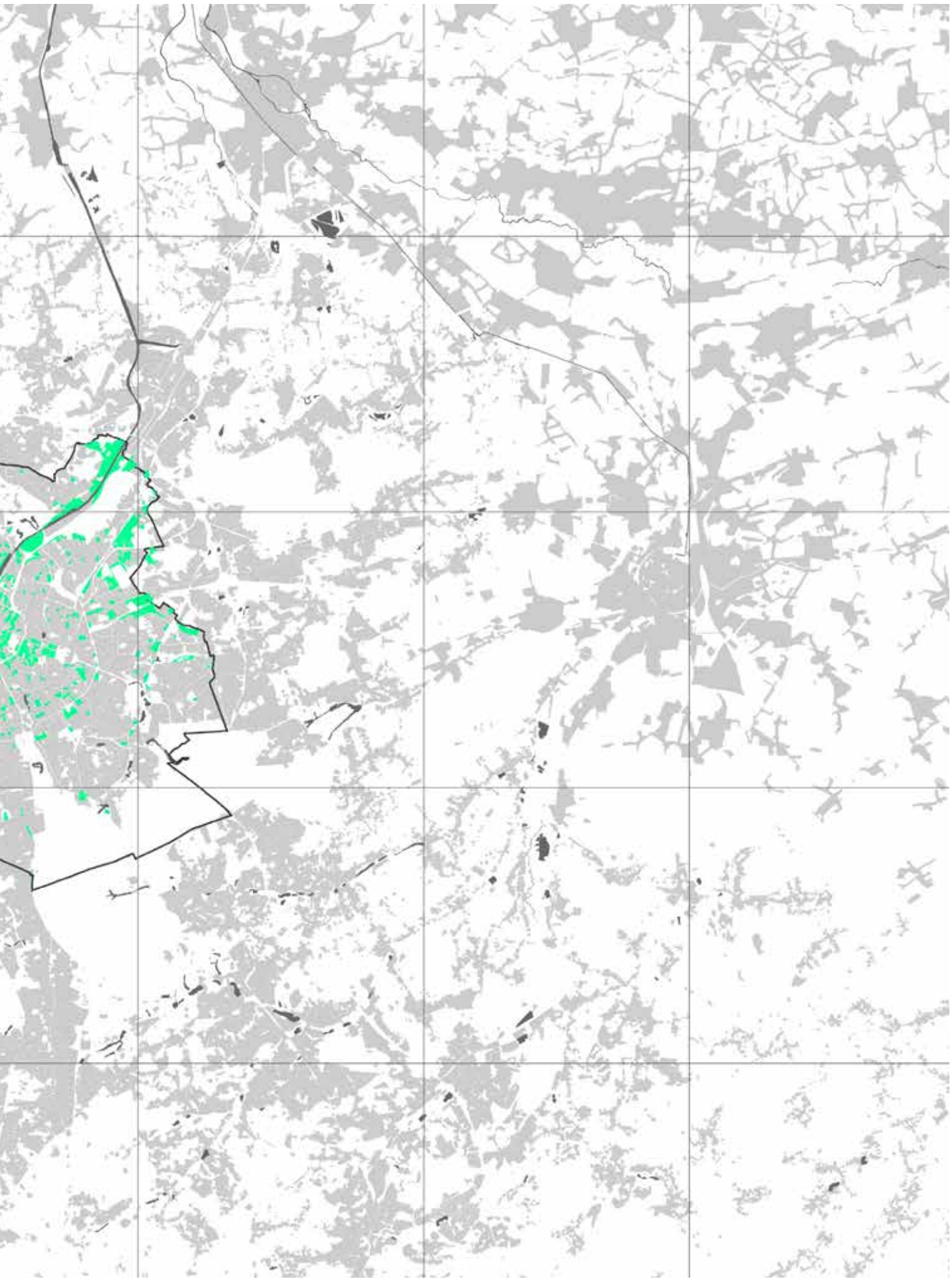
New legislation is allowing housing to be included on land zoned industrial (ZEMU, see below), while the public actors driving the zoning have little knowledge of the types of productive functions (from manufacturing to logistics) that could be compatible with housing. The city's manufacturers remain a quiet voice within the political arena and their needs are rarely prioritised over the needs of other land uses (such as housing, open space or commercial space). The question of what type of manufacturing is relevant to Brussels remains a serious challenge for many public actors and community groups whom are aware of the pressing tide of change facing the little remaining protected productive land currently zoned industrial.

In 2018 the Region has scheduled to launch an 'Industrial Plan', essentially to place this question on the political agenda. However the outcome of the plan may further stress the declining trend of manufacturing rather than look towards a new forms of urban manufacturing. The implications of external forces such as Brexit and growth of the European institutions, will also place a heavy accent on housing and office space at the expense of affordable places for making.

Brussels is home to Belgium's largest student and research population. There region educates some 104,000 tertiary students annually and employs 26,000[13] researchers representing 10% and 2% of the population respectively. It is also seeding the largest number of Belgian startups - some 2/5 call Brussels home. This proves a serious niche for both manufacturing (in prototyping or production) and the technical skills that come with it[14]. Whether this remains in the realm of activities founded in the 20th century such as cars and chocolates or if it will move towards more contemporary high-tech production of sensors and decentralised value-added manufacturing, remains yet to be seen.

Citroën Building, Brussels. Source unknown.


MAP 1: INDUSTRIAL ZONES
REGIONAL BOUNDARY
ZONED INDUSTRIAL LAND
BUILT AREAS
10km
This map shows land zoned for industrial use, compared with the overall built area. It provides an indication of traditional locations of manufacturing. The map does not show the full extent of manufacturing sites as many are embedded within land zoned for mixed or other uses. Source - see Appendix 2.



2.2 Manufacturing sectors and trends

From food production to modern electric vehicles, Brussels contains a small but diverse manufacturing sector that has persisted through half a century of radical change. Despite the intriguing variety of makers, few are confident of their place in the city within years to come.

WHAT IS MADE IN BRUSSELS TODAY

Despite the size of the overall sector, Brussels contains some striking examples of manufacturing as will be illustrated within this chapter. For example, the Audi car factory and SABCA are high-tech based vehicle manufacturers born out of early 20th century factories, employing a few thousand high-skilled workers who mainly oversee expensive robots. A number of agro-food producers including those focused on servicing the local market such as one of the last urban abattoirs in Europe. Other confectionery producers focused on export such as the breweries and some Belgium's most international chocolate names (such as Leonidas and Godiva). More recently, with support from regional planning particularly through the Regional Circular Economy Plan (PREC), a circular model is emerging. A range of other manufacturers have also established that have not grown out of the city's industrial past while producing solutions to urban challenges including folding bikes, medical equipment and air quality sensors.

Existing manufacturing companies fit between two extremes: those that can be integrated in mixed zones (including housing) to those that require dedicated industrial zones. New redevelopment plans of former industrial areas (such as the Plan Canal) and policies for mixed developments (ZEMU) go hand in hand with the struggle to define the nature of compatible urban industrial functions. As local businesses rarely federate their interests, they are highly vulnerable to land use changes or complaints from residential areas as public authorities imposing tighter and tighter restrictions on noise, dust, deliveries and other nuisances.

Many companies are neither owners of their land or comfortable on their site. Intra-Brussels relocations have increased steadily (62% in 2009 and 84% in 2012)[15]. Currently more than 4 out of 5 requests from companies looking to find a better location than their current location are unmet. This represents more than 200 applications per year. In 2012, 234 new applications were registered, totaling

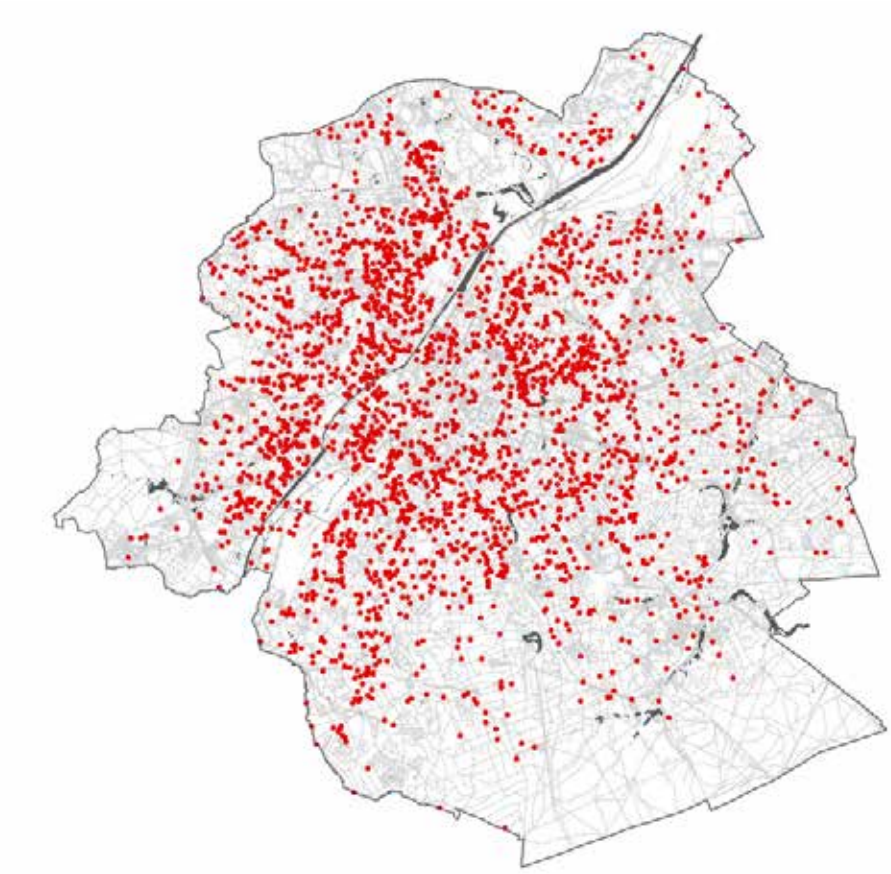
8,956 jobs. The main reason cited is accessibility: Brussels' is also a European capital for traffic congestion while car parking is considered limited where many businesses want it. In other words, one of the most present factors in terms of business relocation is the question of mobility.

Another key question is the availability of space to satisfy all the applications. Out of the 700,000 m² of buildings (above 1,000 m²) listed as empty, only 223,000 m² (33%) are on the market[16]. However, these 223,000 m² represent only 5% of the existing stock meaning that another 15% is un- or under-used. Based on feedback from Citydev, the regional developer of new industrial spaces, the market for semi-industrial is currently in great demand and particularly for smaller sites (150-300sqm). Moreover, among the 5% of buildings available on the market, many owners prefer to use their property for a housing project that has become much more remunerative, leading to a real and serious shortage in solutions for establishing businesses in the Brussels Region.

In Brussels and its fringes there is a constellation of activities that can fall into the definition of "urban manufacturing". Over the following pages, we will present a number of sectors based on a combination of their theme, type of skilled workers and knowledge workers including: vehicle industry, agro-food, construction and material recycling, printing and bio-tech/chemical. Furthermore, with Brussels' focus on the Circular Economy and the fundamental mobility challenge, there are a number of related services that cannot cleanly be treated as manufacturing but for which Brussels based manufacturing is dependent on, including recycling, repairs and logistics.

Over the following pages, these sectors will be described and illustrated with a map presenting locations of businesses who fall into the relevant categories. While the maps offer some clues on where the sectors are located, they offer a better illustration of the challenge to link geographic data with manufacturing data across the city.

The diversity of Brussels' actors



Map 2:
Mechanical
industries

Source:
see Appendix 2

Audi factory, Forest
© Adrian Hill

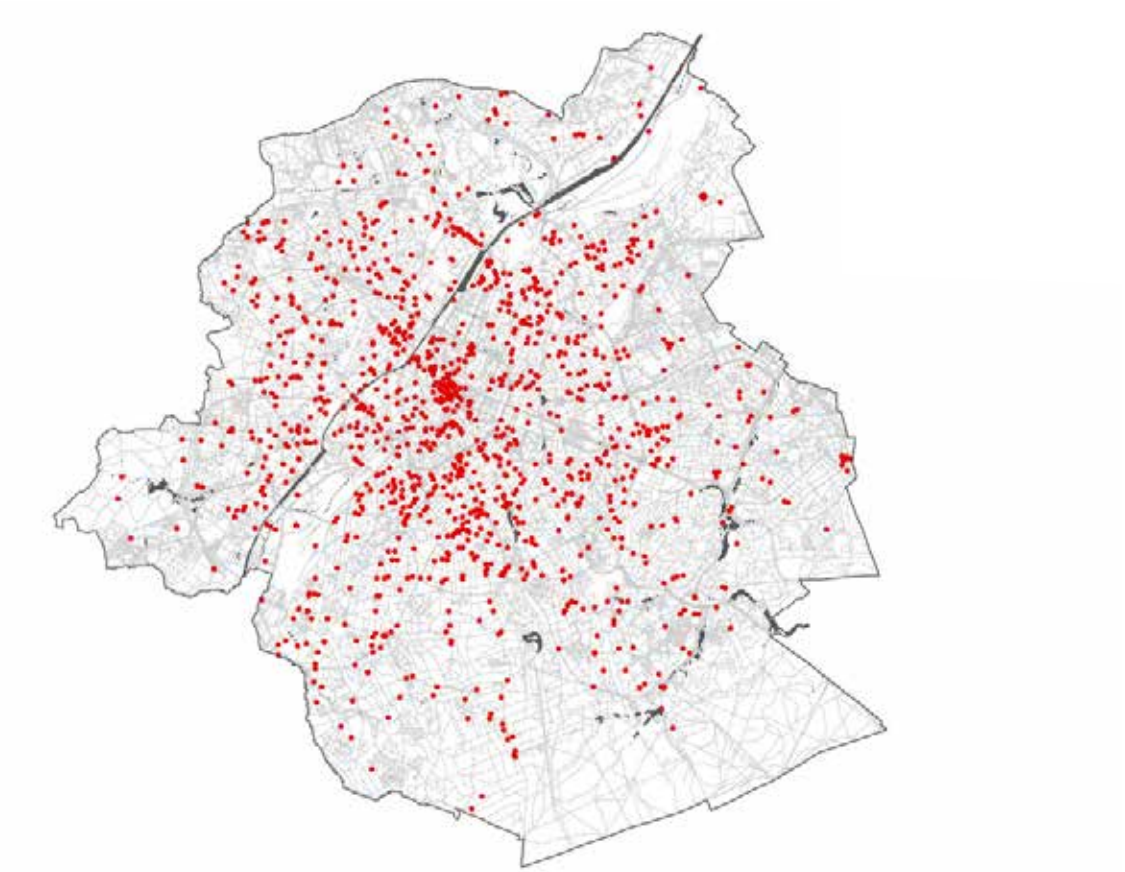
Mechanical production

The at one end of the vehicle industry sits three big companies hiring middle skilled to low skilled factory workers. At the other end, there are a significant number of smaller companies, accounting for 720 jobs (with a lot of low skill positions) within SME's of under 50 staff, consisting of garages and car-repair workshops[17].

The automobile industry is still in growth in Belgium but also in Europe and the international capital is quite important in the sector[18]. The Audi Forest plant, with largely middle skilled labour and some engineers, employs almost 3,000 workers and is now producing the company's flagship electric car with large financial contributions from public institutions[20]. SABCA in the North of Brussels produces high-tech parts for the both the defence and commercial aerospace sector, employing a little over 1,000 engineers and specialised skilled workers and connected historically to the airport[21]. From the time of the pioneers of aviation, Belgium was at the forefront in research and aeronautical construction.

Today, whether in Wallonia or Brussels, aeronautics is one of an attractive employment sector for engineers with representation by the Brussels Aeronautical Group (www.bag.brussels). The companies[22] in the sector are in constant search for qualified personnel, some staff available locally while others are imported. The process from concept to production is highly intertwined as feedback between research and production needs to be very responsive to avoid unnecessary issues therefore design and construction are often located on the same site or building. There is also a very strong link between the mechanics and software, resulting in a lot of in-house training.

The Brussels' region public transport company (STIB / MIVB) is the capital's largest employer[23] (some 8200 employees in 2016) and covers the maintenance and upgrade of a vast range of vehicles from trams, metro carriages and buses. While a relatively small



Map 3:
Agro - food

Source:
see Appendix 2

number of employees are dedicated to maintenance, their repair skills could be interchangeable with other mechanical based manufacturers such as the local folding bike producer, Ahooga or luxury tap-maker RVB.

The debate on the future of Brussels' large-scale urban industry has to deal particularly with the largest industrial plants in the region. In addition to those, there are several other functions necessary to facilitate the design and production: customer support (assistance during the design, manufacturing and repair phases), logistics (order management and inventory) and procurement (negotiation of contracts for parts and services).

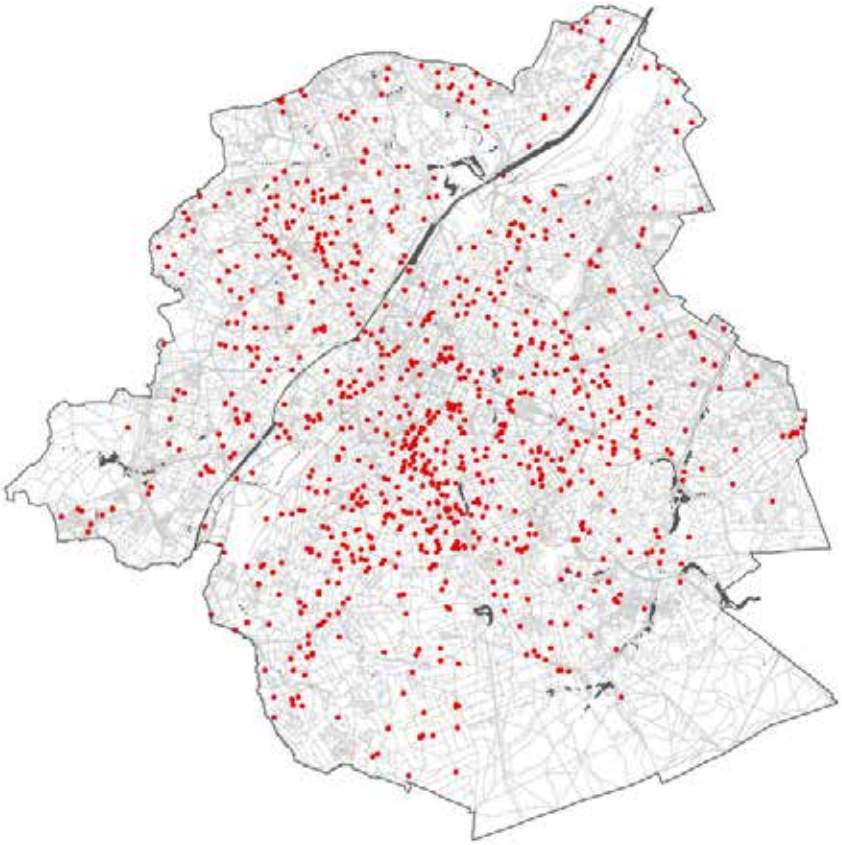
The complexity of the larger ecosystem raises several questions that are mainly linked to their expansion, sourcing personnel, training and particularly mobility (for goods and workers). Furthermore, there was only 11% of Brussels residents among Audi employees in 2017[25].

Agro-food

The food industry is one of the most elementary but overlooked sectors in urban manufacturing. It plays an important role, not only in production but also in the chain of sales and distribution as many manufacturers are also retailers of their own products. The activities can be industrial or artisanal and ranges from the very essential such as baked goods and dairy products to craft beer and luxury sweets (a caveat here as pralines are a Belgian staple). Specialty beer, chocolates and biscuits are but the few perishable products that Brussels produces for the export market.

At one end, the bigger companies consist of Neuhaus, Godiva, Leonidas, Wittamer and Marcolini producing sweets and chocolates firstly for the local and to a varying degree for export. There are industrial bakeries such as Ceres and Milcamps focusing on the national market. In recent years, a

Brussels Beer Project
© Adrian Hill



Map 4:
Bio-tech
Chemical industries

Source:
see Appendix 2

number of local breweries have appeared - such as Brasserie de la Senne and the Brussels Beer Project - adding to an extensive number of established boutique breweries located on the city's outskirts with global demand. Brussels contains also one of the only remaining urban abattoirs in Europe, dominated by Viangro[26] whom produce both for local and national sales.

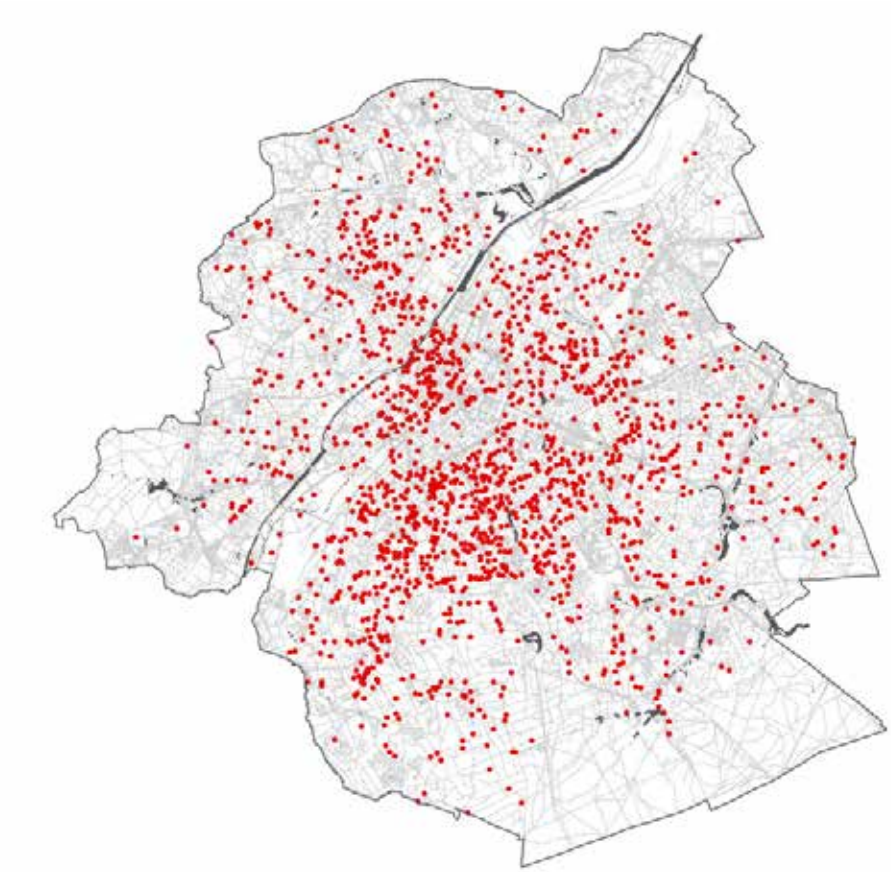
Interesting to note that 95,1% of this sector is occupied by middle and small companies (under 50 workers) with 76,4% of very small companies (<10 workers), especially in the bakery industry[27]. This begs the question where to draw the line between the industrial scale and the neighbourhood scale of production. Furthermore, 64% of the jobs involve manual work[28] indicating that the food sector still requires a skilled labour.

This is one of the only sectors of growth in Belgium but also in Europe[29] with the emergence of many new companies founded within the last 10 years. This could be a good sign of development within the sector[30] with turnover of the chocolate industry and craft industry growing and investments (public and private) increasing considerably such as regional aid for economic expansion, investments in technical and vocational schools. Despite such growth, Brussels' chocolate-confectionary faces numerous challenges, form the lack of the necessary skills in the local labor market, to mobility, production and distribution issues, to expansion vs relocation.

Innovation plays an important role in terms of packaging, food preservation and transport.

Bio-tech / Pharma / Chemicals

The bio-technology and chemicals sector produces a very diverse range of outputs however the processes and relationships with urban areas could be considered as very similar. Bio-technology and the chemicals industry generally are prime examples of 'triple-helix innovation' - where businesses, research and government agencies are closely aligned. In short, through research funded by public and private financers (such as Innoviris and Solvay), fundamental and applied research developed by universities and research agencies is then commercialised by businesses. Both biotech and chemical companies may contain an administrative address in the city centre connected to both research and public agencies while



Map5:
Media and Printing industries

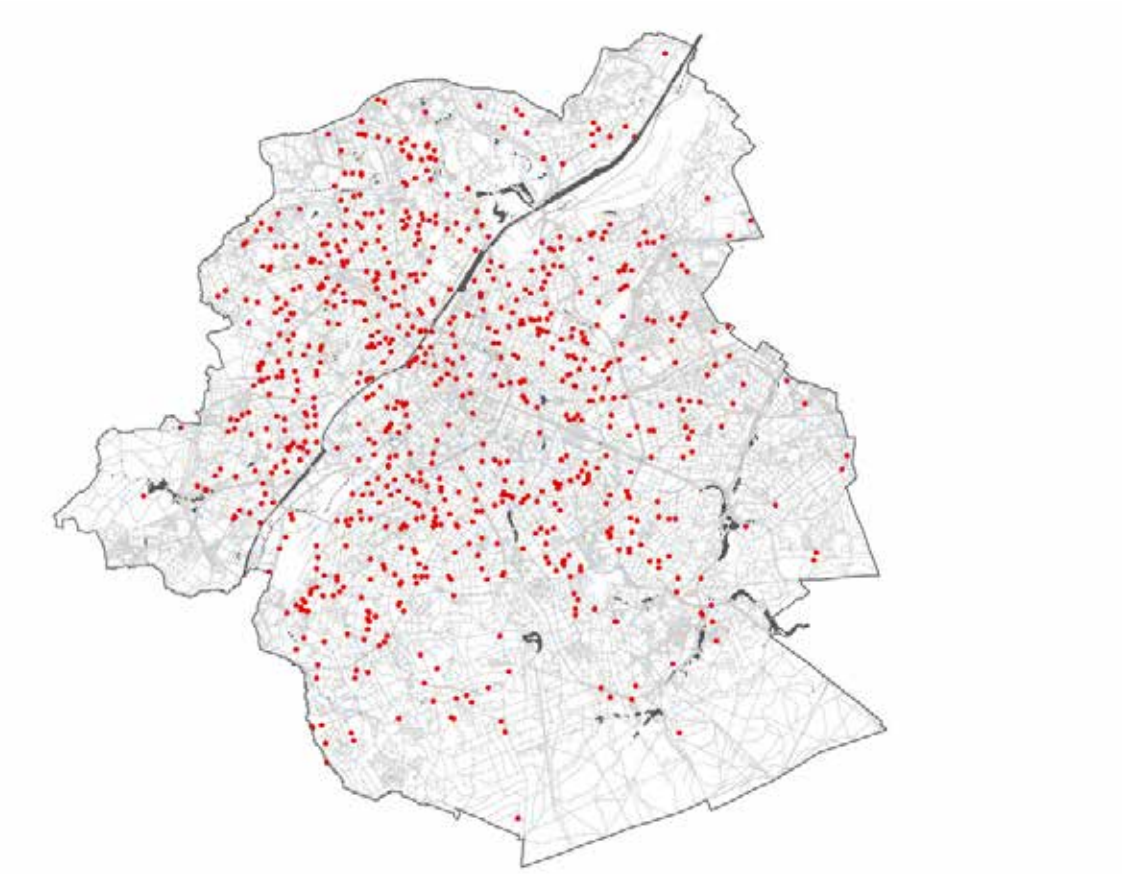
Source:
see Appendix 2

The unassuming facade of MEC, producing devices for the bio-medical sector
© Adrian Hill

manufacturing their products either closer to the material source (such as a port) or at a safe distance from residential areas. Furthermore, the kind of plant work can involve relatively similar ranges of skills ranging from machine technicians to highly qualified chemists. This sector is represented by a high percentage of women compared to other manufacturing sectors and a lot of high qualified workers[31]. Furthermore, it represents a significant amount of international capital[32], which is often headquartered in the city (even if the manufacturing itself is located elsewhere). Finally, value chains are similar - processing can be focused business to business services (such as producing ammonia for the fertilisers) and therefore unlike a chocolate factory the end result remains an abstract material rather than a tangible product.

In Brussels, both the ULB and VUB have a strong research base and both have research centres connected to university hospitals, headed by some world leading researchers. This is complemented by research from KU Leuven and Université Catholique de Louvain (some 30 kms from Brussels) and connected through trans-university organisations such as the VIB. This begs the question of whether we can categorise this type of manufacturing as 'urban', particularly if research is done in urban areas while not always the production. However as much of the R+D, sales, communications and management is attached to urban areas we can assume that the urban component cannot be divorced.

There are some notable differences between bio-technology and the chemical sector. There are numerous spin-offs in both cases, such as high-tech instruments developed for hospitals that have little to do with producing fertilisers, however are firmly focused on bio-technology. Likewise the make-up of businesses are different: 79% of pharmaceutical jobs are in big companies (more than 100 workers) whereas the chemical sector has smaller companies (37% of jobs are in companies of less than 50 workers).



Map 6:
Repair Services

Source:
see Appendix 2

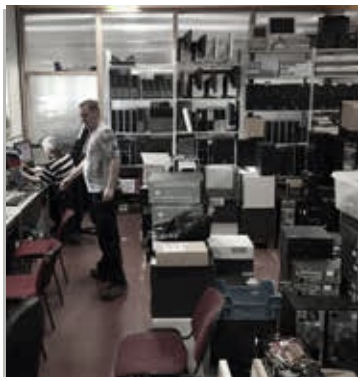
Finally, with a large number of hospitals in the region, there is an ecosystem of local manufacturers providing materials and technology which are linked to R+D associated with medical research such as MEC (Medical Engineering and Construction).

Printing

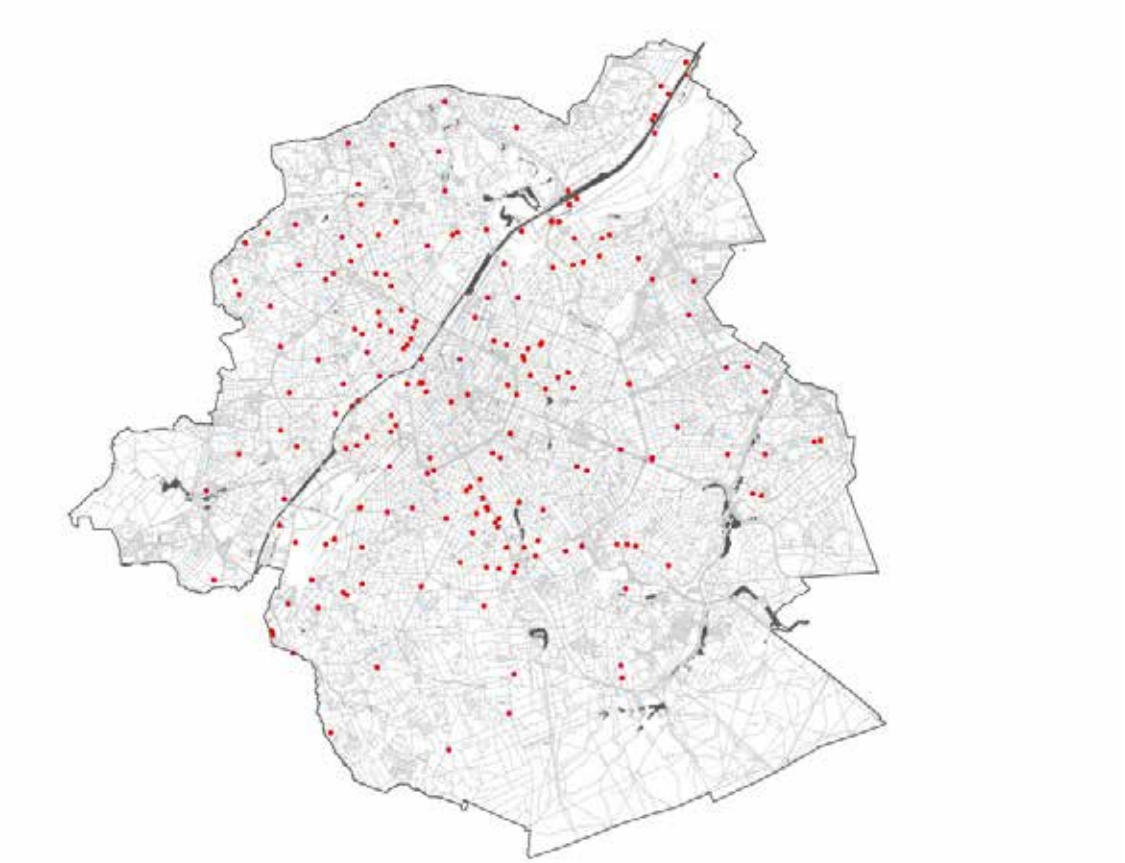
Whether it was due to the region's long history in painting and weaving, or its location as an administrative centre or even due to laxed copyright rules that anecdotally allowed for tomes of counterfeits in the 19th century, Brussels has long been an attractive centre for printers.

The printing industry represents a niche with some 3500 employees with an average company size of 15 workers[34]. Most services are business to business[35] and with more effective printing technology far greater volumes can be produced by a smaller number of suppliers. Likewise, delivery costs are allowing printers to be far from their suppliers and remain commercially viable. The consequence is that the printing sector seems not to have a very confident future with many voices suggesting that the sector will decrease over the following years years.

The printing sector may appear banal and not showing healthy signs for a future in urban manufacturing, if not for the arrival of new technologies that are improving accessibility to new products. This includes 3D printers, CNC machines, laser cutting machines and so forth. While fablabs are experimenting with such technology, it is very possible that once a larger customer base is formed, printers will be the likely professional sector that can provide both private and commercial services. In this sense printing could be at the forefront of an entirely new wave of innovation and we do not see it fading quite yet into the the past. What is questionable is if existing printers are capable of capitalising on this new technology or if a new wave of entrepreneurs will enter the market.



C2FD's workshop space at RecyK, a prime example of linking social economy and repair. © Adrian Hill



Map 7:
Recycling services

Source:
see Appendix 2

SUPPORTING SERVICES

There are a number of sectors that do not focus specifically on manufacturing however are critical for it to function effectively and therefore we have included them here as supporting services.

Repair

The difference between manufacturing and repair can come down to semantics. While repairing is endemic to most urban environments, the last half century has produced vast amounts of almost unrepairable goods. Within the context of the circular economy we should be avoiding where possible the full replacement of machines while fixing parts that are no longer functional. Take for example the public transport operator STIB / MIVB, pieces of buses and trams are constantly being replaced and upgraded without the need to replace the entire vehicle. Repair is thus a critical 'supporting service' that must be associated with 21st century urban manufacturing. There are jobs and skills to be developed within the repair industry that are completely complementary with manufacturing. Furthermore, the environments needed for repair are almost identical to those for manufacturing - such as a workshop or a warehouse.

Since the Employment-Environment Alliance (2010) and the Regional Circular Economy Plan in (2016), repair and new business models associated with services have been promoted at a regional level. New business have emerged since such as CF2D which is a social enterprise rehabilitating office equipment and fit into the circular economy narrative.

Brussels is known for the wide network of second-hand car dealers and car repair garages exporting cars largely to West Africa since the mid-70s. In Anderlecht, the Heyvaert neighbourhood is a cluster of dealerships consisting of more than 150 mostly family-owned garages as well as a tight-knit tribe of related businesses. It is a hub of economic activity, what initially started as a purely import-export-centered cluster of businesses has today evolved into something more akin to an ecosystem including repair, maintenance, painting, welding, electronics, material supply and a raft of supporting businesses, cafes and mosques and churches. Heyvaert neighbourhood is famous for its informal jobs that have allowed low skilled immigrant residents to find work. The peak of 500 cars

The TIR Site, an important logistics hub for the city which will soon be combined with circular economy initiatives
© Adrian Hill

exported daily through to the port of Antwerp has well passed. Business owners' reaction to these plans have been treated with both reluctance and opportunity. The question here is if other forms of repair could replace the cluster of car dealerships.

Recycling

Like repair, recycling is not the most obvious form of urban manufacturing. However within the paradigm of urban metabolism and the circular economy, the re-valuing of material is a critical step in avoiding waste. This in fact is about manufacturing materials however the end result is not a viable product.

In a certain way, Brussels has recycling at its DNA, hosting one of the longest running daily flea markets in the centre of the city at Place Jeu de Bal.

The issue of efficient waste collection, recycling and preparation for reuse is central in the current debate in the region. The current commitment to waste management is the limitation of the quantity of waste through prevention, reuse and recycling. This will be based on a European legislative context.

Waste management is a clear ecological problem, but it also increasingly represents a potential economic resource whose valorisation can bring significant benefits, in particular in terms of job creation. In addition to traditional industrial sectors, social economy enterprises have a societal aim, often including re-employment or reparation projects promoting the social and occupational integration of low skilled or unskilled labour.

Recycling requires the separation of the various components, from the time of collection, in order to serve as new resources. A few questions could be considered. What actual recycling should occur in Brussels? Rather than just collecting material and exporting it for recycling elsewhere, what should be processed here? Secondly, how can recycling services be commercialised or opperationalised? Unless there is a clear business or funding case, it is clear that recycling will not change.

Furthermore, a serious challenge is integrating recycling facilities into urban space. There are a number of collection points across the city yet sorting is limited to five waste streams. Waste transportation, noise, air and visual pollution, are pressing issues that limit the capacity for urban areas to capture and sort waste resources.

Logistics

A large number of businesses complain accessibility and goods transportation is a major challenge. The logistics sector may not produce much however it is a key facilitation service which manufacturers depend on.

Brussels is one of Europe's most congested cities and the widespread use of vans by the logistics sector inside central neighborhoods accounts for. In general, logistics and freight transport companies are more established in the urban periphery, with cheaper land and easier links to highways. Researchers and and institutional experts forecast growth in logistics in the region over the next few years - which could also account for possible employment adding to some 30,000 within Brussels alone.

Logistics is one of the sectors providing an opportunity for growth in low skilled jobs and the regional government has made it one of its priorities in the Strategy 2025 and the Strategic Plan for the Transport of Goods. Furthermore, players such as the Port of Brussels are trying to promote sustainable modes of transport, such as the transport of goods via the canal, and to develop innovative transport infrastructures.

Construction material / material recycling sector

Including the construction sector in this list may raise a few eyebrows, however it is undeniable that a city is a never-end factory of real-estate and this form of manufacturing is core business for cities. Furthermore, the construction sector includes technical skills that could be transferable to other sectors (such as vehicles or repairs) and it is very difficult to distinguish the manufacturing component from the more artisanal construction process. Likewise, physical spaces for working (such as workshops) are quite similar in form to those in manufacturing other things like food or machines. Finally, buildings are vast sinks of materials and energy, making them an obvious target for innovation. In 2014, 628.000 tons of waste was produced by the construction sector, 38% of the total waste in Brussels[36], and its energy consumption was about 150.000 GWh PCI[37]. Businesses are constantly looking for innovative solutions to these kinds of local problems which has been motivated by the Region's focus on the circular economy.

The sector employs a workforce of 33000, eclipsing the sum of all other manufacturing sectors, and has created many new jobs in the past years (3000 between 2008 and 2014)[38]. Over 40% of construction workers come from Brussels[41], while 93% or more than 1500 companies contain less than 20 workers[42]. On the low side, construction is characterised by a high level of sub-contracting, informal work, flexible jobs[43] and involve a very small percentage of women (11% in 2015 for the capital[44]). Over the last years, Brussels' construction sector has seen frequent difficulties in finding skilled workers while there is a noticeable increase in freelance work showing that labour and job security are becoming a challenge for this sector[45].

Construction takes up relatively little space considering the high level activity[39] since much of the activity occurs on building sites. The average surface/worker is quite low comparing to other industrial sectors[40].

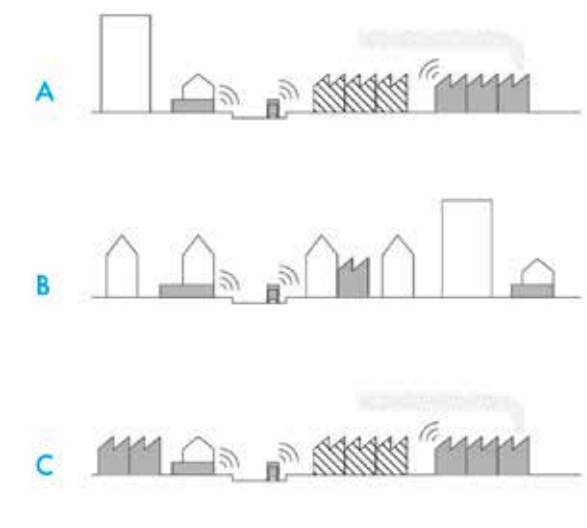
Both recycling and the raw materials for construction are located around the northern and southern canal areas. Cement for example is a material that through European regulation cannot be delivered more than 90 minutes away from its place of production and therefore one company, Inter-Beton (Heidelberg Cement), has gone to great measures to integrate their cement plant into the urban fabric to avoid dust and noise. The Port of Brussels is also finding its niche by attracting large material recyclers, such as Stevens, who live opposite Inter-Beton, who play a role in the construction material life-cycle.

At a smaller end, smaller businesses requiring workshops are finding it harder and harder to find or afford reasonable space and therefore many cabinet makers, plumbers, electricians (and so on) live in the outskirts. The region's developer, Citydev, is in the process of creating affordable smaller 100-1000 spaces m^2 however the demand truly outstrips supply.

View over Heyvaert, famed for its second-hand car market.
© Diogo Pires

THE GEOGRAPHY OF BRUSSELS' MAKING

The current geography of Brussels' manufacturing is the result of an historical distribution of productive spaces that follows a precise infrastructure, socio-spatial and economic/business logic. Recent global economic trends as well as regional competitiveness and local policies and subsidies have largely influenced the appearance, disappearance and displacement of many activities. The Canal[46] has structured Brussels' productive space cutting the city in half, with the main route linking the city to the economic hub of Antwerp and to the North Sea. This has had a dramatic influence in the city's urban, productive and industrial development. The result is essentially three typologies: A) manufacturing blocks adjoining other land uses B) highly mixed zones and C) industrial zones (see image right).



A section of three typical urban typologies for manufacturing in Brussels. © Latitude

A) pockets of manufacturing adjoining other land uses

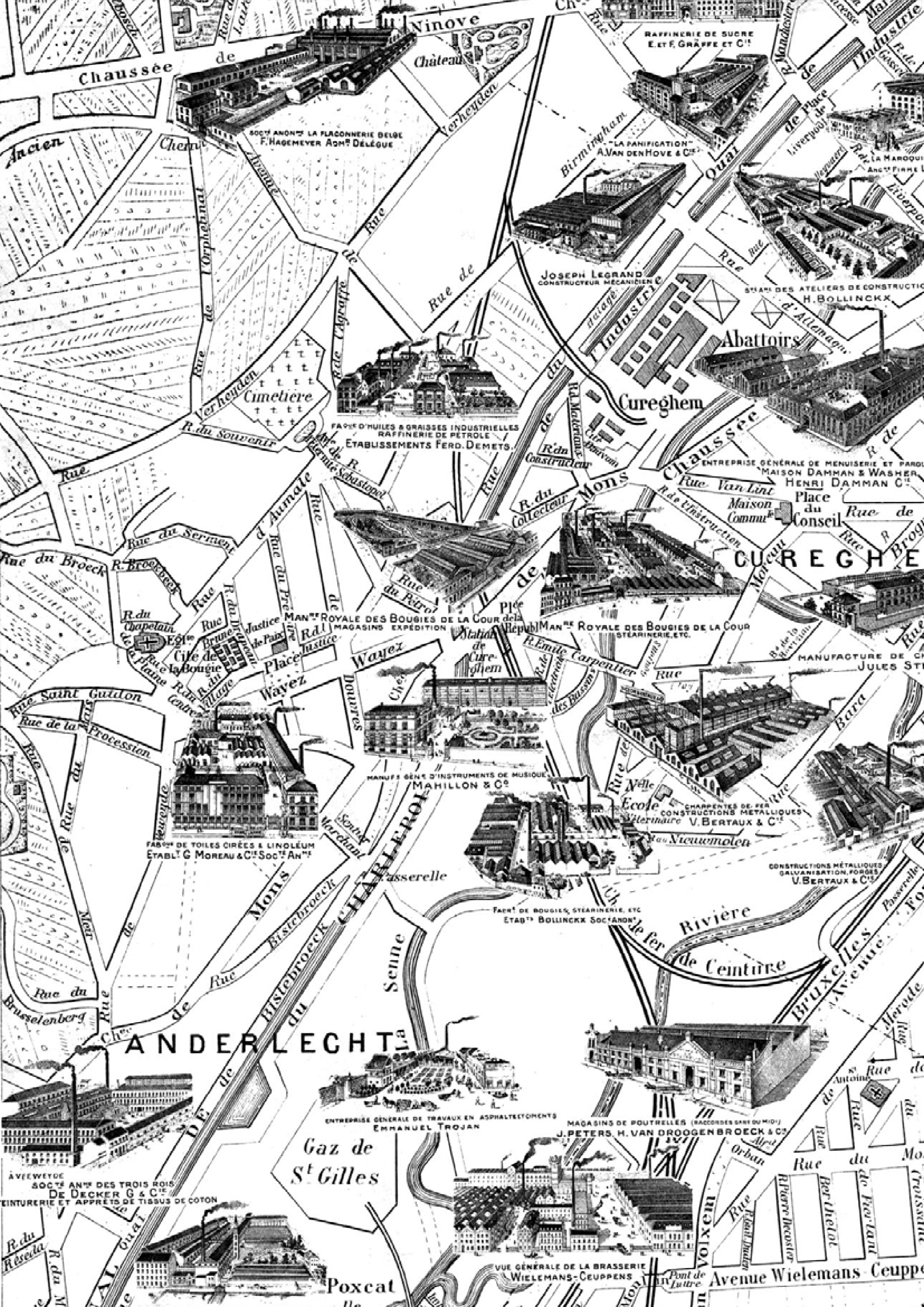
While it is easy to fall into the trap of thinking the canal precinct is the main focus of industrial activity, much of Brussels' 'heavier' manufacturing is located in areas of great 'horizontal mix'. Industry is built next to a sports field which is surrounded by housing, for example. Two of the city's largest industrial employers, Audi in the south and SABCA in the North, are located in industrial areas separated from residential areas by merely a road. The areas include Cureghem and Forest. These zones are neither at risk or entirely safe from redevelopment. The contentious ZEMU projects (see below) are finding their place on such sites.

B) highly mixed zones

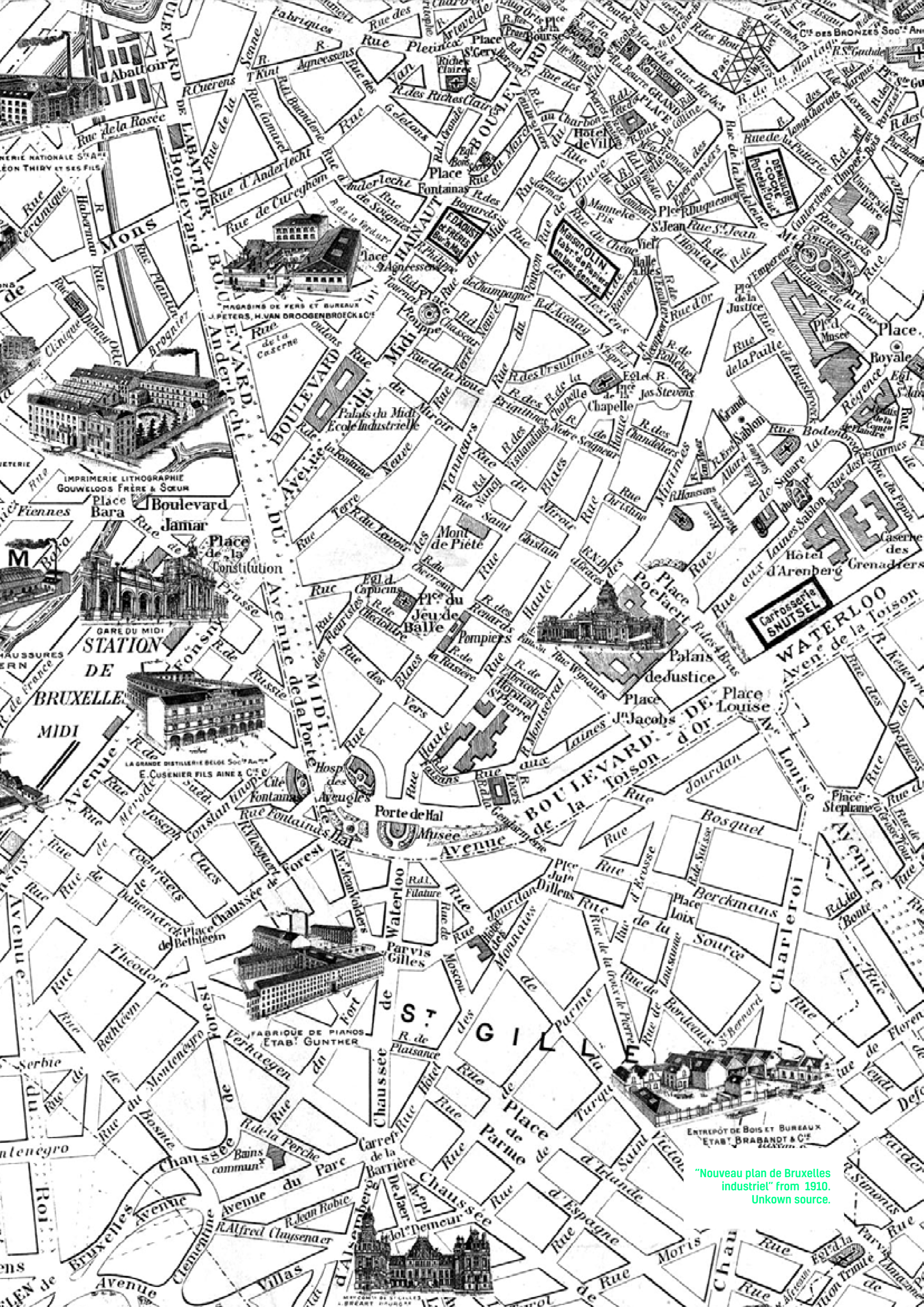
The most particularly interesting and organically grown manufacturing is found in the 19th century neighbourhoods, outside of the medieval city walls, where over time industry and housing built up a delicate ecosystem together. Neighbourhoods including Heyvaert, Molenbeek and Masui are one of the city's peculiarities, located minutes away from the city centre yet containing an incredibly rich mix of housing, schools, garages, small factories, playgrounds, market spaces for informal dealings and some remarkable examples of early 20th century art nouveau architecture. These are the neighbourhoods new poor migrants land in, providing access to low-barrier work (often informal with little need for language skills) which allows them to find their place in the city. These are areas where things are fixed and adapted as both technical knowledge and cheap labour is in supply. However it is also the area under the gaze of developers seeking to transform the charming industrial space into housing opportunities - propelled in part by public authorities supporting 'beautification programmes' - see description of the PADs, CRUs and Neighbourhood Contracts below.

C) Industrial zones

Following the widening of the canal zone as sea harbour (early 20th century) led to the creation of three main docks (Gobert, Béco, Vergote) and large industrial complexes (i.e. Tour & Taxis) and warehouses, developing larger industrial areas in the northern and southern parts of the axis where new sectors implanted (chemical, petrochemical, construction, gas). Due to the deindustrialisation process since the 1960's along the Canal area, logistics have gradually replaced industry. Irrespective a number of larger manufacturers remaining particularly in zones at the north (Buda) and the south (Paepsem). This zone now performs some of the most basic metabolic work for the city: bringing in sand and building material, processing wastewater and recycling building material such as steel. The biggest question is about dealing with noise and dust issues - the Interbeton (Heidelberg) cement factory on the dock edge adjoining one of the city's newest and largest housing towers was forced to adapt its design to manage noise and dust.



Chaussée de Ninove
Château
Socté Anonme La Flaconnerie Belge
F. Hagemeyer Admr Délégué
Raffinerie de Sucre
E. et F. Gräffe et Cie
"La Panification"
A. Van den Hove & Cie
Birmingham
Quai de l'Industrie
Place de Liverpool
Rue Verheyden
Avenue de Rue
Rue de l'Orphelinat
Rue de Verheyden
Ancien Chemin
Cimetière
R. du Souvenir
Joseph Legrand
Constructeur Mécanicien
Sté Ame des Ateliers de Construction
H. Bollinckx
Abattoirs
Cureghem
Fabque d'Huiles & Graisses Industrielles
Raffinerie de Pétrole
Établissements Ferd. Demets
R. du Constructeur
R. du Collecteur
Chaussée de Mons
Entreprise Générale de Menuiserie et Parquets
Maison Damman & Washer
Henri Damman Cie
Rue Van Lint
Maison Commle
Place du Conseil
R. de l'Instruction
CUREGHEM
Rue du Serment
Rue d'Aumale
Rue du Broeck
R. Broekbeek
Rue Sébastopol
Rue du Pétrole
Rue du Prétoire
R. du Chapelain
Egse
Cité de la Bougie
Justice de Paix
R. de la Justice
Place Wayez
Rue Wayez
Manre Royale des Bougies de la Cour
Magasins Expédition
Station de Cureghem
Pce de la Républ
Manre Royale des Bougies de la Cour
Stéarinerie, etc.
R. Émile Carpentier
Manufacture de
Jules St
Rue Saint Guidon
Rue de la Procession
Rue Dourres
Manufre Génle d'Instruments de Musique
Mahillon & Co
Nlle École Vétérinaire
Charpentes de fer
Constructions Métalliques
V. Bertaux & Cie
R. du Nieuwmolen
Constructions Métalliques
Galvanisation, Forges
V. Bertaux & Cie
Fabque de Toiles Cirées & Linoléum
Etablt G. Moreau & Cie Socté Anme
Sentier Marchant
Passerelle
Chaussée de Mons
Rue Bisschbroeck
Chaussée de Charleroi
Fabrt de Bougies, Stéarinerie, etc.
Etabts Bollinckx Socté Anonme
Chemin de fer de Ceinture
Rivière
Avenue de Bruxelles
Senne
Rue du Bruselenberg
ANDERLECHT
Quai de Bisschbroeck
Entreprise Générale de Travaux en Asphalte et Ciments
Emmanuel Trojan
Magasins de Poutrelles (Raccordés Gare du Midi)
J. Peters, H. Van Droogenbroeck & Cie
Gaz de St Gilles
Socté Anme des Trois Rois
De Decker G & Cie
Teinturerie et Apprêts de Tissus de Coton
R. du Réséda
Poxcat
Vue Générale de la Brasserie
Wielemans-Ceuppens
Pont de Luttre
Avenue Wielemans-Ceuppens
Rue du Mont
Rue Berthelot
Rue de Fierlant
Rue Orban
St Antoine



"Nouveau plan de Bruxelles industriel" from 1910. Unkown source.

2.3 Governance and Decision Making in Brussels

While a modest city by world standards, Brussels is a complex stew or political interests from local to continental. This complexity can either render it motionless or result in innovative governance and strategic development approaches, with a recent focus on developing greater intergration of productive and manufacturing spaces.

The following section helps explain some of the complexity of decision making and power relations at a regional level.

To grasp public decision making in Brussels, the complex Belgian political system must be described. Since Belgium's independence in 1830, and after five state reforms, the country evolved into a federal structure[47]. "The power to make decisions is no longer the exclusive preserve of the federal government and the federal parliament. The leadership of the country is now in the hands of various partners [the regions], who independently exercise their authority within their domains." [48]

Belgian politics is not pyramidal in structure and sometimes quite the contrary leading to a complex governance system where competences in several cases are not univocal. The Federal State retains important powers in the area of foreign affairs, national defence, justice, finance, social security, parts of national health and domestic affairs. However, the communities and the regions also have the power to establish and maintain foreign relations to ensure decision processes are closer to the citizens and their quality of life. In this way, the mayor of a city can be the most important person in Belgian politics while another could almost single-handedly halt a trans-Pacific trade deal.

The regions, which historically aspired for more economic autonomy, conveyed economic interests, resulting in the establishment of three regions: the Flemish Region, the Brussels Capital Region and the Walloon Region. Up to a certain point they can be compared with the American states or the German 'Länder'. The country is then further divided into 10 provinces and 589 municipal councils.

The canal precinct, near Biestebroek, one of the Region's largest new mixed urban areas (ZEMU) involving a large range of regional actors. ©Diogo Pirez

Since the redistribution of power occurred along two lines, language and culture, the reform led to the creation of 'communities': referring to persons that are unified by their language (Dutch, French and German) and culture. As a result, Belgium today has three communities: the Flemish Community, the French Community and the German-speaking Community that correspond to population groups[49]. To simplify, French terms and official titles will be used from here-on.

BRUSSELS CAPITAL REGION

The regional boundaries has rendered Brussels almost a 160 km2 city state, with various political parties sharing power, from various language groups. In the Brussels Capital Region (the Region from here-on) is the decision making structure concerning most manufacturing and territorial issues. Manufacturing related issues can fall under four or five different ministers (employment, environment, economic affairs, public works, mobility and so forth), with each politician carrying a very different nuance on the relevance of productive industry. In practice the complexity of this governance structure means that the agencies responsible for executing political mandates have a large responsibility in translating governance into action and in this way hold a certain level of power in simply getting things done. What connects the regional agencies and organisations are the plans including sustainable development, circular economy and local development plans.

Actors

The BDU - Brussels Urban Development agency aims at managing the development of the regional territory while "meeting the basic social, economic and environmental

needs of the population" and it is responsible for specific activities in close collaboration with a series of directorates dealing with planning (development and zoning plans), urban development (regional and communal building permits) housing (renovation and improvement subsidies), urban renewal (urban and landscape revitalisation programmes) and heritage. Within the Brussels Urban Development agency, the Directorate of Urbanism aims at ensuring the proper application of the regional planning regulations, including land parcelling permission and environmental impact reports, keeping informed the public bodies and the general public.

The Region's territorial development is coordinated by the Direction Etudes et Planification (DEP) which monitors strategic planning (Plan Régional de Développement, Communal Development Plan and blueprints) and regulatory planning (Plan Régional d'Affectation du Sol [PRAS] and Private Designated Land Use Plans) and their implementation. It runs the permanent secretariat of the Commission Régionale de Développement (CRD) and represents the Brussels Urban Development agency at the supra-regional and European level.

Furthermore, a range of other public organisations and agencies have some connection to urban manufacturing. Perspective is the Region's centre for territorial expertise and development. The Brussels Region Architect (BMA) is connected to Perspective and helps improve the quality of both private and public urban design and architectural projects - most recently also supporting co-design of mixed use projects. Brussels Environnement is the region's environmental protection agency, handling a range of issues including soil quality, pollution and the region's Circular Economy Plan (PREC). Actiris is the Region's employment agency dealing with the demand and offer of the Region's labour force and training. Hub. brussels is a newly created agency focusing on supporting businesses. Innoviris is the region's research and innovation agency who have a particular interest in technology and artificial intelligence. The Port of Brussels is a relatively autonomous public organisation that manages some 105 hectares and 5.5 kms of keys and port side land. Brussels Mobilité oversees all forms of mobility including logistics. The Société d'Aménagement Urbain (SAU) is responsible for larger development zones, particularly in the mixed and industrial areas along the canal. Citydev is the regional developer for housing, social and industrial buildings whom are pioneering the development of mixed use projects. Each of these agencies and organisations is presided over by a politician and therefore each often executes the political persuasion of that politician or political party. Refer to the actor mapping, page 56.

Plans

There are a range of plans that affect or contribute to the urban manufacturing landscape. From a territorial perspective the PRAS, the regional land use plan, sets the clearest guidelines for where functions occur. Plans can range from the strategic (such as the PRDD) to operational (such as an area plan).

Within the framework of the Regional Sustainable Development Plan (PRDD), the Brussels-Capital Region envisages the establishment of large projects regarding various development focal points. "Large urban renewal projects have been launched to improve the attractiveness of the Region and provide an environment that meets the evolving needs of the inhabitants of Brussels who want to live, work and spend their free time in pleasant surroundings. The main challenges facing the authorities are the need to reduce social and territorial inequalities, strengthen social cohesion through the construction of housing and infrastructure, improve mobility and highlight the Region's international assets".

In 2016, a world pioneering Regional Circular Economy Plan (PREC) which is the

initiative of three ministers and executed by 13 regional agencies (including Brussels Environment, Perspective and Citydev). While not stipulated directly, urban manufacturing could play a clear role. More recently, an Regional Industrial Plan was launched to define a trajectory for industry and is planned for release in September 2018. This plan will focus on the strategic future role of industry in the city.

More concretely there are numerous urban development planning approaches which may impact urban manufacturing. The Plan d'Aménagement Directeur (PAD) is a planning tool to create a regulatory and operational masterplan in sensitive neighbourhoods that are under the likelihood of rapid change - existing PADs are being developed in two highly mixed areas with manufacturing: Heyvaert and Masui. The Contrats de Renovation Urbain (CRU) involve strategic interventions for development such as a park, school or neighbourhood centre. The 'Neighbourhood Contracts' (Contrats de quartier) provides financing for neighbourhoods to improve the social and environmental quality of deprived inner-city neighbourhoods. These plans in practice can work for manufacturers (through creating new facilities) or against manufacturers by appropriating land and pushing up land prices.

IN PRACTICE

The frequent changes in the panorama of Brussels' decision making organisational structure noted above renders a serious challenge in understanding the different relations between involved actors and stakeholders. Plans help structure discussions, however much of the execution depends on the capacities and interests of the individuals working for the regional agencies. In order to better understand the most relevant and urgent regional planning and policy issues in the Region, a series of interviews were conducted with the main organisations operating in the field, from which the following key points have been extracted.

Beyond the border

According to most of the interviewees, one of the most peculiar aspects of Brussels, is the administrative borders of the city-region which is fully surrounded by the Flemish territory making Brussels city-region within a region. Rarely does Brussels, Flanders or Wallonia take a metropolitan perspective on a vast range of issues from mobility to logistics, food, education or industry.

As clearly stated by several experts, the city-region is both a disadvantage and an advantage[49]. Moving across the regional borders involves different administrative, language and cultural contexts (Flanders or Wallonia). For what concerns manufacturing in general, the main challenge is competition with other neighbouring cities whom have far greater influence over peri-urban areas that can accommodate productive activities more effectively than Brussels. Therefore, the dialogue with the other Regions is a very strategic issue. In the recent PREC (Regional Circular Economy Plan) for example, it is clearly stated that the Brussels Capital Region must engage in dialogue with the other regions, showing a growing awareness about the need of an inter-regional vision. However, the main problem remains understanding the right ways to collaborate and operate. The lack of consistent vision and the problems of governance in Brussels highlights an introverted tendency of turning into the local context and the controversial ambition of trying to be fully autonomous - in other words producing all that the region needs within the region[50].

Brussels Public Authorities: a complex machine

The various public agencies, noted above, regularly collaborate yet due to different expertise and bureaucracy, visions can be misinterpreted or poorly delivered. For example, the PREC (Regional Circular Economy Plan), which is driven by Brussels Environnement and the Industrial Plan (Minister Gosuin) are disconnected

The heart of manufacturing.
RVB
© Adrian Hill


Quantité cmd. : 22.00
Quantité prod. : 0.00
Travaux :
Etape | Service / Poste | Description
10 | RVB USINAGE MANUEL WARD55 | Filetage côté 1 (25/100) Boite outils N° 279
20 | RVB USINAGE MANUEL WARD55 | Filetage côté 2 (3/4) Boite outils N° 279
Composition :
Item | Article | Description
Barre creuse 26 x 20 laiton
Queen's Delight
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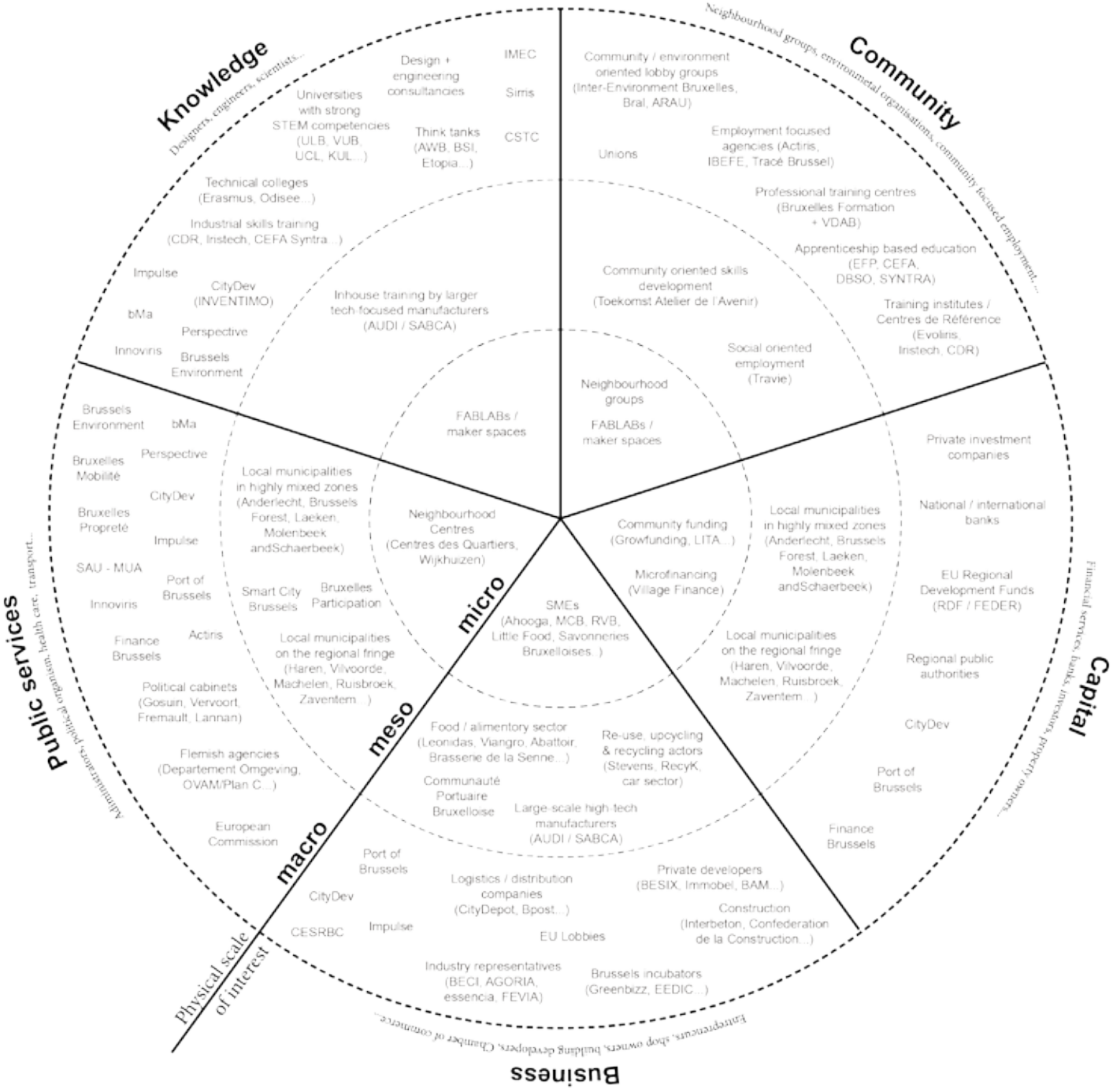


Box 1:

Map of significant stakeholders connected to the manufacturing in and around Brussels

The map shows the five 'penta-helix' stakeholder groups associated with place-based development. Public services include both political and administrative stakeholder Businesses include individual businesses and business organisations such as a chamber of commerce. Capital includes those stakeholder that own land, technology or finance investment. Knowledge focus stakeholder include researchers and consultants. Community stakeholder involve community based organisations, rather than individuals. The scales refer to an approximate scale of interest - micro scale refers to a neighbourhood, meso refers to a municipality while the macro involves stakeholders with regional or inter-regional interests. The map itself is a non-exhaustive map of stakeholders that were identified through engagement with stakeholders. It is completely qualitative and is merely a discussion tool.

This map shows actors connected to manufacturing in Brussels', developed over six months of interviews and discussions

What the map shows is how there are numerous regional agencies connected with the topic, share responsibilities for certain aspects of the topic however there is no single actor that has a wholistic view or responsibility for managing urban manufacturing. A second interesting observation is the range of actors connected with training and skills development.

while they concern for the most part the same subject.

Another example of the weakness of public power are the ZEMUs (Economic Zones in an Urban Context), which will be explained in more detail on page 61. ZEMUs are a special planning tool intended to provide more intensive, mixed use of industrial land. However in practice due to the complexity public authorities have left a lot of the practical detail in the hands of the private sector, that has almost no experience in developing housing projects combined with industrial or productive spaces.

Furthermore, real estate developers have a lot of power compared to public authorities who are unable to oppose certain real-estate pressure. Private developers can recruit highly experienced and qualified staff and are often quite close to public actors helping to adapt ambiguous urban planning in their favour. Consequently activities other than housing driven real estate have a loose footing in the political agenda.

According to various individuals within Perspective (the regional planning agency)[53], a big challenge for territorial governance is the lack of an economic perspective and difficulty to build common ground amongst the regional agencies. The consequence of unfounded knowledge is that personal opinion becomes a driving factor in the regional narrative. Some individuals site the importance of a manufacturing base and skilled workers, the need for resilience, while others claim NIMBYism, noise and air pollution, lack of demand and mobility obstacles. This leads to different institutional visions or even fragmented institutional positions. One interview noted that "there is often little opportunity to collaborate and see each other to share a vision of the city"[54]. The economic model for Brussels is not easy to find: its administrative, geographic and governance limits result in a lack of strategic vision and uncertainty about the right model to follow.

Frictions on competences

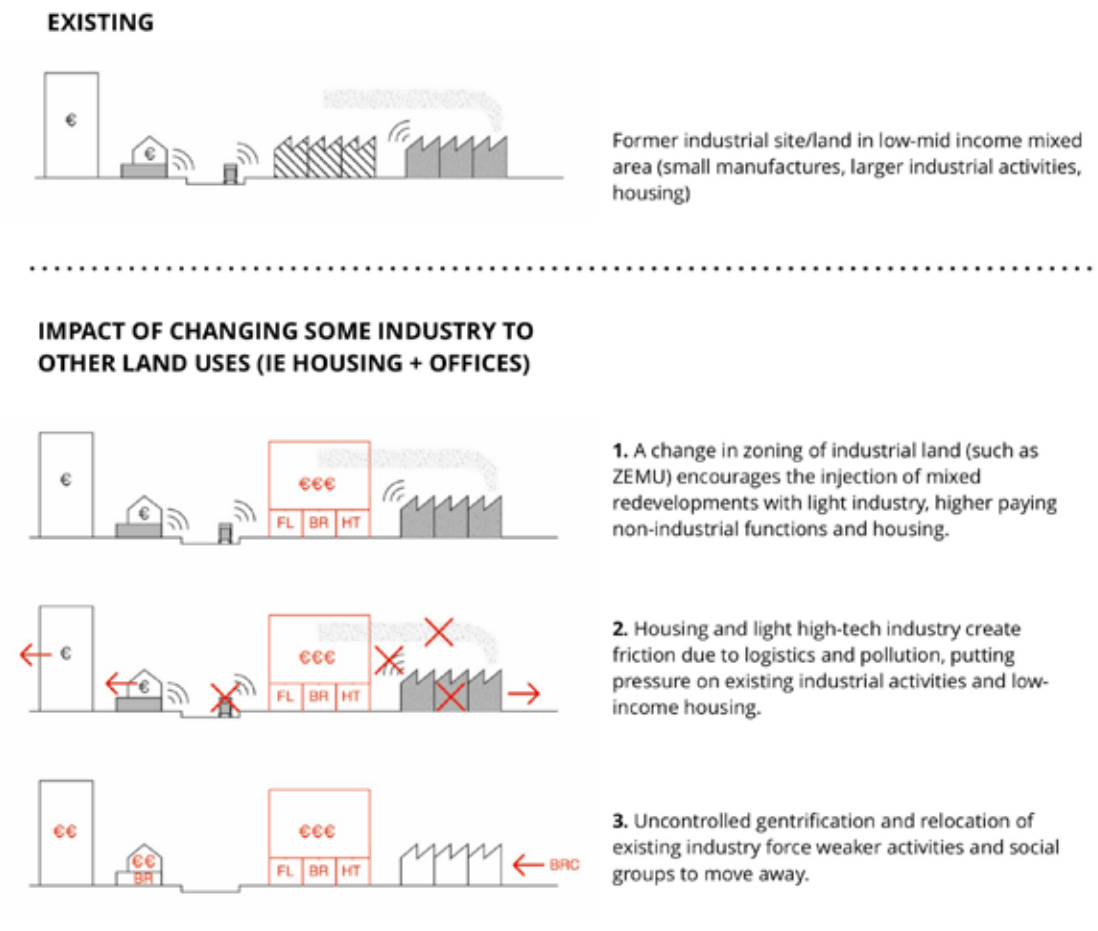
The complexity of the architecture of Brussels' institutions reveals a number of tensions and overlaps. The interviews revealed that recent reorganisations and restructuring have led on the one hand to positive efforts towards efficiency and the willingness to build shared visions, while conversely it seems governance and power issues are still present.

Critical voices claim that since the early 90s, the lack of economic knowledge and specific skills led to colossal damages. Consequently, today is still possible to observe differences of economic visions between Perspective and the newly formed Hub.brussels (formerly Impulse). Furthermore differences can be seen between Perspective/BMA and CityDev in terms of investing public money in housing and industrial spaces. While differences in opinion are natural and expected within regional agencies, it can be troubling for manufacturers whom don't know which public agency to turn to and/or if their interests are being represented by regional policy. In fact numours manufacturers and businesses noted that it was unclear who they should turn to for help. Based on an extensive stakeholder analysis (see Box 1), it is clear that no single agency has the competencies or the capacity to deal with a vast range of issues including: building permits, environmental permits, financing, mobility, training and skills and so forth.

An additional problem styfulling inter-organisational collaborations has to do with a lack of resources to follow joint projects. Impulse, for example, points out that both the idea of collaborating is not possible because of the staff deficit.

Impact of plans and policies on urban manufacturing

Interviews revealed[55] claims that massive real-estate speculation in Brussels, common for other European cities, is well facilitated through legislation and spatial planning. The PRAS (Regional Land Use Plan) gives a lot of de facto power



The impact of mixed use developments on other industrial areas.
© Latitude

to developers, instead of distributing power between developers and the public sector. There is little difference between zoning for administrative fucntions, offices and industrial-manufacturing activities due to the poor definition of manufacturing. Conversely new forms of manufacturing could occur in offices or on municipal land surrounded by residential areas.

More specifically, some regional development programmes may come across as supporting manufacturing, but actually work against it. The ZEMU zoning, puts the onus on integrate productive spaces into their residential programme on private developers. The neighbourhood contracts (Contrats de quartier) invest millions of Euros in the 'renewing' neglected and poor inner-city neighbourhoods, resulting in increase of land value, gentrification and squeezing out manufacturing type tenants. Even designers developing urban masterplans (PADs) struggle to resist concentrating on seductive public space and housing projects while neglecting the business networks that are sustaining the neighbourhoods.

Furthermore the Region's sustainable development plan (the PRDD) confirms the tendency of the city to focus mainly on the tertiary sector (creation of offices, congress center, head offices, ...). Only a small part of the plan is devoted to the local economy and support for urban production (ZEMU, ZEUS, ...). Proposed new training centers are dedicated to digital, media, communication, logistics and catering. While certainly some neighbourhoods are characterised by their shabby industrial character and do not provide a pleasant living environment, the impact of the PRDD and ZEMU could push issues

to another extreme whereby there is no protection for existing manufacturers while all building real estate owners focus on the burgeoning housing market.

Mixed development zones (ZEMU): a troublesome strategy

Industrial areas have been decommissioned regularly since the 1960's, reducing industrial land to a mere 3.8% of the region's surface (some 500 hectares). Furthermore, the last half century of land use planning has resulted in very inefficient use of space through forced setbacks, easements and parking[56]. The ZEMU zones are thus an enterprising solution ennacted by the Region to offer more effective use of available land while and take advantage of the vertical space for other functions such as housing, community functions and even open space. The ZEMU regulation increases the variety of accepted activities, including shops, public services and housing while limiting maximum building footprints and size of lots across six ZEMU in Brussels. While vertical mix is a very sensible idea, in practice it could be troubling for the future of industrial space, with the following points raised in the interviews.

The planning regulation is innovative for Brussels, which allows for more intensive use on the land-poor region, in practice there are no delivered test cases in Brussels or known reliable precedents in Europe to learn about challenges involved in both the development process and the long-term use of such mixed use sites. By the time the first ZEMU projects are being rolled out (somewhere around 2021-2023), there will be hectares of other new projects in the pipeline making it hard to change policy.

ZEMU sites are being built by developers who essentially have a short-term interest in the sites while the developers interested in such projects are generally specialised in housing and commercial real-estate, with no experience in industrial sites. This means that their priority is to build and sell in the shortest period of time and are generally not interested in who occupies the industrial spaces over the long-term. Developers have indicated that the industrial spaces are the price to pay for the opportunity to access the real money maker - housing.

ZEMU is troublesome for future users of the industrial spaces. With residential neighbours, noise, dust and large trucks may be seriously limited in the type of work and working hours. Furthermore, the sites may be far too expensive for manufacturers as developers benchmark commercial or retail space in their spreadsheets rather the much cheaper industrial.

Finally the spaces may not suit the buying capacity of local manufacturers - offered only for sale and not for rent (rental being favoured particularly by risk averse smaller and younger businesses).

According to the BMA[57] the tool remains effective to counter land prices yet requires a more coherent development process and support to connect businesses and available space. However several institutional and private actors have criticised the ZEMU zones in their current legal form[58]. Real estate pressure for residential development, allowed in this type of area, has been recognised to be at the source of both industrial and social gentrification processes.

First studies on the topics seem to confirm this observation[59]. Institutional actors are frequently questioning the lack of adapted policy framework such as rent control instruments, citing a need for a review of the ZEMU requirements. Even real estate developers are complaining because of the obligation for big residential project to integrate less valuable productive activities that they would avoid if they could. Others, such as the VUB's Sarah De Broeck[60], have postulated that such sites will eventually be too expensive for productive activities and it is just slowing the transition from industrial to residential focused areas.

2.4 Ongoing projects and Activity

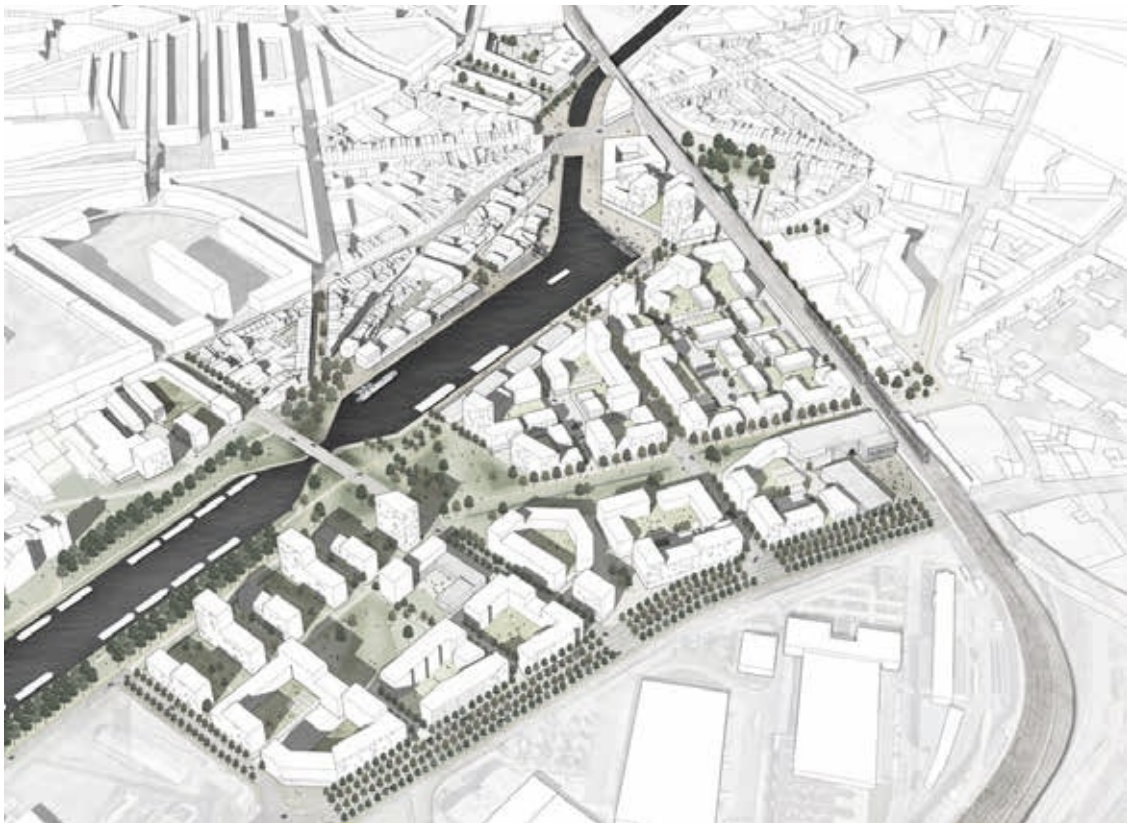
Brussels has been experimenting with the development of productive spaces across a number of scales. This ranges from the design of buildings to the planning of new neighourhoods based on mixed use that combine makers, thinkers, spaces for education, leisure and living. Other initiatives are looking at building better ecosystems between manufacturers in industrial areas in inter-regional sites.

GREENBIZZ

Developed by Citydev, funded by European Regional Development Funds (ERDF) and inaugurated in 2016, Greenbizz is a business center for entrepreneurial projects focused on sustainability, social and circular economy. The project draws together a range of regional actors, including Citydev, Bruxelles Environnement, Impulse (now Hub.brussels), Innoviris and the Scientific and Technical Centre for Construction (CSTC). The main goal is to support innovative and "green" economic activities, which links to a range of regional initiatives such as the regional circular economy plan (the PREC) and Impulse's support for Greentech business start-ups, while creating a socio-economic ecosystem where Brussels focused companies with similar interests and connected activities can collaborate under the same roof.

The low energy building consists of some 16,000m2 workshop and office space while housing the region's first public fablab, inaugurated in early 2018[61] (Cityfab 1). The modular workshop spaces range from 150-500 m2 (the most demanded space) at competitive prices, while the offices spaces include both private offices and flex-desks. Furthermore there are a range of meeting rooms, event spaces and common spaces, intended to not only bring together making and thinking type businesses, but also to attract businesses that need both making and thinking spaces. The fact that spaces are modular and flexible means that businesses are able to grow and adapt.

An example of such a project involves a start-up developing greenhouses from recovered materials called the 'Tomato Chili Project'. The collaboration of a builder, a designer and a number of other businesses located in the Greenbizz build-



Biestebroek ZEMU masterplan © BUUR

ing resulted in greenhouses built from material salvaged from construction sites in Brussels, involving on-site construction training for unemployed job seekers. While the net result is modest, it shows the power of bringing these actors together.

Greenbizz hosts some 30 companies including ecological design, construction, food processing, smart technologies and ICT services. The environmental commitment of the businesses is not always very clear and has raised some criticism of greenwashing[62]. In practice, compromises are impossible to avoid, between finding the appropriate businesses and filling the available space. However it raises alarm bells regarding future long-term management of ZEMU development areas where simply building space will not guarantee the appropriate actors will occupy the spaces. Secondly, while Greenbizz provides a great habitat for start-ups and young businesses, the ERDF financing has allowed financing for a unique space that will not be easily replicated across the city. Therefore, highly subsidised spaces such as this could offer a short-term incubation space for businesses to grow. Yet there is no regional strategy to help businesses shift from spaces such as Greenbizz to longer-term spaces (rented or purchase) that are available on the private market such as those being developed within the ZEMU zones.

BIESTEBROEK

Biestebroeck is a 30 hectares ZEMU site, at the southern end of the canal, which is in the throws of redevelopment. The plan for the area involves a mix of housing, businesses, two schools, public waterfront space, community facilities, a regional logistics point for water based freight, a private marina in addition to the

standard industrial functions required to qualify for ZEMU accounting for some 460,000m2 of development. The public space fronting the canal will be combined with the redevelopment of the port activity around the dock for the an Urban Transhipment Centre (CTU) by the Port of Brussels and the intensification of a building materials company Gobert. Biestebroek is relatively central but located in unknown corner of Brussels, sandwiched between a rail line, a busy arterial road and the canal, while it is located next to one of the region's poorest neighbourhoods.

Much of the land is in the hands of some of the largest developers in the region, making this one of the city's largest mixed-use urban developments. It raises a vast range of questions that will only reveal themselves over the coming decade when the buildings are complete and the neighbourhood becomes active. With high expectations for the project area, it could become a popular destination along the canal. This begs the question, what kinds of businesses would move into such industrial spaces? Will the land value be controlled or will it be subject to speculation in tandem with the value of the residential apartments? Likewise, if the site becomes attractive, will residents put pressure on pushing out any loud businesses that will use the industrial spaces on the ground floors? Who will eventually own the industrial spaces?

Despite extensive uncertainties, the region has a novel planning approach for dealing with mixed use development, focused along the canal zone (a 1 km zone offset either side of the canal). Projects developed in the canal zone are facilitated through the canal team, representing a number of key regional institutions, the local municipality and the Brussels Chief Architect (BMA). Project developers must commit to some 4-5 'research by design' meetings during the project conception process. This means that the canal team

Greenbizz's productive groundfloor. The office spaces are located above. © Adrian Hill

can keep a coherent overview of active projects, curating the contents and urban design, while not being shocked by when a project when it is submitted for development consent. Currently one weakness is that there is no facilitator that has an overview of the spaces being created for manufacturing type businesses, the available stock of space in the pipeline and the businesses interested in the available spaces.

BUDA[63]

The 'Buda' zone [67] is known for the former Renault Vilvoorde factory at the north of the Region. It is a well established industrial zone supporting a range of productive activities, waste management, water treatment and services such as logistics. The area is strategically located near Brussels and the airport and is accessible via road, rail and water - playing an important economic role on a regional and national scale. Nevertheless, the zone is currently facing a number of challenges particularly since it is located on the fringe of two regions whom have neglected investing in transversal spatial policy. This neglect has recently allowed an ambitious developer to propose one of the largest shopping centres in the region (called Uplace) on a site just outside of the Brussels' boundary.

Since 2017, a territorial development program (T.OP) in the Noordrand has been established, in addition to a partnership called Buda+, bringing together for the first time actors from both Flanders (the region of Flemish Brabant, local municipalities, the Flemish planning agency and the Flemish resource agency) and Brussels (Perspective and the municipality of Brussels). This kind of alliance is novel as a metropolitan perspective for Brussels, Flanders and Wallonia.

One of the leverage points for inter-regional dialogue was the 2016 International Architecture Biennale under the theme of the 'productive city', that focused on the Buda zone. This meant the Flemish and Brussels region were mediated through a third actor who's concerns were largely a-political and pragmatic. Since then numerous publicly funded and university based research projects have shown potential for the site.

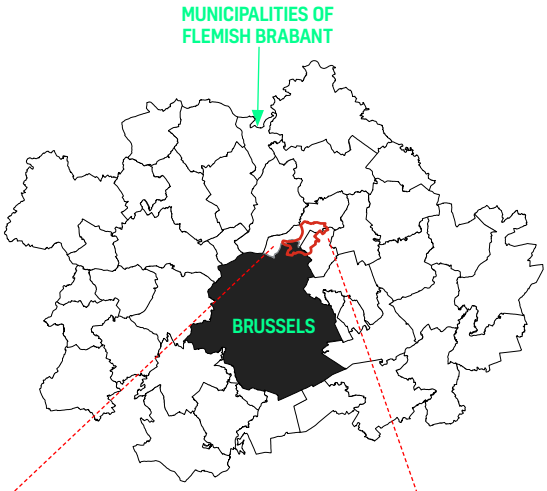
More recently a shared spatial vision is being developed, including a concrete action program to coordinate various initiatives in the area. Consequently there are a series of projects and interrelated initiatives in the pipeline. One such project is to formalise an industrial symbiosis network to increase value of waste streams generated in the Buda itself and Brussels.

Diversity in the Buda district: a regional fuel storage depot, flanked by an ecological pool builder and a large retail hardware shop.
© Adrian Hill

DOMINANT ECONOMIC USE MAP OF BUSINESSES IN AND AROUND BUDA.

Map shows the diversity of sectors and business types in the Buda area.

- Manufacture: Agriculture
- Manufacture: Metals & Machinery
- Manufacture: Food, Beverage & Catering
- Manufacture: Other
- Printing & Publishing
- Utilities
- Vehicle: Air
- Vehicle: Bicycles
- Vehicle: Cars and Trucks
- Vehicle: Railways
- Vehicle: Water
- Construction
- Wholesale: Food & Beverage
- Wholesale: Other
- Transport & Storage
- Services: Education
- Services: Financial, Insurance, Legal consultancy
- Services: Healt Care
- Services: Other Personal
- Services: Creative, Media & Advertisement
- Services: Professional
- Supporting Services
- Services: Public
- Services: Research, Innovation & Development
- Retail: Food
- Retail: Construction
- Retail: Other
- Retail: Personal
- Restaurants, Cafés & Takeaways
- Hotels, B&B
- Arts, Culture, Leisure and Sports
- Faith
- Unknown
- Vacant



Departement Omgeving, Provincie Vlaams-Brabant, OVAM, perspective.brussels, Giaretta F., Architecture Workroom Brussels. (2018) Dominant economic use map of the wider Brussels area. Not published internal document.

2.5 Making at the heart of Brussels

Despite recent efforts by regional authorities to integrate productive spaces into new development projects in established industrial neighbourhoods, much work is to be done to better understanding how manufacturing can be integrated into the 21st century urban economy. Basic questions, such as what types of making are wanted, may need to come before thinking about where to put it. Underlining this is the question of skills gaps and linking thinkers and makers.

1. GIVING URBAN MANUFACTURING A NAME

One of the biggest challenges for urban manufacturing is to define what it means. Currently a vast range of activities fall into an 'industrial' category which can include - transportation, waste management, storage, agriculture, repairs, retail, offices, even film production, in addition to core manufacturing activities such as production of car parts or processing food. This makes it hard to understand what value urban manufacturing provides for the city and why the region should support it. Furthermore it makes it difficult for regional planners to target the needs of specific user-groups, such as manufacturers.

Defining Urban Manufacturing in Brussels

Interviews with regional actors and stakeholders began with an open question - what is urban manufacturing? It is clear that there is no regional definition for manufacturing or what it means for Brussels.

As noted earlier, the translation of the word urban manufacturing into French and Dutch is not entirely the same. The words "good" and "transformation" were present in most conversations or "the production of goods by transformation" as noted by Amynah Gangji from Brussels Institute of Statistics. However there were many questions surrounding supporting services such as design, logistics, repair, recycling administration and so forth. Respondents saw it necessary to differentiate material and immaterial goods - for example the production of software and even water is classified as immaterial goods, a baker can be considered commerce, workshops and storage can fall under office spaces.

Some interviewees also struggled with

London Garment Factory
© Jim Linwood

distinguishing scale differences between crafts, manufacturing and industry. The difference between industry and manufacturing is not so obvious yet industry is generally considered a broader topic. A case in point, the authors of the Industrial Plan, found it possible to include the audio-visual industry into their definition as they saw it is more linked to contemporary production focused on digital rather than physical material.

The Brussels Region Architect Kristiaan Borret, presented another position, associating urban manufacturing with the concept of a productive city, boiling it down to three areas: firstly more traditional ones such as repair and construction (car repairs, plumbers, electricians) that are not producing goods but are working with materials; secondly fashionable activities, such as producing bikes, food, urban farming; and finally sectors of the new economy. Few others considered basic repairs to be manufacturing to be important however it was very difficult to distinguish between a company that built and sold bikes and one that simply repaired them. Urban based agriculture also was not totally dismissed as interviewees understood its link to issues such as the circular economy however it depended entirely on the type of agriculture.

Finally a more strategic position was presented by Patricia Foscolo from Impulse, that it should be focused on sustainable urban production, which is harmoniously integrated into the urban context. The only criteria for keeping production in town should be sustainability and the coexistence of workers, consumers and researchers.

The classification trap

Many interviewees questioned the ability to find terminology or a definition that linked to statistical data echoing management consultants 'if you can't measure it, you can manage it'. Many respondents referred to the European nomenclature system, the NACE codes.

Regularly, interviewees stressed a lack of trust of the nomenclature system[66]. For example a large assembly factory in Brussels that clearly falls into material production is classified as a service according to the NACE codes. The opposite also occurs: Coca Cola is identified as a food and beverage producer however only has a warehouse in the region. Businesses were also reported to register under service codes for market-related strategies[67] - for example three major industries as SABCA, Audi, Viangro are registered in wholesale trade. In France, the change in nomenclature meant that there was a sudden 20% decrease in employment related to the industrial sector.

Employment has also changed radically with technology and automation even though businesses are still producing similar products; SABCA employs a large number of engineers in research and development that spend much of their time behind desks operating software than those on the factory floor. Finally, the NACE code system does not provide a clear indication of the complexity of modern workplaces where work is either outsourced or done by freelancers under contract. Classification has proven to be a hazard when proving regional statistics. Amynah Gangji (IBSA) showed that by adding associated services such as design, circular economy and construction, the total value added arrives at 12.6%, rather than the 2.9% for the 'manufacturing sector' alone.

There are a range of alternative approaches. Perspective, uses SITEX, which focuses on buildings and serves as base for planning documents (i.e. regional land use plan - PRAS). Citydev's (Inventimmo) classification takes into account the building type, studying the occupants and linking the information on company activities with their building but only registering sites over 1000 m^2. A final solution is the Labour Force Survey, that focuses more on the work and workers rather than the businesses used in NACE.

2. SHARING AN ECONOMIC VISION

According to most local organisations and key actors, one of the most critical issues regarding urban manufacturing is the lack of a territorial level economic vision for the Brussels Region and certainly no vision for the larger metropolitan area that includes Flanders and Wallonia. With different political parties representing different agencies and portfolios, rarely is investment made without conflict or cherently integrated into established plans or strategies. Without an economic vision, it is very difficult to create joined up economic development, linked with local business, local researchers, local residents and the local market. As a result, Brussels is famed for a large number of small initiatives and projects, many however struggle to become mainstreamed or survive in the long-term.

Manufacturing - a critical economic issue

The first question is to ask why things should be made locally? Today, Brussel's economy is organised in sectors (housing, retail, office space and so forth). The economy isn't seen as an integral part of urban planning (such as Perspective, the BMA and Bruxelles Environnement) or development (Citydev, SAU, the Port), as those dealing with urban development generally don't have this expertise[68]. Various interviewees noted the importance of keeping a variety of productive activities in the city to guarantee a healthy economic base. Ideally this would support a range of opportunities including: low and high skilled jobs, local innovation and particularly the capacity to locally produce goods for the regional market (known as the 'short-circuit economy').

Furthermore, one respondent noted the actual challenge for Brussel's economy is to bring back value locally[69] in terms of monetary and physical value. Currently most of the value generated due to business development or university research leaves the region or goes abroad which does not support local communities.

Despite the high local unemployment, one reason for exporting production is the expensive labour rates - those businesses that remain are pushed towards automation.

Finally even if local manufacturing were to grow, one respondent noted that while some 15% of industrial land remains vacant, only 5% of available industrial land is currently on the market[70]. Furthermore, the available land on the market involves large and complex sites that are outside of the scope of many smaller businesses. Spaces between are being developed, particularly by Citydev 100-1000m^2, yet it takes some 4-5 years between writing a brief and for the building to be completed.

Numerous respondents noted the challenge to build a shared vision and strategy for the economic future of Brussels, which includes manufacturing. However involve different regional actors and disciplines[71] and without a strategic vision it makes it very hard to coordinate research, communication and strategic investment[72]. Business as usual projected by the authors of the Industrial Plan[18] will highly likely result in a gradual decline of manufacturing activity due either to alternative development pressure or lack of regional support.

An economy of proximity?

Throughout the interviews there was a regular discussion on local jobs provided through manufacturing that were essentially divided into two fundamentally different concepts for the future regional employment. One accepts or supports the disappearance of low-skilled jobs for a shift towards a specialisation in the digital economy. The other stresses the importance of sectoral diversity, to encourage urban economic growth supported by interaction between sectors.

Projections for for job growth in the Region of Brussels is oriented more towards services, while Flanders and Wallonia foresee a modest growth in manu-

facturing jobs. One interviewee suggested that this trend towards digitalisation will not be beneficial for the Region as it will only increase the level of commuting as new work will be filled by higher-educated workers living outside of the city.

Manufacturing is far from local, at least in terms of the larger companies. Around 10% of Audi's employees are local to Brussels while another large employer, SABCA, also imports a lot of its high-skilled labour. Local tap manufacturer, RVB, conferred that their policy not to support company cars meant that they have lost several suitable skilled workers, forcing them to reduce dependence on labour through automation.

Furthermore, discussions regarding the link between manufacturers and local research organisations and universities has been hard to define. It was very unclear how much local manufacturers were themselves involved in research and developed within Brussels and which organisations supported them.

This very issue could be seen as an opportunity in itself and proves that there is a serious lack of formal joined up policy between manufacturers, training and research and development.

3. FINDING THE RIGHT MIX

The current strategy to reintroduce industry and manufacturing in the Region of Brussels clashes on the one hand with the demographic boom resulting in a growing demand in the housing market, and on the other hand with the large presence of (empty) office spaces. Brussel's planning tools that should encourage mixed developments are not connected to clear typologies or spatial models, nor to a clear idea of the kind of productive activities that are compatible with the urban realm.

Housing and offices vs productive spaces

The massive development of office spaces until the end of the 1990's transformed a number of industrial sites and mixed working neighbourhoods. The Region's average office vacancy rate is now 8%, 6% in the city center and up to 12% in other neighbourhoods. For the Flemish region bordering Brussels in the north (Zaventem), vacancy is upward of 30%.

Now the trend is for housing - but is it really necessary? Various interviewees considered that the housing market will soon be saturated with high-end apartments in the wrong end of town. Today the actual demand is for affordable housing and social housing, while a large number of projects under construction foresee luxury or middle-class units. One such example is the recently completed Up-site Tower, the city's tallest residential tower, located on the fringe of a poor neighbourhood and the working harbour precinct (the Vergrote Dock) - while the building remains heavily vacant, it has consequently put significant pressure on Heidelberg Cement located diagonally adjacent the tower to invest in a new facility to minimise noise and dust.

As noted earlier, there is an initiative based along the canal zone that involves a dialogue and research by design platform for developers in the catchment of the canal, allowing developers to build housing above industrial space. This rather informal approach may be the most effective way in reaching suitable design solutions to fit the city's remaining industrial land. However this initiative is not lead by an economic vision and there is no clear plan of the kinds of business that would occupy future available space.

Compatibility

A number of regional policies, such as the Region's Circular Economy Plan and the low emissions zone are pushing businesses to be greener, more local, and more compatible with urban environment. This includes urban farming, recycling and lower impact logistics.

The city's productive base is shifting. Certain businesses are leaving the city (due to issues cited in section 2.1) other city oriented activities are finding their way into the city. A process of "triage" (filtering out)

is occurring, with new activities contributing to the quality of life in the city. The most obvious are numerous craft breweries (Brasserie de la Senne and Brussels Beer Project), while others cited earlier include Ahooga that produce folding bikes[73]. However replacement is not happening one for one and new manufacturers need to adapt to a lower pool of available real-estate alongside other detractions of setting up shop within a dense and expensive urban area.

Citydev develops much of the Region's new industrial spaces and follows two selection criteria: firstly the quantity of jobs provided by newcomers (bias towards higher numbers of jobs) and secondly the possible nuisances produced (noise, dust and logistics). The range can be quite diverse - from suppliers of spare parts, to brewers, mechanics and high-tech SMEs (such as an optics company). However respondents from other public agencies provided criticism. Firstly some businesses are incapable of providing the job density expected, despite offering beneficial functions for the region. Secondly, there is no strategy to curate and combine compatible businesses that can be interdependent.

Irrespective of all the constraints, a range of businesses find Brussels to be the most attractive place to establish - be it for the proximity to the workforce, research institutions, a certain brand or simply because Brussels is the place the business calls home. The question should be reversed: what does the city offer manufacturers? How could new and established businesses make the city a better place?

4. LINKING SKILLS AND KNOWLEDGE

Another urgent, delicate and yet complex issue peculiar to the Region is the polarised and large presence of non or low skilled labour in central areas. The city boasts a population of 1.2 million and some 600,000 jobs. However there is an exceptionally high unemployment rate of 17% while the city is one of the highest income rates per capita in Europe. Such a problem is perverse when almost each manufacturer interviewed complained about the challenge to find suitably skilled workers. In contrast, there are a vast range of training organisations based in the regions, addressing a range of skill levels and in (more than) the two local languages - see Box 1. The challenge here is to link up supply of appropriately skilled workers with the demand for employment. This is not especially straight forward when industries change faster than the training sector can keep up with.

Unemployment and low skilled labour

The question of jobs is generally at the top of all of Brussels political agendas. The manufacturing sector dropped in Belgium from 16% in 2000 to 12% and in 2014, while in Brussels it dropped from 6% to 2.7% in the same period. Therefore the decrease in manufacturing jobs may have played a small but fairly subtle role in this unemployment quandary.

What kinds of business could have a positive social impact on local employment? Some respondents suggested the answer could lie in manufacturing, productive activities and training centres[74]. Is this a romantic idea or a possible new business?

Is the manufacturing sector a source of low-skilled work? Roughly 80% of the industrial sector consists of highly qualified workers (white collar) and 20% of low qualified workers (blue collar), reflecting contemporary services oriented and highly mechanised businesses. This shows that jobs within manufacturing are relatively small compared to the larger employment debt.

By contrast, it is reported that there remains a significant amount of lower skilled workers (including illegal migrants) supported through informal work. The second-hand car market in Cureghem is one such example. While researchers suggest thousands of such informal jobs, they simply do not show up on statistics.

On a positive note, there is a niche which may be exposing a place for low-skilled employment. A number of established businesses are showing how social enterprises may offer affordable services for repetitive tasks while providing stable work under good working conditions. Travie is one such operator, established in 1980 that employs some 450 handicapped workers. CF2D is a non-profit established 15 years ago, focused on recovering and repurposing technology, employing almost 20. Such businesses can provide important value for the region however also require support for suitably accessible locations, training and financing for support staff. The net result could be far lower levels of unemployment, lower mental health issues and community building.

Adapting to demand: training and education

Interviewees regularly noted a missmatch of training and skills and questioned the capacity of local training facilities. One interviewee specialised in employment cited that the local workforce can fill a large amount of the employment opportunities[75] - some job openings receive thousands of applicants with numerous relevant candidates.

Large employers have very specific needs and tend to do a lot of training in-house. SABCA seeks qualified profiles and they have established a bespoke training plan, working directly with Actiris. AUDI tends to do the same and have signed a convention with Actiris and have agreements with the Dutch and French speaking training centres (SYNTRA and SEFA).

As noted earlier, there is no shortage of skills and training providers. This could be seen as both a strength and weakness. Employers regularly criticise the local training facilities, not matching the correct skills for the job. Public agencies in suggested that it was challenging to link training and jobs, when the jobs and technology changed rapidly.

Education could start at an early age and possibly within the basic school system. One interviewee suggested that there is a strong lack of vocational and practical technology based learning which means that kids have little practical experience of making things themselves when they leave school[76].

Finally, low-skilled jobs will not disappear, however there may be greater levels of growth in supporting sectors. Logistics for example, with the implementation of the low emissions zone, is an area where a rise in lower energy modes could be foreseen to build on the 30,000 strong sector. Repair, recycling and waste management is another sector that could see growth.


AHOOGA
AHOOGA

Ahooga - folding bike company founded and based in Brussels.
© Adrian Hill

APPENDIX 1: BRUSSELS ACTORS

The Bouwmeester / Maitre Architect (BMA) is the region's City Architect, which is an independent office advising architectural matters concerning the regional urban development. The team of architects and urbanists are currently supporting work closely with a range of other regional actors such as Perspective, the SAU and Bruxelles Environnement. Thanks to its position independent of the regional authorities, the City Architect has a certain freedom in its function.

Brussels Enterprises Commerce and Industry (BECI, Chambre du commerce et de l'industrie) is an employers' federation that represent and provide support and professional training for Brussels' companies and independents. They are one of the main partners of Cities of Making Brussels, are very active in public debate and have a great interest in the matter.

The **Plan Canal** is a authoritative document that stresses the regional objectives, planning principles and priority strategic zones for further urban development in Brussels. It has been supervised by Alexandre Chemetoff and regional administrations and was delivered in 2014. The purpose of this document was not to have concrete and practical propositions but more to identify general and consensual principles. The Canal Plan is still today a reference for public and private actors involved in urban planning and manufacturing development.

Circular Economy Regional Program (PREC) is the regional development document that aims to transform environmental goals in economic and job opportunities. Numerous concrete projects are identified in order to apply a circular economy model to Brussels. The Circular Economy Regional Program has been approved by Brussels' government in 2016.

CityDev is the region's public developer, managing real estate development of economic, housing and mix projects. It is a key player in the recent history of the establishment of productives activities, notably in charges of several economical and scientific zonings. Citydev is also a famous actor of urban renewal, producing middle class housing in order to keep them in the regional area. The regional authorities allocates significant financial means to this operational institution with which they manage a considerable area in the region (196 ha in 2016[97]). Citydev has been an important proponent of social and functional mix in the innercity neighbourhoods. They are proponents of a certain amount of classic industrial areas, in order to retain "heavier" manufacturing activities that are not always compatible with housing[98].

Company in Urban Area Zone (ZEMU) is a type of mixed zone created in 2013 and integrated in the Land Use Regional Plan. This zone allows productive activities (with a limitation of 2000 m2 per project), commercial functions, public infrastructures and housing on the concerned areas. In the last years, the Company in Urban Area Zone have replaced significant areas of industrial and monofunctional zones. Therefore the real estate development have put a considerable pressure on manufacturing activities that are moving out of the city.

Goods Transport Plan is a regional plan developed by the Brussels Mobility administration. It aims to ensure supply, improve its efficiency and its integration to logistic coordination while reducing its nuisances. Adopted by the regional government in 2013, its implementation is in progress.

Cabinet Gosuin is the administration of the current regional minister Didier Gosuin of Economy and Employment. He's also responsible for Health Policy, Civil Service, Finance, Budget, Heritage and External Relations at the Joint Committee of the Common Community Commission (COCOM) and in charge of Vocational training for College of the French Community Commission (COCOF). Hence, this administration has a certain power concerning Brussels' economic policies. In 2017, Didier Gosuin announced that he would deliver in 2018 an Industrial Plan for the capital

Impulse (now called Hub.brussels) is the Brussels agency for companies with an important role in providing supporting services and project development. From 1 January 2018 Impulse has merged with Atrium and Brussels Invest and Export which are organizations that provide support to business, forming an accompaniment and supporting pole. That has been made in the frame of the government effort in rationalizing its institutions, forming three main poles: (i) Impulse (ABE-BAO): the Brussels agency for the accompaniment of the company; (ii) Finance Brussels - the financial center - with Innoviris ; (iii) CityDev and SAU, which are the urban development pole. The

approach at Impulse is sectoral because the work is subdivided according to specific priorities (IT, Lifetech, Green - in the Regional Innovation Program). Its economic coordination cell supports company - especially those with a particular number of employees who have a certain weight on the Region - helping directly with their business, permits, conflicts and so forth while connecting with political actors.

The Industrial Plan is an industrial development program that have been announced by Didier Gosuin in 2017 due to a request from the trade union FGTB. Hence, this program didn't represent a specific ambition from the regional minister of Economy. At first, its administration had only but the general goal of promoting manufacturing, high-tech production and creative activities. Then the research center Environmental management and Land Use Planning Institute (IGEAT) of the Brussels' Free University (ULB) received the mandate to develop his program to deliver the Industrial Plan in June 2018.

Innoviris is the regional institute that promotes scientific research and innovation for companies but also non-profit organisations or research centers. They develop and want to develop industrial technology in Brussels, directly linked to spatial planning. For instance their Doctiris program supports PhD projects on industrial issues, making a bridge between university and companies or administrations. Recently, Innoviris has taken a broader set of topics and emphasize the research on social innovation, civil society's projects and start-ups development, in addition to industrial technology research[99].

Inventimmo is a branch of CityDev that specializes in professional real estate in the Brussels Region building an updated on-line inventory of existing offers - office buildings, commercial areas, warehouses, workshops, and land. It originated from the idea to keep productive spaces in Brussels, and the goal was to keep and enhance mix in the city, through a door-to-door survey contacting directly the owners. Today, 99% of these workshops have changed function. The interest in urban mix has recently came back into interest, but prices prevent this diversity to return. A limit of Inventimmo's survey is that it does not consider spaces below 1000 m2, due to their lack of means: however, the entire number of spaces below 500 m2 corresponds to a minor % on the total overall productive surface in Brussels.

Regional Plan Land Use (PRAS) is the reglementary document that stresses the rules in terms of land use in the Brussels' region. It's one of the most important plan in urban planning policies. The Land Use regional Plan has been modified several times and have always been the object of controversy. For instance the last versions of the Land Use Regional Plan have transformed several monofunctional Urban Industry Zone in Company in mixed Urban Area Zone, allowing housing development in these economical areas.

Contrats de quartiers durables (Sustainable Neighbourhood Development Contracts) are urban renewal programs assigned to neighborhood areas for a limited time. The finance of these programs usually comes from regional and, to a lesser extent, municipality. Middle class housing, public and green spaces, social cohesion and public infrastructures are the priorities here. Through these amenities regional authorities aim an increase of the quality of life for everyone in these neighborhoods. However, academics and civil society have criticised their involvement in gentrification processes.

Perspective is a regional territorial research and planning organisation that works between public and private interests. Perspective are very concious of the future of (urban) manufacturing. The Plan Canal (300ha of public property along the canal with a huge potential in terms of housing, economy, mobility) was the first step to understand how to imagine the future of productive activities and the first clear claim by the Region to set up and maintain industry and manufacturing in the city. More recently, Perspective is working on how to maintain industry in the city on a small scale, negotiating directly with companies to plan their possible integration in the urban fabric. That can bring many advantages guaranteeing their longer stay thanks to contract of 10-15 years with the Port Authority.

The Port of Brussels is the public port opperator, managing 105 hectares of harbour land along the canal. The Port of Brussels have defended for years the place of goods transport and logistic activities in the city. They recently produced a Masterplan 2030 that stresses developments to come according to the strategy of regional authorities.

Sustainable Development Regional Plan (PRDD) is a strategic document describing the regional authorities' decisions and orientations for further urban development in Brussels. Its purpose is to be implemented in reglementary plans such as the Land Use Regional Plan. This plan has 4 main axes : (i) urban planning and housing, (ii) environment, (iii) economy and (iv) mobility. Strategic zones are identified and will receive specific attention through particular urban development plans.

Urban Economy Stimulation Zone (ZEUS) is a project or zone that would frame a financial incentive policy towards companies in order to promote the employment of local labor. Even if the idea has been framed and approved by the regional Parliament, its implementation and relative adjustments have never been made. In 2017, Didier Gosuin conceived this strategy and declared it will be in the future Industrial Plan.

Urban Development Society (SAU) is a public developer of larger sites of public interest. Their goal is to specifically develop strategic zones identified by the regional authority and according to its urban planning policies. To that end they frequently work with Perspective and the BMA, following the Canal Plan.

Urban Industry Zone (ZIU) is a type of land use zone assigned to productive and logistic activities. Several areas of this type have been transformed in mixed zones during the last years in Brussels.

APPENDIX 2: MAPPING DATA

Separate Industry Maps
Each dot represents an individual business registered with the NACE code related to the described industry
Source: ORBIS database [web]

Manufacturing Maps Urban Regions
The maps give an overview over industrial land use in each urban region.
Sources map Brussels: Urban Atlas – Copernicus Land Monitoring Service accessed April 2018. [web]
All locations of registered business in the metropolitan area from ORBIS database NACE sector C Manufacturing. [web]

APPENDIX 3:
SUMMARY OF INTERVIEWS

Name	Organisation	Date
Kristiaan Borret Julie Collet	BMA	19/06/2017
Jeremy Levin	Innoviris	21/06/2017
Elsa Colsado Ralph Boswel	Perspective	27/06/2017
Amynah Gangji	Perspective (IBSA)	28/06/2017
Jan Ackenhausen	Perspective	28/06/2017
Sven De Bruycker	Perspective	28/06/2017
Philippe Lefrancq	Ahooga	24/08/2017
Patrick Van Den Abeele	Bruxelles Environnement	24/08/2017
Alain Doornaert	Citydev (Inventimo)	31/09/2017
Patricia Foscolo	Impulse (now Hub.brussels)	3/10/2017
Frédéric Reynaud	Perspective	4/10/2017
Walter Tempst Jan Zaman Koen Vermoesen Tinne Verheyen	OVAM Departement Omgeving VLAIO VLAIO	4/10/2017
Claire Scohier	Inter-Environnement Bruxelles	8/10/2017
Laurent Schiltz Hugues Kampeneers	Confederation de la Construction	14/10/2017
Alain Gillieaux	RVB	18/10/2017
Caroline Philippe Isabel Zerard	Bruxelles Economie et Emploi	9/11/2017
Valerie Tanghe	Port de Bruxelles	28/11/2017
Mariane Thys Charlotte De Broex	Bruxelles Mobilité	4/12/2017
Olivier Menalda Claire Heughebaert	SAU	4/12/2017
Arianne Wautelet	Innoviris	5/12/2017
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Emmanuelle Pottier	Actiris	6/12/2017
Rene Konings	Agoria	8/1/2017

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London,
UK
3

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Photo, previous page: Brompton bike factory

«Places for making in a megacity.»

London is a highly successful global city. It is the seat of national government and a core part of the UK economy. In 2014, it accounted for more than one fifth of the UK's total GVA output[1]. On a comparable basis, the city's economy is larger than that of many European countries, including Belgium, Sweden and Norway[2]. The region governed by the Greater London Authority (GLA)3 covers 1579km².

London has a large population of almost nine million[4], much higher than other UK cities, and this is set to grow to around 10 million in the next decade as migrants are attracted from across the UK and further afield. This is a diverse population, the most diverse in the UK, with a wealth of culture and communities[5]. It is a well-educated population too, with the city topping European tables for levels of tertiary education attainment amongst its residents[6].

Today the city faces the challenge of adapting to continued population growth and accommodating both people and industries. It must also address significant inequality amongst its citizens. Despite its economic success, these fruits are not evenly distributed: a Londoner in the top 10 percent has 295 times the wealth of a Londoner in the bottom 10 percent, and 27 percent of the city's residents live in poverty (after deducting housing costs)[7]. If its citizens of tomorrow are to live happy and healthy lives then London must also improve its relationship with the environment, from tackling its serious air pollution breaches[8] to dealing with its waste.

Manufacturing has played a role in the city's economy and society throughout history. Like other UK cities London underwent deindustrialisation in the late twentieth century, but unlike many others it thrived in this new environment and has established itself as a leading global financial services centre. The story of manufacturing in London is far from over, however, and new technologies look set to shape a new chapter.

Along with the rest of the UK, the city is gearing up to exit the European Union in 2019. The implications of this transition are not yet clear but will have significance for the capital's manufacturers.

3.1 London's manufacturing: a brief history

With a heritage of trade, culture and productivity London has played an important role in UK industry for centuries. Whilst manufacturing in the city has changed, it remains part of London's economic foundations. This chapter explores these changes over time.

CENTRE OF MAKING

The Industrial Revolution began in Britain in the late 1700s and heralded dramatic changes in manufacturing. During the first half of the 19th century British-made goods dominated world trade. For a time the country was the world's largest manufacturer - dubbed 'the workshop of the world'9.

London was a leading centre of UK manufacturing from the late 18th to mid-20th century. In 1861 around one sixth of the country's manufacturing workers were employed in the capital[10]. Some large British cities were known primarily for one industry, like Manchester's textile production. London, however, was home to a diverse set of industries including garment, furniture, and jewellery making. These businesses were situated towards the end of the production chain and their location was driven by proximity to large markets or a large and skilled workforce[11]. London, during this period, offered them both.

London's port was an important part of the country's trading infrastructure. By the late 1700s more than half of England's imports and exports came through the city's docks[12]. The situation of manufacturing and industry influenced London's geography and its neighbourhoods. Today this heritage is visible in city street names like Cable Street, a 'rope walk' where businesses supplied cables for ships.

POST-WAR POLICIES AND DEINDUSTRIALISATION

In the period following the Second World War, a series of policy interventions attempted to constrain the growth of industry in core cities like London and to encourage growth in other regions of the country. This approach was taken in response to high regional unemployment, and an attempt to 'take the work to the workers'. For a period London's manufacturing sector grew at half the national rate and its overall employment levels grew at a lower rate than any other region bar one[13].

With the onset of deindustrialisation the ensuing decades signalled a period of transition for the UK's manufacturing

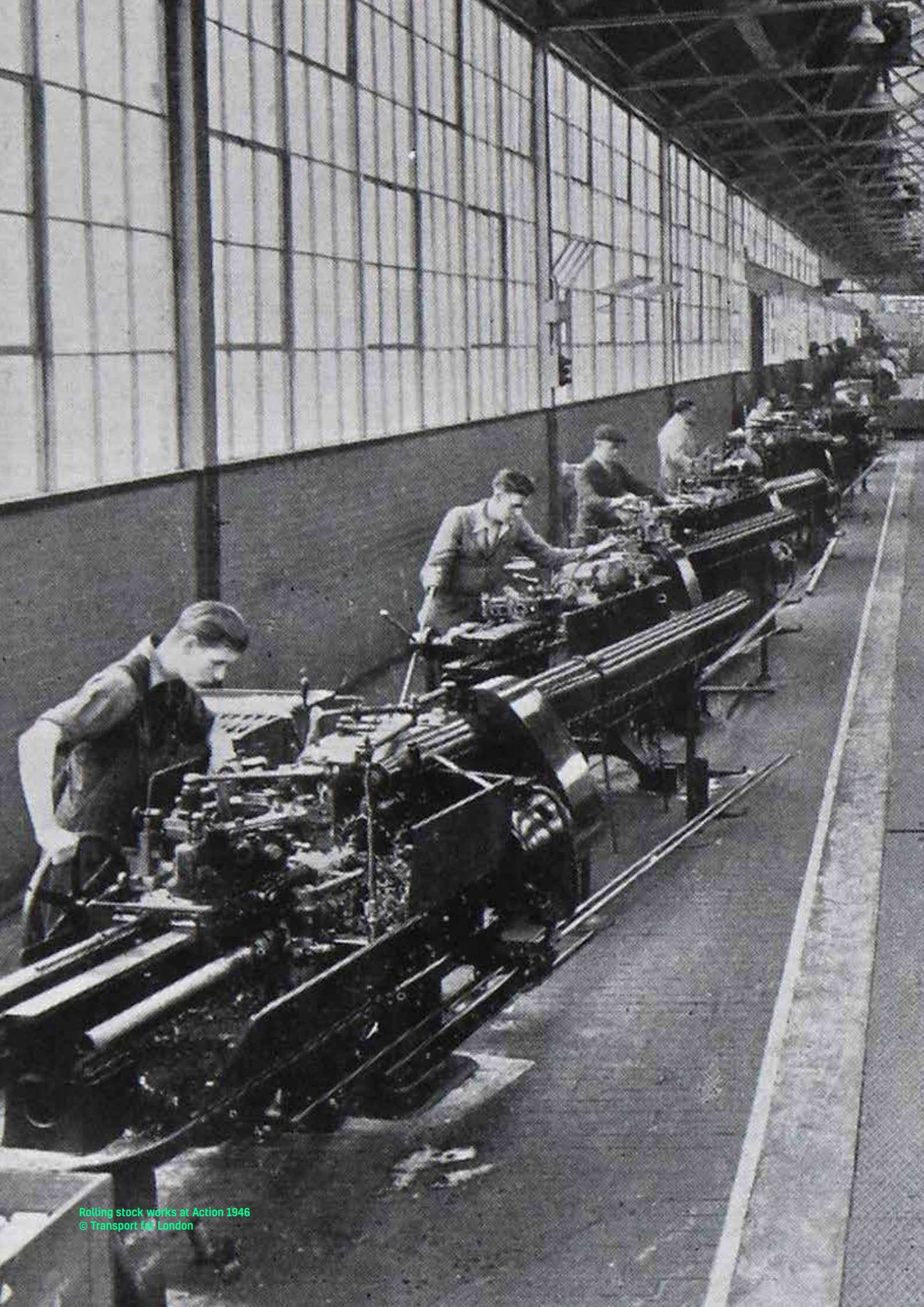
Garment Factory
© Jim Linwood

base[14]. During this period manufacturing began to take advantage of an increasingly globalised world and move overseas in search of lower production costs. Although the sector remained important for the economy (in 1970, manufacturing still accounted for 27 percent of the UK's economic output[15]) during the 1960s and 70s it began to see a relative decline in its share of output and employment[16]. These factors contributed to the decline of manufacturing activity within London.

Between 1971 and 1996 London shed around 600,000 manufacturing jobs[17]. The city's population was also declining, a trend which began during the war[18]. By the 1970s and 80s concerns about inner city decline led to policy strategies to preserve and improve what was left of the city's manufacturing base in order to retain employment opportunities. An Industrial Strategy developed by the Greater London Council (GLC), the city's governing body at the time, was developed in response to these challenges. It identified a range of key sectors and developed actions for each, including interventionist-style policies to boost industry. Its implementation was curtailed when the GLC was abolished in 1986[19].

URBAN REGENERATION

The1990s saw London and its centre become a desirable place to live once again. Its population began to grow and, with this, housing provision became the dominant focus[20]. This led to the release of vacant employment sites in favour of residential development and it became increasingly difficult to protect industrial space. Industry, including manufacturing, continued to decline, particularly in the centre.



Rolling stock works at Action 1946

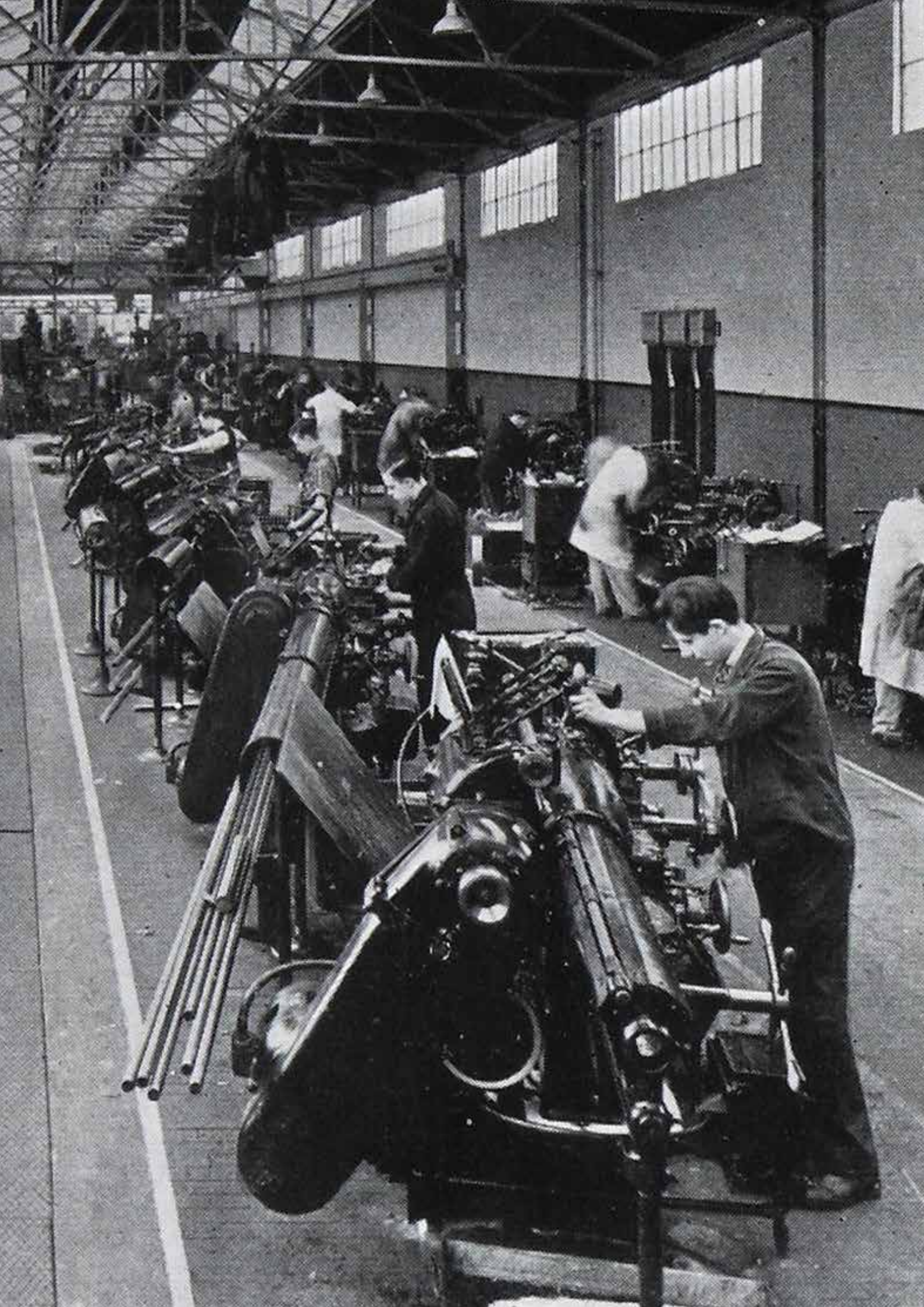
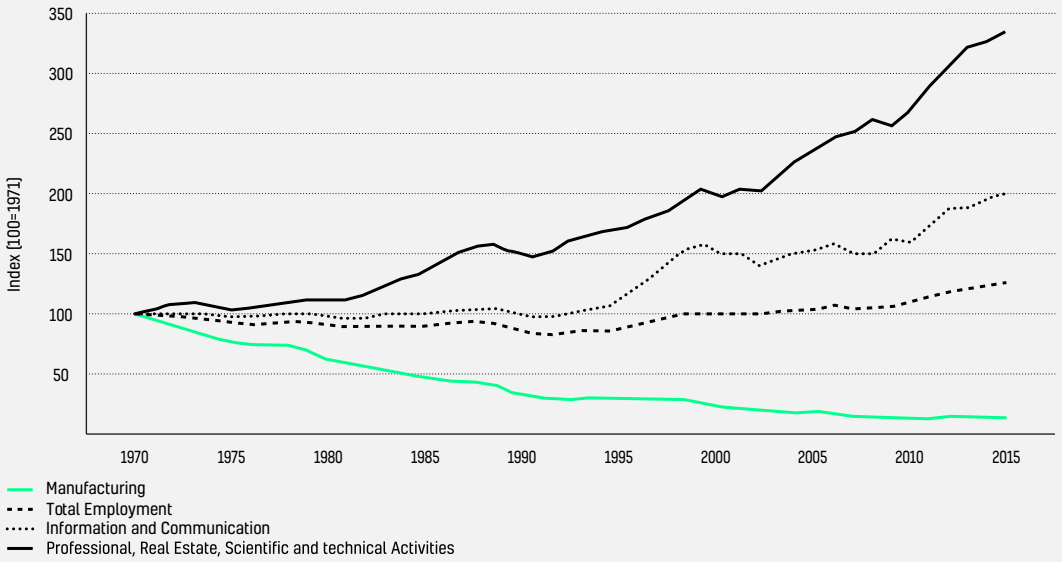


Figure 1: Changes in employment in London since 1971



Source: ONS Workforce Jobs (2017), GLA estimations and RSA calculations

Over this period knowledge sectors, including professional services, more than doubled their employment footprint (see Figure 1). This shift to 'higher-skilled, higher productivity employment'[21] has enabled London to thrive as a post-industrial city.

MANUFACTURING IN LONDON TODAY

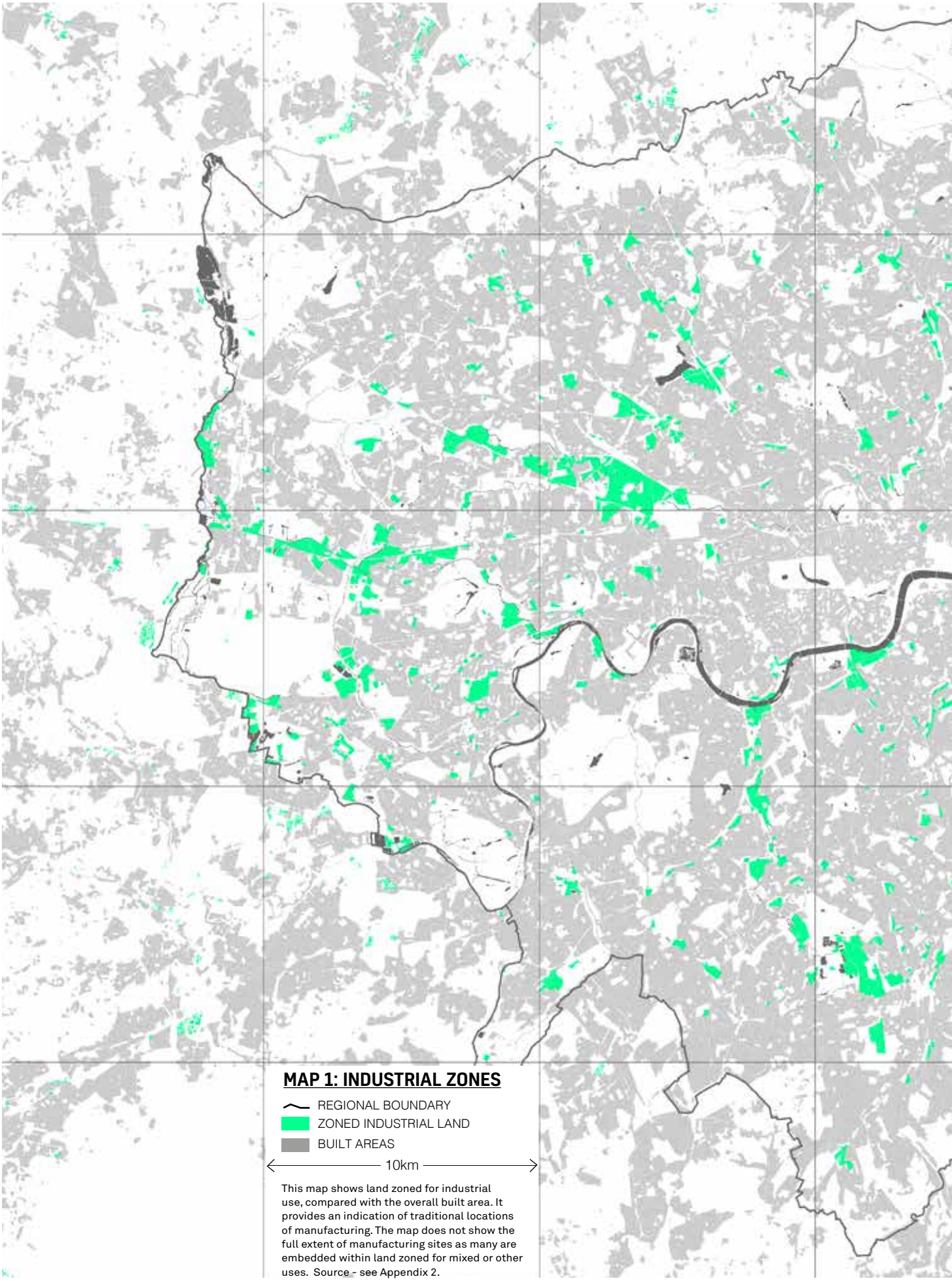
London's manufacturing base has declined significantly over the last 50 years. Its role has shifted as both the city and the country as a whole have developed post-industrial economies. However, while the city is clearly no longer geared towards manufacturing, it is still an important component of London's vast and diverse economy. London should not be written off too quickly as a city that makes.

In London today the manufacturing sector accounts for 2.2 percent of total employment[22] and a similar share of GVA[23]. Whilst this is a small proportion, the city still plays an important role in the nation's manufacturing sector: more people are employed in manufacturing in London (114,000) than in other UK city regions such as Greater Manchester (108,000) and West Yorkshire (99,000); places more often perceived as manufacturing strongholds. Its output is significant too; at £8.5bn, London's total GVA from manufacturing is close to that of the sector across all of Wales[24]. Looking at output per hour as a measure of productivity, London is in line with the UK average for the sector[25]. Whilst the city's manufacturing employment figures have reduced over time, these seem to have reached a plateau since the end of the financial crisis (see Figure 1).

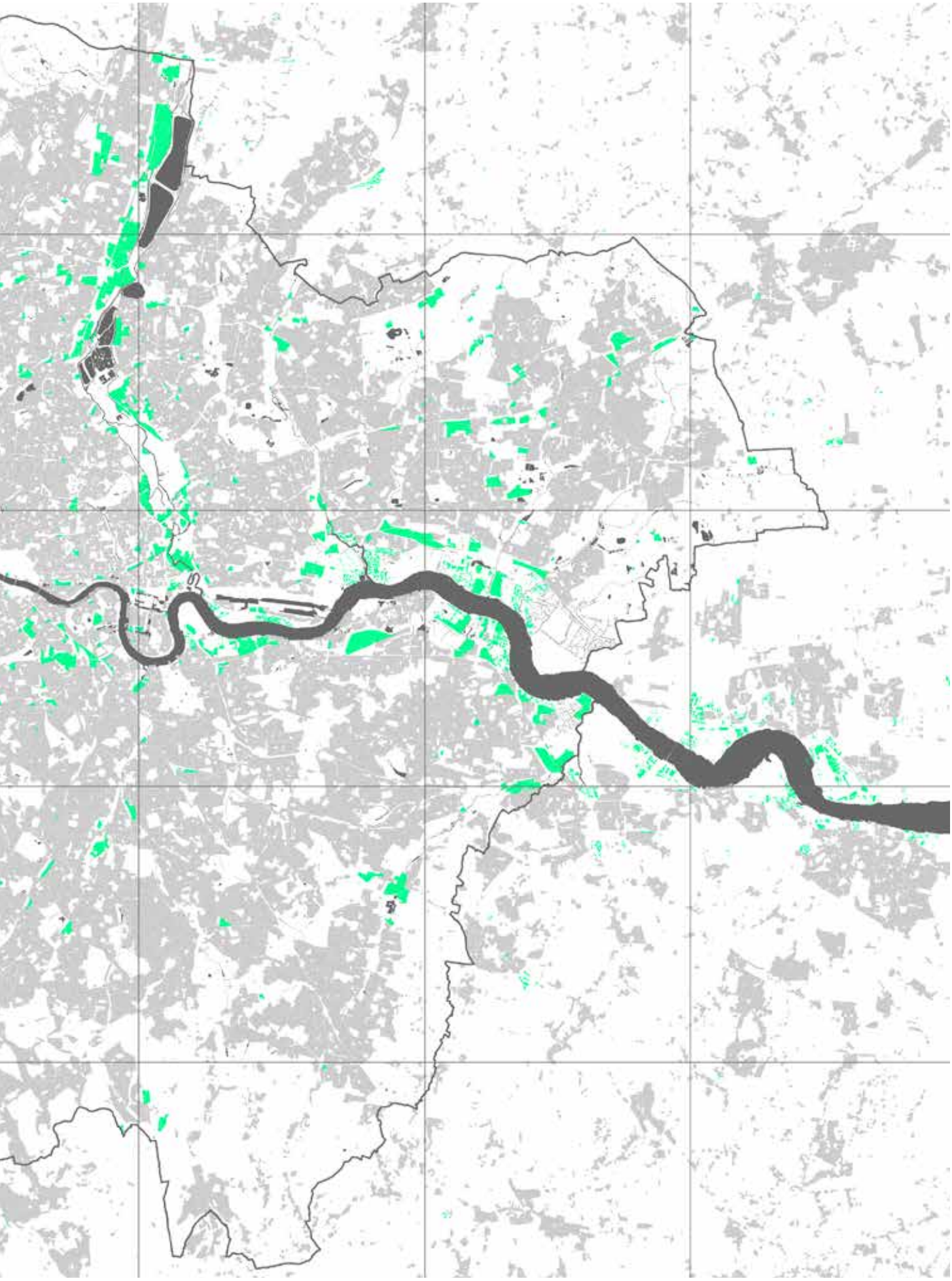
As the sector has developed over time, its needs have also changed. A study of Park Royal (London's largest industrial site) describes a trend that has seen some of the larger businesses on the site relocate or close, to be replaced by smaller businesses today[26]. Trends like this one, along with the enormous growth of the services sector relative to manufacturing, make the picture in London more complicated than one of simple decline. It would be a mistake to think that London's manufacturing sector is destined to shrink further or that it is not relevant for the city simply because it makes up a small part of its economy.

The rest of this chapter will explore London's manufacturing activities in more detail.

Sugru is made in London
/ © Sugru



This map shows land zoned for industrial use, compared with the overall built area. It provides an indication of traditional locations of manufacturing. The map does not show the full extent of manufacturing sites as many are embedded within land zoned for mixed or other uses. Source - see Appendix 2.



3.2 Manufacturing sectors and trends

London is home to diverse manufacturing activities, from baking to bike making. These productive business are found across the city, providing employment and supporting the city's other activities.

MADE IN LONDON

As has been the case historically, manufacturing in London is comprised of many different activities, the majority of which are situated towards the end of the production chain (see Figure 2). Many provide just-in-time products and services that support London's wider population of residents and businesses.

In terms of employment, food manufacturing is the largest sector. Its 24,000 workers account for more than 20 percent of London's manufacturing workforce. Employment is also concentrated in the following industry divisions: manufacture of fabricated metal products, printing and reproduction of recorded material and manufacture of wearing apparel. These four industries collectively make up almost half of all manufacturing that takes place in London[27].

Repair and installation of machinery is also a major employer with 12,500 workers[28]. This industry provides services that support the wider functioning of the sector. It includes activities relating to the maintenance of machinery used in industrial processes, such as bread making or welding, but also commercial equipment used in other sectors[29].

London's car making heritage should not be forgotten; GVA output highlights that transport equipment is still a significant part of London's manufacturing economy, contributing more than £1bn[30]. Ford's engine factory in Dagenham is the largest single manufacturing site in London, with over 1,800 employees[31]. Transport equipment figures also include the value added by Brompton Bicycles Ltd. A great success story of London's contemporary manufacturing scene, Brompton make foldable commuter bicycles, over 45,000 units a year. They recently expanded, moving across London to a new site in Greenford, Ealing and now employee over 300 workers[32].

Other industries where there is noteworthy activity include the manufacture of rubber and plastic products, furniture, and computers, electronic and optical products. Roli, for example, a music technology

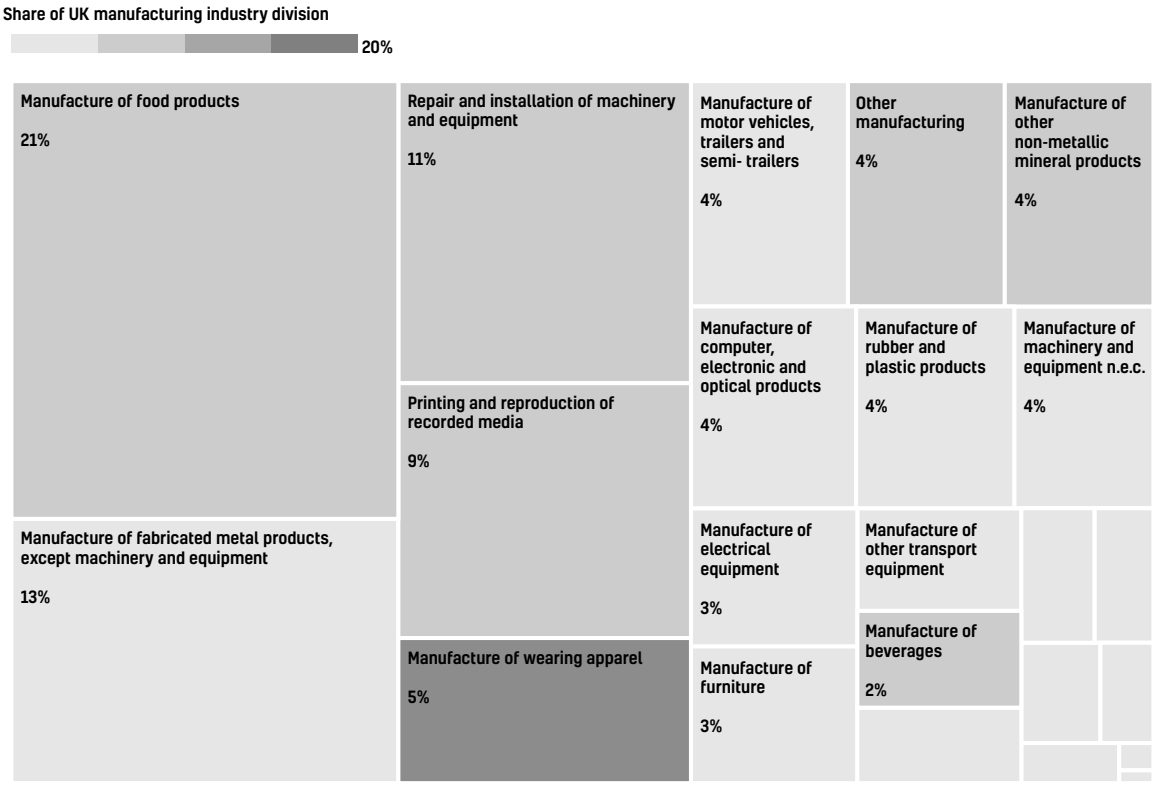
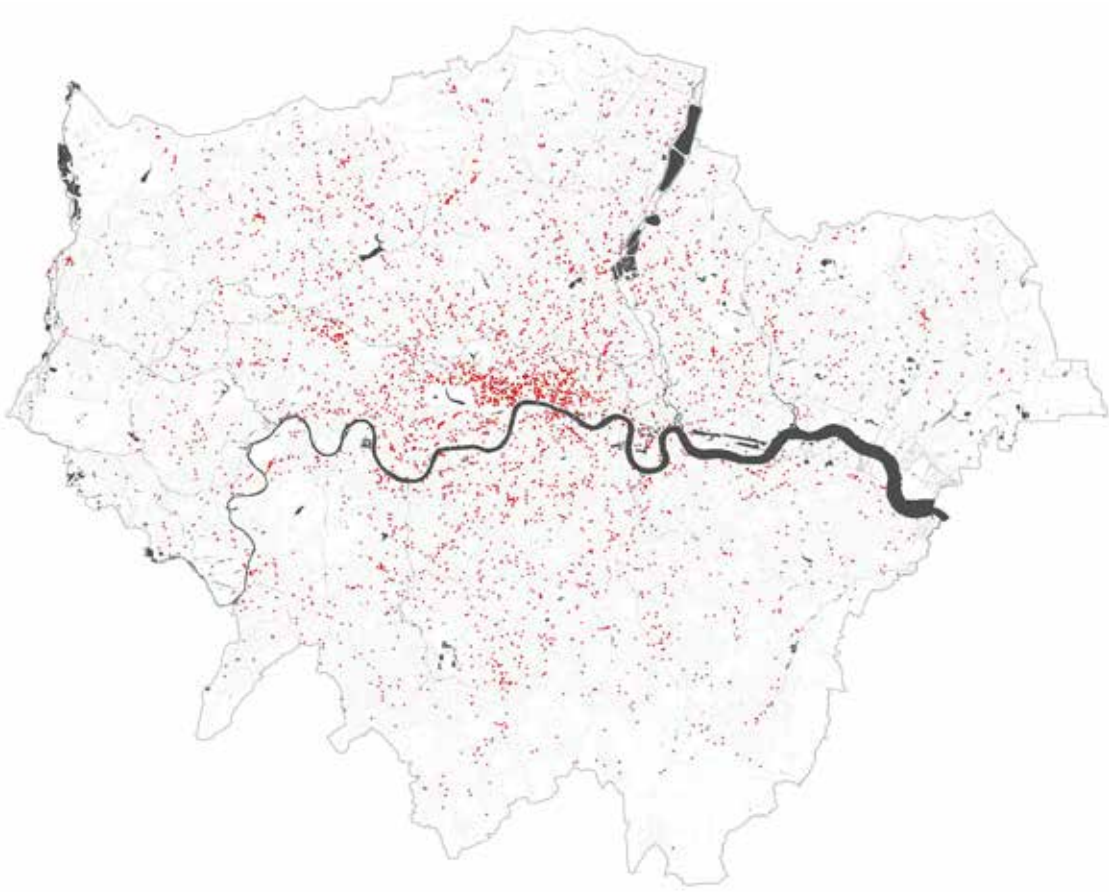


Figure 2: Employment in London's manufacturing economy by industry division

Source: RSA analysis of Business Register and Employment Survey (2016)

start-up, assemble high-tech music instruments in a railway arch in East London[33].

Manufacturing has evolved over the centuries in London. Much of it has gone from the city, either because it is no longer considered compatible for environmental reasons (consider the chemical works which once existed in East London[34]) or because it became more cost effective to produce elsewhere (as was the case for Vauxhall cars, whose early life started in South London). So why have the remaining businesses stayed in London? A closer look shows that these businesses, many of which are small and light industrial operations, are plugged into the city. The manufacturing that has remained is that which either fulfils the needs of the city's residents and businesses, that which derives value from being situated in London's unique business climate (whether their products are consumed by locals or exported), or that which benefits from being close to its niche, and diverse, consumer markets (see Box 5).



Map 2: Business locations - Food and drink products.

Source: see Appendix 2

MAIN SECTORS

Food products

Food and drink manufacturing collectively contributes over £2bn to London's economy[35]. This includes the labour of the 2,000 workers involved in the manufacture of alcoholic and soft drink beverages. Map 2 shows locations of businesses in this sub-sector.

More than 15,000 workers are involved in the production of bread, biscuits, ready meals and other just-in-time foods such as sandwiches[36]. Greencore Group plc[37] is one example of this type of manufacturer. Greencore is a leading international manufacturer of convenience foods, with multiple sites across the city. While you are unlikely to see their branding on products, they make many of the sandwiches, sushi and prepared salads found at major supermarkets and high street chains. Another more familiar example might be the bread and baked goods manufacturer Warburtons, who have a base in Enfield[38]. Both these businesses work around the clock to provide the city with the foodstuffs its residents consume daily.

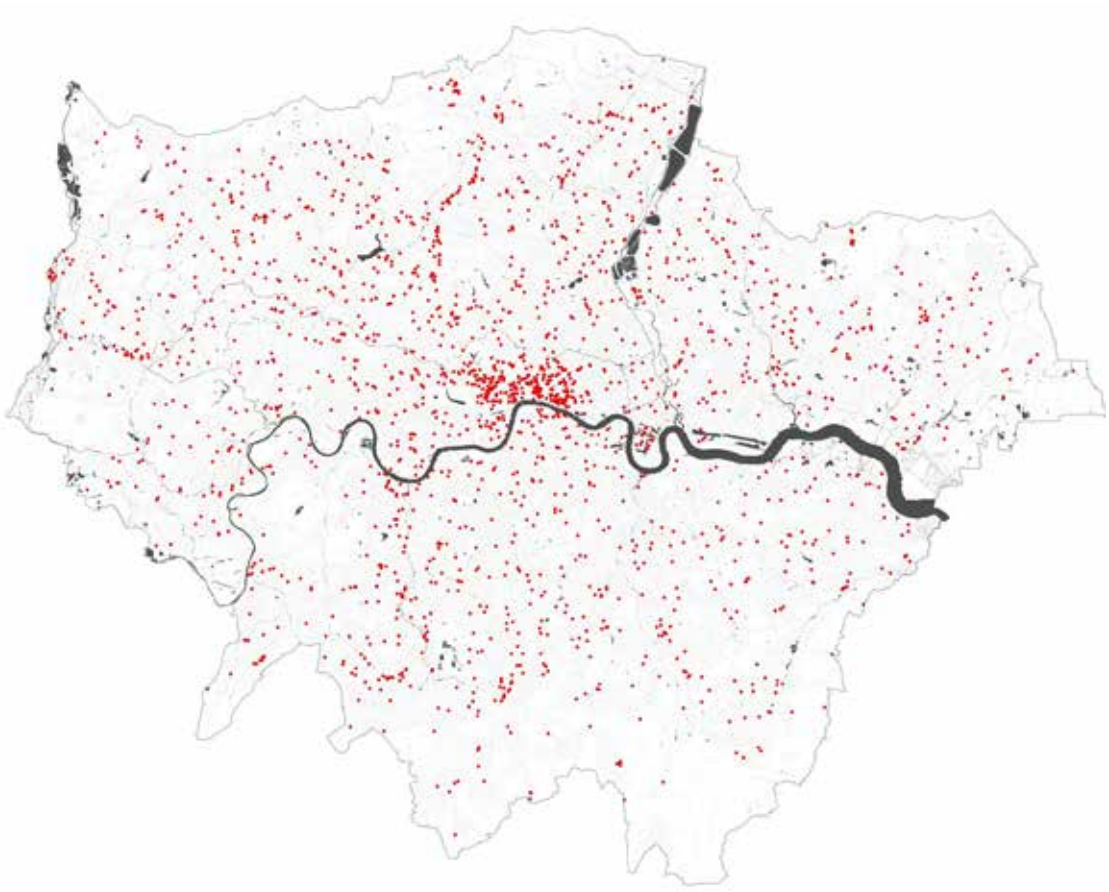
London also has a noteworthy contingent of artisan food producers, for example: La Latteria produce a range of handmade fresh British cow's milk mozzarella in a North Acton warehouse[39]; while Bermondsey Street Bees make award winning honey with a little help from hives on a South East London rooftop[40]; and Secret Smokehouse cure salmon and kippers just off London Fields[41].

In order to service their market, these food manufacturers need to be close to their consumers, and demand for their products is likely to increase from both population growth and consumer trends. If predictions are right, the UK 'food-to-go' market is set to increase by over 8 percent between 2017 and 2022[42], and a greater interest in high-quality food from small producers is already seeing SME food producer profits grow[43].

Tate & Lyle factory © Les Chatfield

Fabricated metal products

While Sheffield may be more famous for its steel production, London has its share of metal workers, often providing highly specialised products and services. This industrial sector



Map 3: Business locations - Fabricated metal products.

Source: see Appendix 2

Metal worker ©Brompton Bicycle Ltd.

includes the manufacture of locks and hinges, tools, cutlery and other metal products with a variety of household and commercial uses[44]. Map 3 shows locations of businesses in this sub-sector. Kaymet is a manufacturer of luxury trays, trolleys and electric table hotplates. Based in Peckham, this small manufacturer has been making anodised aluminium ware since 1947. Today they have 7 employees. Their products are stocked worldwide, including in London's most famous department store, Harrods[45].

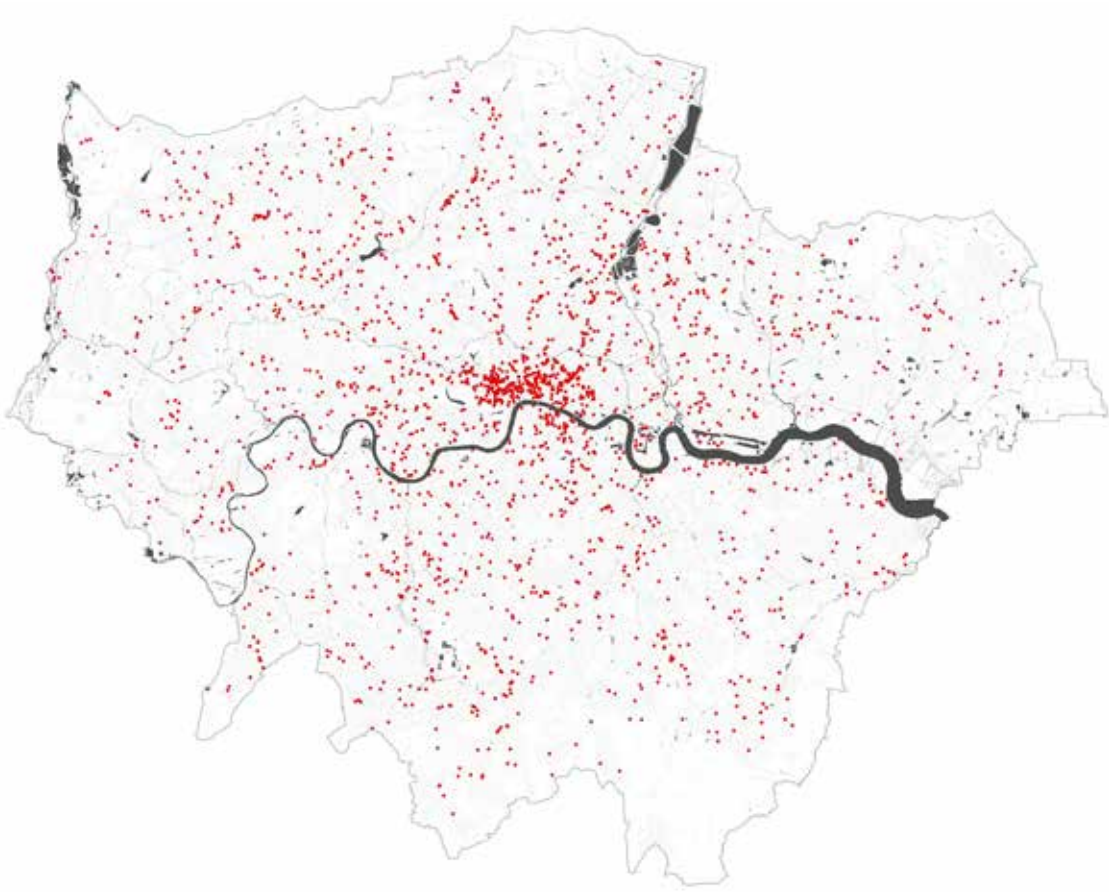
An estimated 5,000 of these metal workers are employed in machining, which involves industrial processes such as milling, polishing and welding[46]. Today, these processes are often aided by computer numerical control (CNC), in which computer software is used to more precisely control the operation of machinery. Some of them supply products and services to London's leading cultural institutions. Factory Settings, for example – based in Leyton – design, fabricate and install exhibitions, theatre sets and experiential environments for the likes of the Barbican and Natural History Museum[47].

Nearly 4,500 are employed in the manufacture of metal doors, windows or other metal structures, supplying London's renowned architects and interior designers[48]. Metal Works in Brixton is one of these manufacturers, supplying high-quality staircases, gates and balconies[49].

Printing and reproduction of recorded material

Traditionally, printing has involved techniques such as lithography, whereby images are transferred from a plate or screen, but today they are often transferred digitally from computer files.

Despite being home to most of the UK's newspapers, printing these publications now accounts for fewer than 100 jobs in London. But print lives on in different guises. The majority of employment in this industry is in other forms



Map 4: Business locations - Printing and reproduction of recorded material.

Source: see Appendix 2

of printing, including books and magazines, brochures, personalised stationery, and posters[50]. Printing therefore supports the activities of a wide range of other businesses in the city, from professional services firms to restaurants.

Many also offer specialised services, including graphic design. Based in Bethnal Green, Calverts is a printers that specialises in publications and sustainable print, but also provides design services such as branding and web design[51]. Calverts is a workers' co-operative, meaning profits and decision making are shared amongst their employees. And printing does not always rely on paper; businesses such as BAF Graphics in Wandsworth print signage straight onto glass, plastic and other materials[52]. Map 4 shows locations of businesses in this sub-sector.

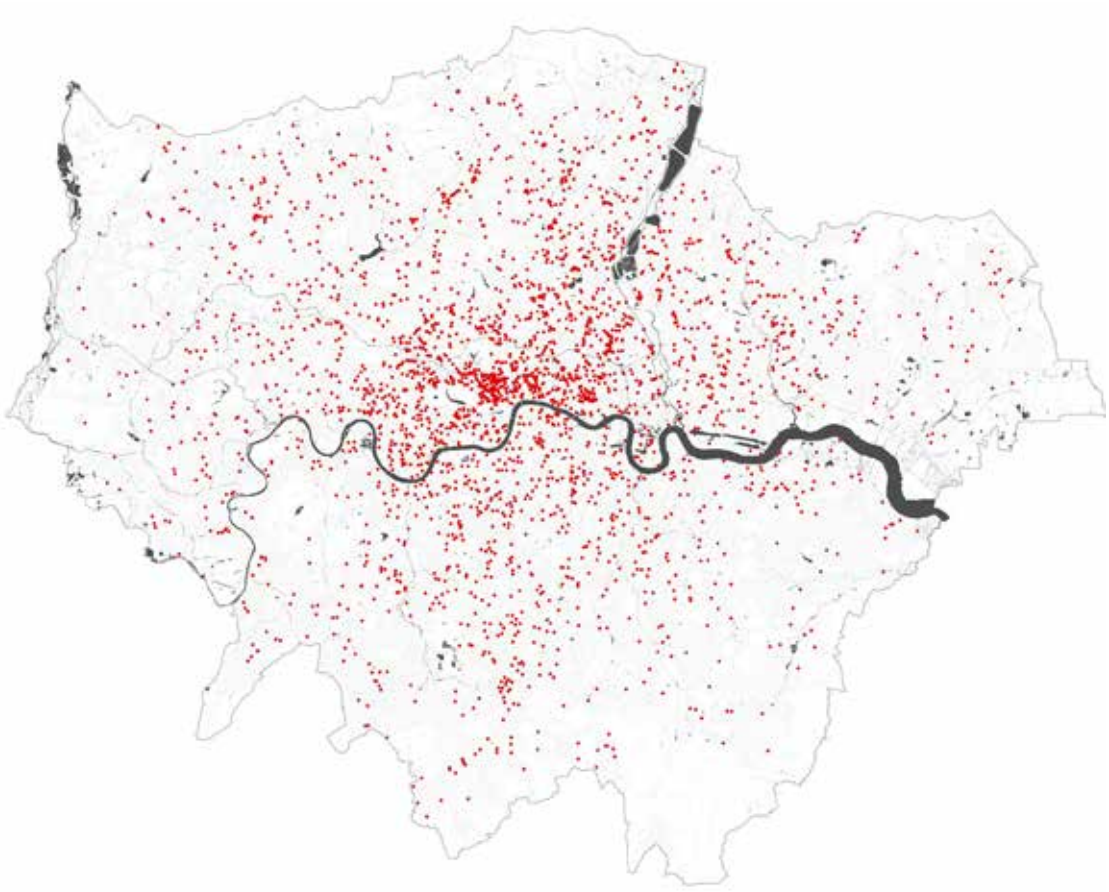
Calverts printers

Wearing apparel

Wearing apparel is a traditional sector for the city. Whilst it is not London's largest manufacturing sub-sector, it is certainly important for the rest of the country as 20 percent of jobs related to the manufacturing of wearing apparel in the UK can be found in London[53]. It also adds £800m to London's GVA output[54].

Supplying clothing for as diverse uses as the Changing of the Guard to London Fashion Week, these garment producers range from the traditional to the contemporary. Most workers (4,500) in this sector are involved in the production of outerwear, both in sample and batch production of garments[55].

Savile Row has a reputation for some of the best tailors in the world. Norton & Sons, established in 1821, gained eminence for making suits for the likes of the young Winston Churchill and have cut cloth for the royal households of many European countries[56]. The making of a single suit can involve up to eleven craftsmen and 60 hours of work. Kashket & Partners, based in Tottenham, cut a different cloth. Their bespoke tailors and artisans produce and service ceremonial military uniforms for regiments in the



Map 5:
Business locations -
Wearing apparel.

Source:
see Appendix 2

British Army, including the Household Cavalry[57].

But modern apparel manufacturers are also thriving, for example the company Fashion Enter, which supplies e-commerce giant ASOS with womenswear from their factory in Haringey. Their 40 strong contingent of machinists produce up to 7,500 units a week. This social enterprise also offers a range of learning and development opportunities for would be designers and makers, including apprenticeships and mentoring[58].

Just down the road are The Albion Knitting Co. Established in 2014, they are the first industrial scale flat knitting factory to open in London in the last sixty years[59]. Their parent company, Alphatex, is a Beijing based manufacturer whose owner moved from the UK to China two decades ago when most of the knit industry relocated there. He and his co-founder opened Albion in order to be close to their clients in Europe's luxury fashion houses, including Alexander McQueen and Givenchy[60].

Manufacturing's relationship with the creative industries

London's manufacturing businesses service activities across London's economy. An important relationship exists with the creative industry. London has a world leading creative sector, from theatres to architectural firms. These businesses represent a significant part of the capital's economy. In 2015, they contributed an estimated £42 billion, accounting for around 11 percent of London's total GVA, and just under half that of the UK creative industry's total contribution. The wider creative economy is a growing sector for employment. There were 882,900 jobs in London's creative economy in 2016, up by almost a quarter since 2012[61].

Manufacturing in the capital underpins this sector in ways seldom appreciated; the theatres need props and costumes, while the fashion designers need garments sampled and small batches produced. A short film, 'London Made', created for the Seoul Biennale of Architecture and Urbanism in 2017, explored some of these connections by tracking the supply chains from one of the city's most distinctive cultural centres, the Barbican[62]. Its case studies highlight the importance of local links and demonstrate the need for the creative industry to be close to a network of local manufacturing businesses.

LONDON'S MANUFACTURING GEOGRAPHY

Manufacturing employment in London is concentrated in the outer boroughs where there tends to be more industrial space (see Figure 3). Ealing has the largest share of London's manufacturing employment (11 percent) with 13,000 workers employed in the sector[63], many of whom can be found in Park Royal, often claimed to be Europe's largest industrial site[64]. Park Royal is located on the border of three London boroughs: Ealing, Brent, and Hammersmith and Fulham. The birthplace of London's Routemaster bus, Park Royal is home to household names such as McVities, who have been making biscuits here for over 100 years and today have more than 700 employees[65]. A range of different sized manufacturers are located here. Sunbeam Group, who have 35 employees, design and install shop fittings for the likes of Selfridges, while two person start-up Botanic Lab, who make deluxe organic juices, have recently relocated to the site from East London[66]. Nearby in Chiswick is Fullers' Griffin Brewery, London's oldest brewery, who have been providing the city with fine ale since 1845[67]. Together with neighbouring boroughs, Hillingdon and Hounslow, this part of North West London accounts for nearly a third of total manufacturing employment[68].

Many of London's manufacturing workers can also be found alongside the River Thames in East London. Industrial sites on either side of the river span the boroughs of Greenwich, Newham, Bexley, Havering and Barking and Dagenham. Charlton Riverside is one example of a key location in this area, as is the aforementioned Ford plant in Dagenham Dock. "Out of the strong, came forth sweetness" goes the slogan of UK heritage brand Tate & Lyle, which has not one but two sites on the Silvertown area in Newham[69]. Their Thames Refinery site is the largest sugar refinery in the EU. One mile away, their Plaistow Wharf site ships out more than a million tins of golden syrup every month[70].

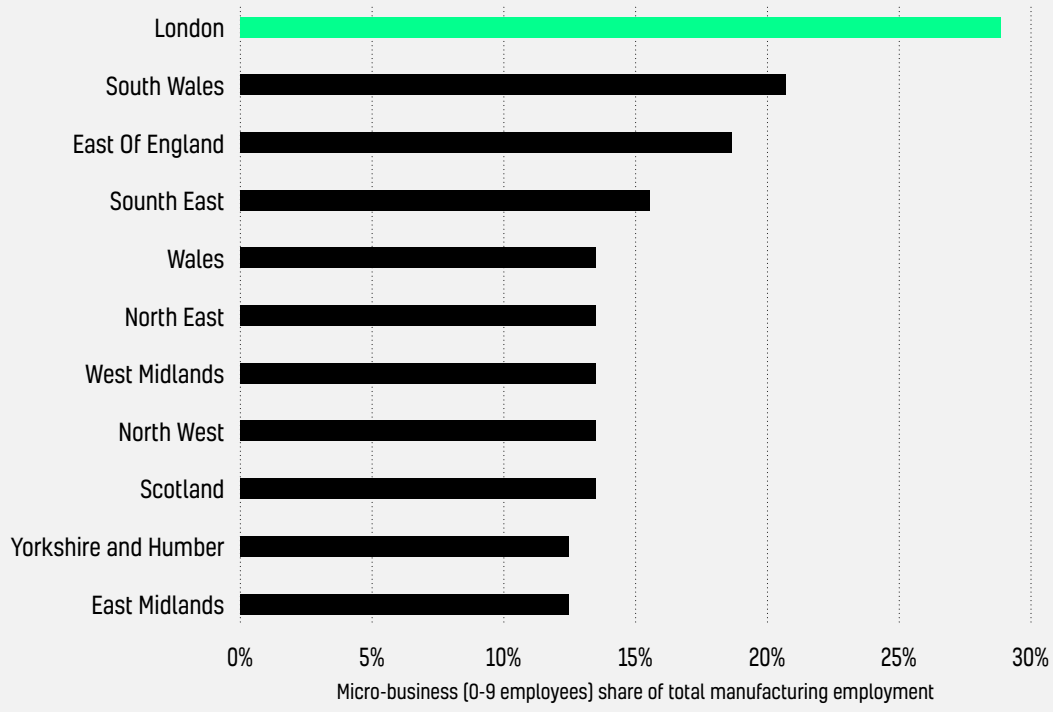
One of the largest industrial corridors in London, the Upper Lea Valley spans the boroughs of Enfield, Haringey, Waltham Forest and Hackney. Once famous for gun and motorcycle production, this borough acts as a gateway to and from London due to its proximity to the North Circular ring road (rather than the river and canal which once were the highways of the area). Coca Cola has been bottling drinks here for over 40 years and, more recently, Greggs Bakers opened up a distribution centre of excellence[71].

Additionally, smaller scale manufacturing can be found across the city. East London is home to the 'Maker Mile', a creative cluster of more than 80 fabricators, studios and workshops[72]. A one-mile radius from Mare Street, this area spans the boroughs of Hackney and Tower Hamlets. Machines Room is a makerspace based here which enables businesses and members of the public to access workspace and machinery, including laser cutters, 3D printers and CNC machines[73].

With an extensive rail transport network, railway arches criss-cross London, and many are home to smaller scale manufacturers. Be it craft beer makers Brixton Brewery[74], Sourdough bakers E5[75], or one of London's many metal works. These sites beneath railway lines are ideal for this kind of activity. They are inexpensive because they are incidental to main purpose of carrying trains, and noise of these trains means other business noise is also tolerated. London has a particularly large number of these. In fact, the brick viaducts that extend from London Bridge and Blackfriars through South East London are among the largest built structures in the world[76].

Manufacturing activity takes place all across London. The spatial distribution of these activities today is in large part driven by the history of the city; industrial space and businesses are found where previous generations of makers set up shop. But the city is constantly evolving and the space available for making is shifting too, shaped

Figure 4: Regional share of micro-businesses in manufacturing



Source: RSA analysis of Department of Business, Energy and Industrial Strategy (2017) Business Population Estimates

by political decisions as much as business ones. London needs to consider how manufacturing fits into its future geography - see Map 1 showing industrial zoned land.

EMPLOYMENT IN MANUFACTURING

This section explores three different aspects of work experience in manufacturing in London, namely business size, job types, and job quality.

Business size

As of 2017, there were almost 14,000 manufacturing businesses based in London, the vast majority of which are micro-businesses; 11,700 or 87 percent have fewer than 10 employees. The largest number of these businesses can be found in printing (1,800), fabricated metal products (1,500), wearing apparel (1,100) and 'other manufacturing' (1,200), which includes crafts such as jewellery making[77]. Hatton Garden may be the most famous example here, with businesses such as Just Castings offering casting, plating and finishing services to London's designers[78]. One person businesses can be found in shared workshops across the city, such as Made By Ore, a silversmithing workshop in Walthamstow, which houses 7 independent makers[79].

Self-employment and micro-businesses account for a high share of London's manufacturing employment compared with other regions (see Figure 4). Almost a third (29 percent) of London's manufacturers work in these kinds of enterprises, a figure more than twice that of many other UK regions[80].

Larger businesses are mostly found in the food and drink industry. There are an estimated 25 businesses in these sectors with over 250 employees, accounting for half of all industry that takes place at this scale. In the food industry, 855 companies are micro-businesses, indicating the extent of artisan production in this sector. There are also a handful of large businesses in printing, the manufacture of rubber and plastic products, the manufacture of machinery and equipment, and the

repair and installation of machinery[81].

Larger businesses also account for a significant share of London's manufacturing employment, providing 38 percent of all jobs, a figure slightly below the UK average of 42 percent. London's manufacturing workers are also less likely to be employed in medium sized enterprises (50-249 employees), which account for only 15 percent of jobs, compared to 23 percent across the UK[82]. This suggests that there may be barriers to expansion.

One such barrier may be a shortage of available, affordable and appropriate industrial space. An analysis of Valuation Office Agency (VOA) data shows that London has more property units per m^2 of industrial floorspace than other English regions[83]. The cost of this space (per square metre) is also more than twice as expensive as other parts of the UK and available industrial floorspace declined by 20 percent between 2000 and 2012 (see Figure 5). This may be posing challenges for business expansion and new business creation. Challenges presented by a lack of space for making are further discussed in Chapter 3.3.

The ability for smaller scale manufacturing businesses to grow is important for both London and other parts of the country. London could act as an incubator for some manufacturing businesses, enabling them to develop before relocating outside of the capital. For other businesses, remaining in the city will continue to be necessary

London's manufacturing occupations

Manufacturing is made up of a diverse range of occupations, from skilled tradespeople such as garment makers or metal workers to engineering professionals, warehouse managers, forklift operators, and accountants[84].

Skilled trades account for approximately one in five manufacturing jobs in London (18 percent) (see Appendix 3). Many

Figure 5: Regional cost of industrial floorspace

Region	Rateable value £/m²	Industrial floorspace £/m²	Hereditiments Units/m²	Change in industrial floorspace (%) 2000-2012
London	68	21,115	2,1	-19%
South East	50	35,627	1,7	2%
East	42	33,299	1,5	4%
South West	37	26,575	1,8	1%
West Midlands	33	44,375	1,2	-6%
East Midlands	32	37,787	1,1	5%
North West	30	49,411	1,2	-9%
Yorkshire and Humber	29	40,919	1,2	0%
North East	25	15,744	1,2	-2%

Source: RSA analysis of Valuation Office Agency (2012)

Commercial and Industrial Floorspace Rateable Value Statistics Used here, hereditiments refers to property units

of London's makers providing bespoke or artisanal services will fit this bill.

Workers employed in manufacturing in London are much less likely to be employed as process plant and machine operatives, with just 11 percent found in these jobs compared to 20 percent across the whole UK. These are the job types that are typically found on the floor of large factories and involve the routine operation of heavy machinery.

Instead, London's manufacturing workers are more likely to be employed in associate professional occupations or as managers and directors[85]. Both job types are linked to business support and administration, and include roles like marketing professionals and functional managers responsible for corporate strategy. Many of these jobs are those that that one would expect to find in manufacturing firms whose head office is located in the city. This includes businesses such as drinks manufacturers Diageo who don't make any products in London but develop advertising campaigns here[86].

More broadly, many of London's manufacturers benefit from having access to a diverse pool of talent that comes with London being a global commercial centre. Be it a business like Tate & Lyle who make and market their products in London, or smaller start-ups looking to develop their brand.

Job quality in London manufacturing

The ability of a sector to provide jobs is an important factor in its role within the economy. The recent Taylor Review asserted that, as a whole, the challenge faced by the UK is not with the number of jobs, but with their quality, and highlighted issues with the markers of pay, progression and security[87].

Manufacturing jobs are often perceived as higher quality than those in low skilled service sectors such as retail and hospitality, where huge swathes of the workforce are poorly paid. This is true to an extent. In London the typical weekly wage for a full-time employee in manufacturing is £624, compared to £516 for retail and £386 for hospitality workers[88].

However, manufacturing consists of a diverse range of industrial divisions and these vary significantly in the skills they require. This is reflected in workers' pay packets. Workers in low tech manufacturing sectors earn considerably less than their high tech counterparts. With a median hourly wage of £25, workers involved in the production of motor vehicles typically earn more than twice that of those working in food (£10.50) and wearing apparel sectors (£12.50). Workers involved in the production of computers, electronic and optical products command a similarly high salary of £22 per hour[89].

Sadly, low pay is a problem for parts of London's manufacturing sector: 21 percent of these jobs pay less than the London Living Wage (set by the Living Wage Foundation at £9.75 per hour for 2016[90]). Food manufacturing may be especially guilty here as 43 percent of workers earn less than this living wage, a figure no different from retail[91].

Manufacturing jobs in London are not, however, associated with insecure forms of employment, such as zero hours' contracts. Less than 2 percent of workers in manufacturing have these contracts, whereas in low skilled service sectors, such as hospitality, this figure is as high as 8 percent[92].

STRONG SIGNALS: FUTURE MANUFACTURING TODAY

Alongside the established manufacturing that takes place within the city, there are pockets of activity that signal future directions for London manufacturing.

The circular economy

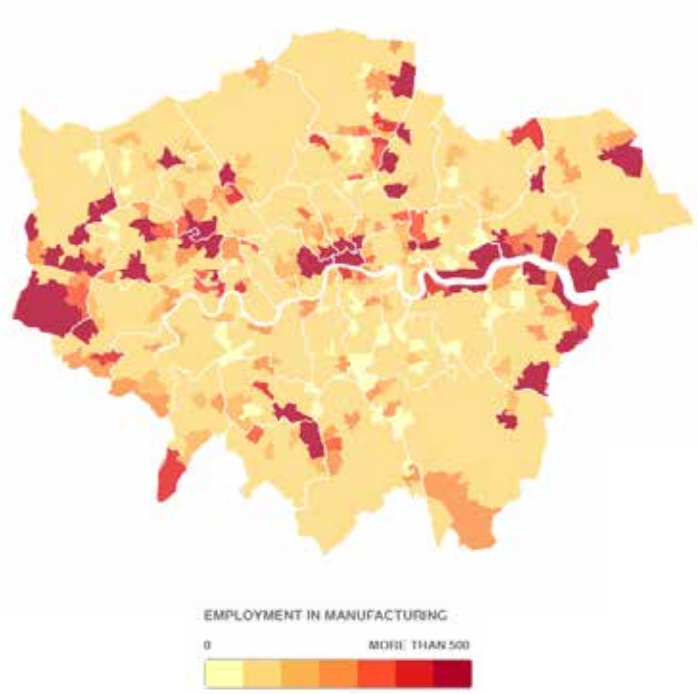
The Mayor of London has ambitious targets for improving the environmental sustainability of the capital, including the aim to become a zero waste city and to move to a more circular economy[93]. These

ambitions are discussed further in Chapter 3.3.

Achieving these goals will require a fundamental shift in the way products and materials are produced, consumed and cared for in the city. Already there are new initiatives and businesses showing the potential that exists. These sit alongside the sectors of industry critical to delivering a circular economy, such as the waste and recycling sectors.

Part of London's booming food manufacturing sector, companies like Rubies in the Rubble[94] and Snact[95] are capturing old or misshapen fruit and vegetables before they go to waste, and turning them into business opportunities. In the garment sector, Worn Again, based in East London, are developing a chemical textile-to-textile recycling technology that will enable clothes and textiles to be collected, processed and made back into new yarn again and again[96]. Helping to take care of London's offices are Premier Sustain who remanufacture desks, chairs and other office furniture at their Renew Centre in North London[97]. This furniture remodelling and refurbishment helps minimise waste and extends the lifecycle of these ubiquitous products. Sugru, originally invented and now made in London, is the world's first mouldable glue, which enables people to repair, modify and create items. It is available worldwide, with fourteen million mini packs reaching people across the globe, helping them to fix and customise their products[98]. Other home-grown businesses similarly offer Londoners the opportunity to repair their goods. The Restart Project is a social enterprise that helps people to fix their electronic items and to learn the skills involved at 'parties' hosted across the city[99].

Figure 3: London's manufacturing clusters; employment in manufacturing by Middle Layer Super Output Area (MSOA)



Re-distributed manufacturing and local production

Re-distributed manufacturing is one of a number of terms (others being 'distributed manufacturing' or 'decentralised manufacturing') referring to changes in the economics and organisation of the sector that shift production sites closer to consumption[100]. This is a contrast to previous trends in manufacturing, which centralised the production of goods. The phenomenon is driven by new production technologies that enable smaller volume and bespoke production to be viable, including additive technologies like 3D printing, and technology which changes communication across value chains, such as cloud computing. These activities are anticipated to significantly change the way goods are produced, and enthusiasm is building across sectors, from healthcare to construction, for the opportunities this could bring, for example in reducing transport emissions and costs, and enabling bespoke production.

Within London, pockets of re-distributed manufacturing are emerging. Several of the city's leading universities provide research on new manufacturing technologies and support the development of

young engineers and designers. University College London's Institute of Making[101] and the Royal College of Art's work on the role of makerspaces in the circular economy are two examples[102].

There are independent institutions too, such as HSSMI based in the Olympic Park who support the research and delivery of digital technologies for manufacturing[103]. Across the city, the wealth of expertise in these institutions is a source of, and draw for, entrepreneurs. They could be key to positioning the city to make the most of these new technologies.

Opendesk, a company based in East London, capitalise on this technology. Their online platform hosts digital furniture designs and helps customers connect with local manufacturers in order to have them produced[104]. Whilst they are not manufacturers themselves, the service they provide enables re-distributed production across the world.

The city has other opportunities for local production in its makerspaces and other open workshops, offering London's businesses and residents' access to new technologies[105]. A 2015 study by Nesta suggests that London has many more of these makerspaces than other parts of the country: an estimated 20, compared to only 3 in other major UK cities[106]. And this number is growing. The Open Workshop Network – London's network of open-access workshops – now boasts more than 40 spaces as members[107]. One of them, Building Bloqs, is a not-for-profit open workshop near the river Lea in Tottenham. It is a home for over 350 makers and small business, providing them with access to workshop space and equipment for metal and woodwork, textiles, and digital fabrication. These makers support Made at Bloqs, a service for the design, fabrication and installation of products, serving private and business clients across the city[108]. These spaces are indicative of the pervasive entrepreneurial spirit that draws capital and talent to the city, earmarking London as a great potential place for innovative manufacturing businesses to start up.

3.3 Governance and Decision Making in London

The manufacturing sector in London is shaped not only by business decisions, and market trends, but also technocratic decisions made by both national and local government. Support for manufacturing from these authority bodies has fluctuated over time as political and economic ideals have changed.

Before exploring these changes and their impact in more detail, it is important to note that London's governance arrangement in the UK is unusual, with the Greater London Authority having a distinctive structure and set of powers. This has been the case for the last two decades, and the model provides London with greater local power than other regions in the UK including, importantly, the ability to integrate economic and spatial planning across the city region. Appendix 1 briefly describes the main actors and their roles.

INDUSTRIAL POLICY

TO INTERVENE OR NOT TO INTERVENE: CHANGES IN NATIONAL INDUSTRIAL POLICY

Whilst manufacturing remained core to the UK's economy well into the twentieth century, the story of manufacturing policy latterly became one of neglect. Manufacturing, and industry more broadly, has suffered from a lack of strategic direction, lack of investment and lack of continuity[109].

The post-war period saw the attempt to redistribute industrial growth from successful city hubs, such as London and Birmingham, to areas of the country suffering from industrial decline. This followed the logic of 'bringing work to workers' rather than defining policy based on the needs of industry. The 1945 Distribution of Industry Act introduced Industrial Development Certificates which enabled the government to direct the location of industrial growth through preventing factory development in some developed areas and assisting development in depressed regions. The success it had in boosting these regions is unclear and somewhat contested. But it does seem likely that it served to damage industry

View to Canary Wharf
© Bex Walton

within previously successful cities through discouraging business growth[110]. During the 1950s, London's manufacturing sector grew at half the national rate[111].

Attempts to 'pick winners' through industrial intervention policies in the 1960s and 70s were a response to de-industrialisation and its economic and social impacts. However, failures such as the unsuccessful bids to save automotive company British Leyland resulted in political disenchantment with industrial strategy[112]. By the 1980s the government's position had shifted to trusting in the free market over state intervention[113].

Policy at the London level broadly mirrored this changing national context. A notable difference, however, came in the mid-1980s, when the then regional authority, the Greater London Council, produced a London Industrial Strategy. This interventionist-style document, produced by the Labour led Council, was at odds with central government policy[114]. The detailed document set out actions to support key industries, including the automotive sector. The government dismantled the GLC shortly afterwards which curtailed the strategy's implementation. Since then, London's economy has shifted dramatically from manufacturing and industry towards services, particularly in the finance sector. In comparison with other de-industrialised cities in the UK, London has flourished. Capitalising on the booming financial and knowledge sectors, the city's economic development policy has focused on supporting services.

Set within this context of London's economic restructuring, manufacturing has recently received little attention from the city's policy makers. While recent strategies have not explicitly disincentivised the sector there has been an assump-

tion that the decline in manufacturing will continue. This has resulted in little focus on it as a distinct sector. Policies designed to protect industrial space are not working well enough.This has had significant impact and is explored later in this chapter. There has been little attention given to the sector outside of the planning policy domain and the links between the capital's manufacturing base and the rest of its economy are underdeveloped.

Take, for example, the draft Economic Development Strategy released by the Mayor in late 2017[115]. This document lays out ambitions to make the capital's economy fairer and more inclusive, and to create the conditions for businesses to start and grow. It lays out seven sectors which the Mayor believes are key to creating this, including 'cultural and creative industries', 'tech and digital', and 'low carbon and environmental goods and services'. It contains nods to the role of manufacturing, most notably in recognition of the importance of having industrial space within the city. But it lacks a vision for enabling London's manufacturing base to drive and support the Mayor's overall ambitions; a role that it could potentially fulfil given its fundamental links to the key sectors identified.

Reignited interest in manufacturing: a new industrial strategy

The financial crash in 2007-8 spread ripples of concern about London's reliance on its financial sector, and led the national government to reprioritise the need to rebalance the economy geographically and reduce the widening gap between UK regions. Despite the then-Chancellor George Osborne's call in 2011 for Britain's economy to be fuelled by the 'march of the makers'[116], the North-South divide is still growing, with London and the South East faring better than the rest of the country[117].

Although in practice relatively little change has been achieved, this interest is a marked shift in the national government's approach to industry. Last year's publication of the UK Industrial Strategy set out a long-term vision for ensuring that all areas of the UK benefit from a strong and prosperous economy, with industry at its heart. It takes two approaches, firstly it identifies Five Foundations for boosting productivity across business: ideas, people, infrastructure, business environment, and place, and lays out actions to support these. Secondly it calls for significant innovation within industry. It identifies four Grand Challenges set to transform the way people live and that, the government believe, the UK has the opportunity to play a leading global role in developing. These are AI & the Data Economy, Future of Mobility, Clean Growth, and Ageing Society. The strategy stresses the importance of manufacturing to the country and places particular emphasis on developing high-value manufacturing sectors and on enabling SMEs, including manufacturers, to grow[118].

The document also calls for the development of Local Industrial Strategies. The Mayor of London has said that a city-focused Industrial Strategy for London is key because being 'closer to the ground' than national government, the city is able to identify locally relevant initiatives[119]. How this national strategy is translated to the local London level will be of significance to the city's makers.

SPATIAL PLANNING POLICY

Amongst the policies that affect manufacturing are those governing spatial planning. This section gives an overview of the key aspects of planning policy affecting London's manufacturing base. In order to set the context, this section starts with a brief description of the UK planning system.

UK planning: a hierarchical system

The UK spatial planning system is a hierarchical stacked structure starting with national policy and cascading out to local areas. The overall guidance for planning policy within the UK comes from the National Planning Policy Framework (NPPF). This legislation was introduced in 2012 in order to reduce and streamline planning policy across the UK, and the policy seeks to contribute to the sustain-

able development of the UK, marrying the social, economic and environmental roles of places and spaces'[120]. All regional and local planning policy must conform to this central framework.

Within London, responsibility for planning falls to the Mayor, who must produce up to date spatial development strategies. This is known as The London Plan and is 'the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London'[121]. In December 2017 a new Draft London Plan was published. This document will be in consultation and examination during 2018 and will plan for London's development until 2041[122]. Beneath the London Plan sit Local Plans produced by each London borough. These Local Plans must be 'in general conformity' with the London Plan[123]. London boroughs determine the outcome of planning applications, though boroughs can refer certain applications for the Mayor to determine, and the Mayor can 'call-in' certain applications, superseding the jurisdiction of boroughs. These criteria for referral and call-in relate to large housing proposals, tall buildings or the use of land protected as Green Belt or open space.[124]

In the Draft London Plan, the Mayor sets out his ambitions for London's spatial and economic development to deliver 'good growth' that improves health, reduces inequality and sets a sustainable future for Londoners[125]. In order to achieve this the document outlines a number of priorities for London's places and spaces:

- **Intensification**
  The Plan seeks to intensify land use in order to increase efficiency, accommodate the city's growing population and provide more living and working space.
- **Housing**
  It is estimated that 66,000 homes need to be built every year over the next few decades in order to meet demand for housing in the city. The Plan specifies that smaller plots of land, as well as larger sites, need to be developed in order to meet this.
- **Resilience and efficiency**
  In order to provide a safe future for Londoners the city needs to improve resilience in the face of climate change and reduce its environmental impact, including through its infrastructure and built environment.

London planning policy position on industrial land

Manufacturing jostles for position amongst the many spatial demands on the city. As has already been described, manufacturing has not been a core strategic focus for London's economic development in recent years and land policy has reflected this.

Over the last two decades the London Plan has allowed for the managed release of industrial land (see Box 2) for transfer to

Box 1 Industrial land classification

The land and buildings governed by the planning system are categorised into 'use classes', following legislation laid out by the Town and Country Planning (Use Classes) Order 1987[126]. These 'use classes' determine the type of activities that may be carried out on a particular site. Industrial uses, including manufacturing activities, are categorized under use class B. Manufacturing encompasses a wide range of activities each of which fall into different sub classes, such as B1 (business and some light industrial use), B2 (general industrial use) or B4 (certain types of metal work). It is possible for land and buildings to be reclassified in order to allow for a different activity to take place, like converting an office building into residential accommodation. Change of use usually requires planning permission to be granted by the local planning authority in charge of deciding whether the proposal is in line with both regional and local planning policy.

other use classes. Between 2001 and 2015 over 1,300 hectares (approximately 1,800 football pitches) of industrial land was released. This figure is well in excess of the benchmark figure that had been set out[127]. The London Plan (2015) does provide some protection for industrial space, which is outlined in Box 3.

This policy approach sought to rebalance land use from a sector that had declined, and was predicted to decline further, releasing land for housing development and other uses. In 2013 GLA employment projections calculated that manufacturing would continue to shed jobs and leave only 15,500 workers in the sector in 2050[128]. However, predictions of terminal decline are underpinned by the belief that the past employment trends of deindustrialisation will continue, a view which may not be fully considering the role of the sector as a whole. Critics point to recent small increases in manufacturing employment and note that the decline in manufacturing contribution is relative rather than absolute, meaning that its economic share has reduced overall because of the rapid growth of the service economy. The productivity of the sector is important as well as the employment figures. Indeed, the rise of the former may lead to a reduction of the latter, but does not negate the contribution of the sector to London's economy, nor the requirement for appropriate space within the urban economy[129].

Further critiques of the policy argue that this rapid loss of industrial space has largely been fuelled by financial speculation rather than simply being a result of low demand from industry or pressure from other uses. London's residential property market has boomed in recent years, with growth far outstripping other UK regions[130]. In this heated market it is claimed that owners of industrial space have grasped opportunities to transfer their sites to uses that offer higher financial returns, such as residential buildings and offices[131].

The approach to managing industrial land has had significant impacts on industry. The redevelopment of such sites has resulted in many firms needing to move, either because their site is being transferred to a non-industrial use, or as the result of rent increases driven by high demand or raised land value. These factors are also reportedly affecting tenancy contract lengths, with some landlords unwilling to enter into long-term agreements that would prevent redevelopment or rent increases.

With land being squeezed across the city, businesses that find themselves needing to relocate face the difficult challenge of finding a suitable new site. In many cases, these sites are not available. Several businesses interviewed by the RSA explained that they had carried out a search, by way of risk assessing their current situation, and could find nothing to adequately meet their needs[132]. A wood workshop in South London said that despite only relocating from North East London last year (they could find no other suitable space nearer their previous home) they were already feeling under threat from potential future redevelopment of their new premises[133]. The costs to the business of moving once were high, moving twice could prove to be prohibitively so.

These concerns affect the ability of businesses to secure their long-term future. A lack of space hampers a business's ability to grow and thrive. James Morgan, Chief Executive of Truman's Breweries, gave an example of this, explaining that his company has been seeking a site for a second brewery since they built their first, but in the past five years they have had no success. Their business is growing rapidly and they have plans to expand production and employment, but the lack of space is the biggest challenge they face[134].

These significant challenges inevitably lead firms to question whether or not to remain in the capital. Brompton, for example, found themselves having to invest large sums in a move to a new site when their previous site would not allow them

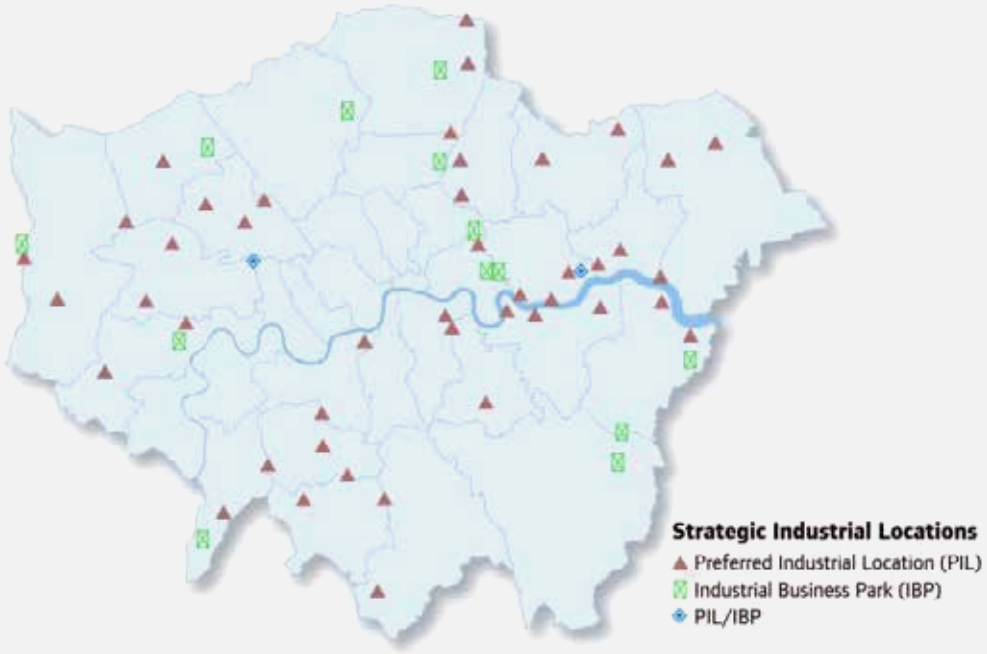


Figure 6: Strategic Industrial Locations

Source: GLA © Crown Copyright.

Box 3

Protection for industrial space[136]

The London Plan (2015) contains provisions for the protection of some industrial space through the creation of two categories of site: Strategic Industrial Locations (SILs) and Local Significant Industrial Sites (LSISs). Both categories incur additional planning guidance and restrictions to protect their industrial use, over and above the protections provided in the NPPF, namely the need for planning permission to be sought for change of use.

Strategic Industrial Locations (SILs) - see Figure 6

These are designated sites identified by the GLA as the main reservoirs of industrial land. There are 59 SILs, and together these sites account for more than 50 percent of London's industrial land supply. Most employment clusters are located in SIL areas.

SILs are subject to additional planning policy criteria, designed to discourage or prevent change of land use. These sites are important because their homogenous nature means they offer space for activities that may be incompatible with other use classes.

There are two categories of SILs, designed to meet different occupier criteria:

- Preferred Industrial Locations (PIL), which are suitable for general industrial use. There are 44 of these sites.
- Industrial Business Parks (IBP), which are suitable for activities requiring higher quality surroundings, such as research and development. There are approximately 16 of these sites.

These sites are subject to periodic review within the London Plan.

Locally Significant Industrial Sites (LSIS)

These sites are identified by Boroughs as having significance for the industry of the local area, and are given protection through policies contained in Local Plans. Their significance must be robustly evidenced, and whilst protection is advised, these Local Plan policies tend to be given less weight in the quasi-judicial planning system, than policies for SILs set by the London Plan.

Maker in Opendesk network
© Opendesk

to grow. Despite wanting to remain in the same borough, no site was available. The company was, however, determined to stay in London, in part because of the significant investments they had made in staff[135].

Concerns like this have been growing in recent years. Business leaders, industry bodies, academics and campaigners have all called for this tide of loss to be stemmed. There are now signs that the GLA is listening. The new Draft London Plan (2017) marks a change in policy for industrial land and requires that there be no net loss of industrial space in London. It mandates how this will be applied across each borough, requiring that they either maintain industrial capacity, increase it, or in a few situations that they may transfer a proportion of industrial land to other uses. Whilst this recognition is welcomed, it is unclear if these measures will be sufficient to protect industry in future, these issues are further explored in chapter 3.5.

RESILIENCE AND EFFICIENCY

A core strand of the London Plan is dedicated to ensuring that the city is resilient in the face of disruptions from climate change and, in order not to contribute to further environmental damage, that its activities become more resource efficient. In support of this, the GLA have recently strengthened their commitment to the application of circular economy principles in the city. This is reflected in recent high-level strategic policy and planning documents, including the drafts of the Environment Strategy[137] and London Plan.

The Mayor's draft Environment Strategy pledges to move to a more circular economy and combines a host of approaches to improving the capital's environment, including a commitment to become zero carbon by 2050, targets for a sustainable transport system, commitments for improving air quality and plans to mitigate climate change impacts. By 2026 no biodegradable or recyclable waste will be sent to landfill and, by 2030, 65 percent of London's municipal waste will be recycled.

The London Plan also sets a 95 percent recycling target for construction and demolition waste and a commitment to generate low carbon energy from waste from remaining suitable waste flows138. The Plan also stresses the important role of infrastructure for waste treatment and valorisation , and the need to safeguard existing waste management sites. In terms of space, it identifies suitable locations for managing waste and secondary materials, with a reference to Strategic Industrial Locations (SILs) and other sites, such as wharves. This may create trade-offs between the space for valorising waste and space for making, unless a better understanding of the untapped potential to link valorisation and manufacturing can be generated through, for example, the identification of opportunities to substitute primary materials for secondary ones in the manufacturing sector.

Meeting these targets, and doing so in a way which does not simply offload the problem to other areas of the country or the globe, will require a fundamental shift in the way the city produces, consumes and cares for the products and materials within it.

3.4 Ongoing projects and Activity

Recent development on London's manufacturing sites have focused on consolidation and more efficient use of space. Numerous industrial sites are considered prime locations for the burgeoning housing market while there is pressure for industrial activities to be re-accommodated rather than being erased. Tensions are emerging in finding the right mix of housing, working, making and leisure that can host existing manufacturing, high-tech and the creative industry.

OPDC

The Old Oak and Park Royal Development Corporation (OPDC) are redeveloping a very large site in North West London: Old Oak Common and Park Royal. Two new rail projects are coming through the site, High Speed 2 and the Elizabeth Line. This infrastructure investment is initiating the redevelopment, which is intended to increase economic activity in the area and provide new homes.

The Mayor formed the OPDC to manage the development. They are only the second corporation of this kind in London, the first being the London Legacy Development Corporation, which managing the transformation of the former Olympic site in East London. The OPDC are a local planning authority, meaning that they develop a Local Plan for the area and manage planning decisions based on that policy.

Park Royal is one of Europe's largest industrial estates, if not the largest[139]. It has been home to household names such as McVities and Heinz, and it is thriving today with over 30,000 people working there in over 2,000 businesses. The site has very low vacancy rates and demand for space is high. As a key industrial site, Park Royal is one of the city's Strategic Industrial Locations, and the OPDC plans to retain and improve the area's industrial capacity.

An employment study of the area in 2014, the Park Royal Atlas, is one of the most comprehensive studies of industrial space in London. The study provides an insight into the diversity of activity taking place there, and the desire the residents have for it to remain a core part of the city's industrial infrastructure[140].

OLD KENT ROAD

The Old Kent Road, in the south east of central London, is a designated Opportunity Area (OA) in the London Plan. OAs are identified as being brownfield sites which offer significant development opportunity to create new jobs, homes or transport infrastructure[141]. The proposed plans for the Old Kent Road area will see all three.

These plans, however, are concerning to the area's industrial businesses and many SMEs (including many manufacturers), who fear that proposed developments are tantamount to a sweeping away of industrial space. Local businesses are calling on the local council to ensure that they develop plans in collaboration with them, and not only with larger stakeholders and developers[142].

FUTURE DEVELOPMENT: THAMES ESTUARY PRODUCTION CORRIDOR

A collaboration between the GLA and South East Local Enterprise Partnership is setting the vision for a new 'Production Corridor' in the Thames Estuary area to the east of London. Long the heart of industry in the capital, this plan imagines a new future for the area in supporting London's creative economy with production facilities and space, along with a large number of new homes and other developments. The vision document explains that in order to grow London's successful creative industries, space must be provided for production: 'World class pieces for the Fourth Plinth [in Trafalgar Square]', the document cites, 'often have to be built elsewhere in Europe, because more space [in London] is given to consuming products and not enough to making them'[143]. The plans it proposes would provide high-quality space for the production of large works, TV and film production, and other creative industry activities.

These initial proposals are currently being developed into larger plans, but point to a recognition of a need for space to make, and in the need for 'making' to support the creative industries of which London is so proud. How these plans develop, and how this interplays with industrial capacity across the rest of London remains to be seen.

Hackney Wick
© Adrian Hill

3.5 The Future of Making in London

London's manufacturing base plays an important role in the city. Supporting this and unlocking its potential further requires a number of challenges to be addressed. For manufacturing to flourish in London a number of themes have been identified including the provision of suitable space, a greater focus on sustainability, industry voice in policy making and a more coherent vision for London's manufacturing sector.

1. PROVIDING SPACE FOR MAKING

A bustling city like London must accommodate a range of commercial, domestic and civic activities. Spatial planning and architectural decisions made today will shape the future of the city. This is as true for the future of manufacturing as it is for the future of residential and civic spaces. Proper provision for these activities is crucial to the future success of the city's manufacturers.

The Draft London Plan shows ambition to address the provision of industrial space. It seeks to prevent further net loss and to ameliorate the available space through the intensification of existing industrial spaces and through provision of new mixed use developments, which bring industrial and other uses together[144]. This step demonstrates the GLA's recognition of the importance of protecting industrial capacity within the city and is very much welcomed.

However, it is unlikely that this alone goes far enough in mitigating the threat of insufficient space. Whilst the policy goal is that there will be no net loss there will be loss in some areas as land is consolidated and shifted within boroughs. These movements will continue to be felt by businesses across the city. The largest concern is that in protecting industrial land boroughs are likely to focus on SILs and LSISs. It is right that these segregated spaces are duly protected, but it is important to also recognise the impact that the loss of undesignated[145] industrial space has. These sites, at the backs of high streets for example, provide important and distinctive space for business and play a role in the vibrancy of high streets and town centres across the city. Calverts, for example, are situated on this kind of site, as are the units in 'Maker Mile' just around the corner.

Machines Room, a new space accessible space for making.

Design and proving concept

The Draft Plan places emphasis on intensifying current industrial land, and on creating more mixed use developments, where industrial, residential and/or other employment uses are co-located. Both of these routes offer potential for tackling the constraints of space in the city, but bring their own challenges in design and execution.

Intensification involves increasing the efficiency of the existing stock of industrial buildings. Some examples of this exist in the city, like Segro's multi storey warehouse in Heathrow that houses industrial units on multiple levels. The company are planning another of these at a development in Meridian Water in North London[146]. Examples similar to this exist in other countries. However, it will be important to understand which activities these developments are providing for, and specifically how manufacturing space can be made available, not only space for warehousing and logistics.

The second route brings together industry and residential or other employment space in 'mixed use' developments. This is increasingly appealing as space in the city becomes ever more in demand. However, there are significant challenges in doing this, indeed the existing land use classifications were implemented in order to prevent mixed activities being unhappy neighbours. Industry can be noisier or smellier than residential activity and there is often a need for industry to operate around the clock or to receive early deliveries. On a segregated industrial estate this causes little concern, but when residential developments are nearby or co-located with industry, issues can arise. Where this occurs it is more likely that the industrial occupiers are required to compromise their activities. Whilst these are valid concerns, it should also be remembered that industry and residential buildings already exist together all across the city, and that these concerns can be overcome and managed through good design and governance.

Employing high-quality design will be critical to making these ambitions for mixed use and intensification work. Business requirements like yard space and access must be taken into account, as must residents' need for tranquillity. The challenges to success may not lie solely in design however, but also in financing. The real barrier may come in proving the financial viability of such schemes and attract-

Brompton production line. © Brompton

ing developers[147]. Because these require new models, and because industrial space commands lower prices than residential, developers are likely to be reluctant. Investment and support from both the GLA and local borough authorities may therefore be needed to develop proof of concept examples in the city.

Increasing demand for industrial space

Vacancy rates on many industrial sites across the city are low or very low. In the case of the popular Park Royal estate, vacancy rates have fallen to as low as 2 percent[148]. This is due in part to the loss of industrial land across the city, but also as a result of new demand from the growing 'just-in-time' economy, whose need for warehousing and logistics space is contributing to an already stretched capacity. London is also experiencing an increasing demand for industrial space from e-tail and e-commerce companies who need it to provide next day (or even next hour) delivery to residents and businesses across the city. Even within industrial sites, the manufacturing sector is competing for the available space with a host of other industrial uses. Demand for warehousing and logistics is likely to grow so it will become increasingly important that industrial space is able to cater for the wide range of sectors for which it is vital. Manufacturing must have a voice in that discussion.

2. GIVING MAKERS A VOICE AND MAKING THEM VISIBLE

Despite employing over 110,000 people within London, the manufacturing sector lacks visibility. Its activities are found across the city, however they often take place in locations that are out of sight to Londoners, in industrial parks or behind unlabelled doors. Most residents have no idea what is made in their borough[149] and many Londoners' perceptions of manufacturing may be anachronistic and not reflect the true nature of industry today. There is a danger that manufacturing could suffer because it is unfamiliar. A lack of interaction may lead to misconceptions about what manufacturing is and does, which could have negative impacts on skills development and retention within the city.

This perception can be powerful and it is not only residents who are unaware of the activities taking place. The same challenge faces local and regional authorities. At a recent GLA Planning Committee hearing, concerns were raised about planning officers' lack of understanding of the sector and its requirements[150]. This is particularly concerning as they take important decisions which affect the future of manufacture in London.

Precise, centralised and accessible data about numbers of firms and where and what they are making is lacking. There have been a number of in-depth studies carried out on particular industrial estates, such as the Park Royal Atlas[151], and these provide fascinating and useful insights into the detail of the activities taking place. However, these studies are concerned with a small proportion of London's industrial activities, and given that manufacturing is but one activity taking place on industrial sites, there is even less information specifically about manufacturing. The data from these reports is generally to be found within pdf reports and case studies rather than in more easily searchable formats. This limits their ability to be searched or aggregated by local authorities, researchers or other organisations seeking to understand the sector.

It is important that policy makers hear the voices and concerns of the sector. However, given that London's manufacturing base is made up of many small organisations it can be challenging for these diverse organisations to be heard. The size of these firms means it is likely that they are focused on their own daily activities and may lack the resources or connections to engage with policy makers or developers. Organisations and bodies to provide platforms for the collective voice of manufacturers are therefore particularly import-

ant. This includes sector organisations like EEF[152] and Soloman, and place-specific organisations, like East End Trades Guild[153], or Industrial Business Improvement Districts. This collective voice is particularly important when it comes to the spatial planning arena where large, often multinational, stakeholders dominate the field and technical language can make it difficult for non-experts to engage in discussion[154]. There is a significant power imbalance between these groups and it is important that the concerns of London's manufacturers are heard, whatever their size. East End Trades Guild, for example, are calling on prospective local councillors to support their Affordable Workspace Manifesto, which lays out ambitions for a London Working Rent for workspace[155].

3. BUILDING CONNECTIONS AND CAPACITY FOR INNOVATION

Lack of visibility also affects manufacturers' ability to connect with one another or with potential clients. Interviewees frequently cited concerns about the lack of connectivity and capacity in London's manufacturing base. These issues both have potentially significant implications for the future prosperity of the sector and of the wider economy as they threaten to dampen opportunity for new business and innovation.

London has enormous potential for fostering innovation. The UK and London develop excellent designers, but these designers must also be able to take products to market. Creating strong relationships with industry, which has the technical knowledge, is vital for enabling this[156]. The purpose of the Central Research Laboratory (CRL) in Hayes, who run an accelerator programme for start-ups, is to prove that the supply of talent and skills in London are such that you can run an investable and sustainable hardware business. They are working on innovations from science education kits to cleantech[157]. When it comes to manufacturing however, these businesses, and others, go outside of London and the UK, often to China. One interviewee likened manufacturing in China to going to the supermarket "we know we can find everything and everyone we need". They likened the same process in the UK to "making your way to a farm and being told 'there might be some carrots in the field'" - neither the infrastructure nor the work is easy to navigate[158]. This was not to criticise the local firms, rather to highlight a lack of support over time resulting in manufacturing infrastructure that is feared to be too fragile to deal with the potential that exists in the city. Things are ticking along, but there is a lack of dynamism. Others share similar concerns, believing that this fragility leads to defensive behaviours; people are reluctant to share their manufacturing connections in the city for fear that they themselves might lose out on capacity[159]. Potential for growth and innovation are slipping through the gaps. Given the ambitions set out both in the Industrial Strategy and in the London Plan, improving the situation is an opportunity that should not be missed.

Support to broker relationships could help to address this. An example of this from outside the capital is Make Works. Beginning in Scotland, but now rolled out across a number of cities, the organisation facilitates connections between manufacturers and designers, with the aim of igniting new working collaborations[160]. London's makerspaces could also play an important role through opening up routes to making. However, they themselves face challenges in developing sustainable business models and securing workspace[161]. It is worth exploring how London can support these spaces. Barcelona's Fab City approach is an interesting model for this as it brings together the city council, private business and makers to explore how local production can support the city's future[162].

Education and skills are also critical, and whilst better accounts exist of the need for improving the supply of skills for the manufacturing sector as a

whole, suffice to say this applies equally to London's workforce and education system. And whilst London can be an attractive place for a business, it is an expensive place to live for its staff. Despite its success, Brompton has found it challenging to compete for skilled engineers against other parts of the country where the cost of living is lower[163]. The city needs to find ways to grow, maintain and attract skilled workers for its manufacturing sector.

An investigation of the links within industry was not the main focus of this work. Nonetheless it hints at a challenge facing the sector and one that may significantly hinder its future. More investigation is needed into the interconnections within London's manufacturing base.

4. MAKING IT SUSTAINABLE

Policy makers, residents and businesses are recognising London's urgent need to become more sustainable across all of its many activities. Manufacturing has a key role to play in this future and needs to be involved more in these discussions.

Practical investigations into developing and implementing a more circular economy within London are underway. In 2017, The London Waste and Recycling Board (LWARB) released a route map proposing five focus areas for circular economy opportunities: food, built environment, electricals, textiles and plastics. By 2036, it is predicted that circular economy developments in these sectors could provide London with net benefits of at least £7bn every year, as well as 12,000 net new jobs in the areas of re-use, remanufacturing and materials innovation[164]. As part of this work LWARB and partners are working to provide business support, develop sector knowledge bases and encourage collaboration between stakeholders. Practical investigations of this kind are key to better understanding the networks involved and the support needed to unlock the potential in the city.

Policy makers need to continuously engage with this developing knowledge in order that policy can accurately reflect the needs identified. The current policy picture is not yet comprehensive. Whilst the high-level policies described in chapter 3.3 acknowledge the relationship between the circular economy and business competitiveness through improved resource efficiency, they demonstrate little understanding of how that potential can be unleashed through links with the manufacturing sector in the city. There is, for example, limited discussion about how recycled and secondary materials will be incorporated back into local productive cycles in the city, or of the economic potential of those resources. The London Plan explicitly encourages exemplar case studies of circular economy practices, such as extending product lifetimes, the production of secondary materials, and repair, refurbishment and remanufacturing activities, but provides no indication of how these activities may compete with other uses in the city. Given the current spatial challenges for industry in London, this needs to be given due consideration.

If London is to meet its sustainability ambitions it needs to look at its current manufacturing sectors and ask if it has the skills and technologies required to transition to a more circular economy. Both existing and new manufacturers can be supported in developing products and services that support this. Mobilising around this challenge would provide an exciting opportunity to develop skills and harness technology within the city.

5. CREATING A VISION FOR MANUFACTURING

London's manufacturing sector will continue to evolve, shaped by new technological developments, consumer demands and political choices. A new wave of technological change is on the horizon and London should take the opportunity to consider what role it wants its manufacturing sector to play in the city's future,

as well as what policies and initiatives are needed to facilitate this. Perhaps not all manufacturing that could be based in London, should be based in the city. Space is limited and the Industrial Strategy is seeking to rebalance economic growth across the country. Within its own vision for manufacturing, London needs to consider its relationship with other parts of the UK.

However, there are activities that need to remain. The city's residents and businesses need goods and services that enable them to go about their lives and activities. There will always be a need for the local manufacturing businesses that provide produce perishable and time-sensitive goods, or specialised methods of production. As the city grows, this demand is likely to increase. Take the large food sector in the city, or the printers and set makers.

In addition to this local demand, London's ability to draw entrepreneurs, investors, and a creative and educated workforce provides a huge opportunity for innovative manufacturing businesses to start. These businesses are attracted to London's unique business climate and the city should recognise the value that they bring in both employment and innovation. The draw is illustrated in the decision by The Albion Knitting Co. to set up in London. Despite there being more traditional locations in the UK for knitwear, Albion chose London to be close to both its clients and to a dynamic workforce[165]. London should consider its opportunity for incubating new manufacturing businesses. Some, such as Brompton, may then continue to stay in the city as they grow. Others may choose to move elsewhere.

London's vision for manufacturing in the city should be based upon a sound understanding of its value and an appreciation of its economic and social connections. London's manufacturing community should be involved in shaping this vision.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APPENDIX 1: DESCRIPTION OF RELEVANT BODIES IN THE LONDON GOVERNANCE STRUCTURE

Greater London Authority (GLA)
The administrative body for the Greater London region. It consists of an elected Assembly of 25 elected members and a directly elected Mayor. It is a strategic regional authority with powers over policing, transport, economic development and planning. This structure enables it to take a strategic approach to supporting the economy through an integration of economic development, planning, transport and housing strategies. It is unique in the UK in its structure and powers, and was established in 2000 to replace a series of more local boards.

Mayor of London
Along with the members of the London Assembly, the Mayor is accountable for the governance of Greater London. The Mayor serves a four-year term.

London Assembly Committees
Made up of cross-party members of the London Assembly, these committees discuss key issues for the capital. Pertinent to manufacturing, there are currently committees looking at planning, housing, economy and regeneration.

Local authorities
There are 33 local authority districts within London, 32 are London boroughs and one is the City of London. Each is governed by an elected borough council (or in the case of the City of London, the City of London Corporation). These borough councils oversee the provision of many of the public services in the capital, from schools to social care, although councils work together on delivery. London-wide services are delivered by the GLA, other key public service include health providers accountable to national orgnisations (eg NHS).

London Waste and Recycling Board (LWARB)
This board, set up by the GLA, works on, promotes and encourages waste reduction, pushing for an increase in the proportion of waste that is re-used or recycled and the use of methods of collection, treatment and disposal of waste which are more beneficial to the environment in London. It has a fund from central government (DEFRA) with which to carry out these goals

APPENDIX 2: MAPPING DATA

Separate Industry Maps
Each dot represents an individual business registered with the NACE code related to the described industry
Source: ORBIS database [web]

Manufacturing Maps Urban Regions
The maps give an overview over industrial land use in each urban region.
Source: Urban Atlas – Copernicus Land Monitoring Service [web] accessed April 2018.
All locations of registered business in the metropolitan area from ORBIS database NACE sector C Manufacturing. [web]

APPENDIX 3: ADDITIONAL DATA TABLES

Table 1: London's manufacturing occupations

Source: RSA analysis of Labour Force Survey (2016).

Major occupational group	Proportion of UK manufacturing employment	Proportion of London manufacturing employment	Difference in proportion
Managers, Directors And Senior Officials	12.2%	18.5%	6.3%
Professional Occupations	12.9%	12.8%	-0.1%
Associate Professional And Technical Occupations	13.7%	21.2%	7.5%
Administrative And Secretarial Occupations	6.7%	6.7%	0.0%
Skilled Trades Occupations	22.6%	17.8%	-4.8%
Caring, Leisure And Other Service Occupations	0.3%	0.0%	-0.3%
Sales And Customer Service Occupations	2.9%	2.8%	-0.1%
Process, Plant And Machine Operatives	20.0%	10.6%	-9.4%
Elementary Occupations	8.6%	9.5%	0.9%

Table 2: Median hourly earnings across London's manufacturing industry divisions

Source: RSA analysis of Office for National Statistics (2016) Annual Survey of Hours and Earnings

Manufacturing Industry Division	Median hourly wage (£), London, all employees
Motor vehicles	25.1 £
Computer, electronic and optical products	21.9 £
Other transport equipment	19.7 £
Repair and installation of machinery	18.8 £
Chemicals and chemical products	17.7 £
Machinery and equipment n.e.c	16.1 £
Rubber and plastic products	15.8 £
Furniture	13.8 £
Printing and reproduction of recorded media	13.8 £
Fabricated metal products	13.0 £
Other manufacturing	12.6 £
Wearing apparel	12.5 £
Food products	10.5 £
Wood and of products of wood and cork, except furniture	10.5 £
Other non-metallic mineral products	10.3 £

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Rotterdam The Hague, NL

4

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Photo, previous page: RDM Innovation Dock, Rotterdam.

« Making paths to the next economy »

This chapter looks at the region comprising Rotterdam and The Hague, a richly productive landscape characterised by a vast port, intensive greenhouse based agriculture and urban areas. The recent economic and urban development of this region has resulted in a spatial configuration with unique characteristics, strongly interwoven with each other. Firstly, demand for space has led to the transformation of the region, which has been sculpted, made fit for specific purpose, with barely inches of unproductive land. Secondly, modernist principles introduced new functional zones with segregated areas specialising in mechanical manufacturing, chemical processing, logistics, to housing and leisure, resulting in a particular composition of building and urban areas. Thirdly, as a consequence of ongoing planning and adaptation of this productive environment, socio-economic stratification with a strong spatial manifestation continues to be noticed to this day.

The region hosts a vast range of manufacturing. Many of these have emerged from the port and access to goods, resources and an international market such as chemical processing and machine production. Newer forms of manufacturing are spinning out of centres of innovation such as bio-technology and sensors and are showing that the city's productive base is moving further and further away from the port. As the port itself changes and becomes increasingly automated, it leaves behind vast areas of land. While projected housing demand is putting pressure on the available vacant port areas, there are movements towards districts with new forms of production.

Challenged by climate change and international competition, ambitions have been set for a radical transition towards a new economic models such as the Next Economy. The stakes are high for both private and public actors to focus on building out clean energy, resilient high-tech solutions, and radical innovation. However a range of visions and the strategic sectors have resulted in confusion about what should be stimulated and what the city's new economic profile, regardless of what actually lands on the ground. In the absence of clarity and a holistic approach, the pressure mounts. Providing the desirable Next Economy workforce - those with higher incomes, education, and demands - with suitable housing and attractive urban environments puts in question the region's economic, social and environmental stability.

4.1 History and Present of an Industrialised Territory in Transition

Rotterdam's manufacturing has grown out of its two definable industries: the port and agriculture. As the port grew, so did ship building and process of the resources that arrived at the port. Agriculture on a small but highly productive landscape generated a speciality in food based technology.

TWO LANDSCAPES, TWO ECONOMIES[1]

Rotterdam and The Hague were born on two waterfronts: Rotterdam has grown along the river towards the North Sea and The Hague on the old dunes parallel to the coast that housed nobility, high bourgeoisie and civil servants. They have been connected by parallel forms of infrastructure since the fourteenth century, including canals, railways, motorways, and metro. If Rotterdam's economic character has been historically dominated by its port, The Hague's has been a center of government of and diplomacy. The combination has resulted in an internationally trade focused region with Europe's largest port and most intensive agricultural area.

INDUSTRIAL PAST AND PRESENT

The recent history of industrial development in the Rotterdam-The Hague region is inextricably linked to the port of Rotterdam. Beginning in the late 19th century, the port of Rotterdam transitioned from functioning under a staple market system to being a modern port; it ceased to base its activities in the exchange of high value commodities and specialized on the throughput of bulk and raw materials, and later to additional port-related industries, such as shipbuilding. Eventually, Rotterdam itself transitioned from a mercantile town (where a handful of merchant families were key in orienting the development of the city and market) to an industrial town. It shifted from having a mix of industry, trade, and socio-economic functions, to becoming dominated by a strict separation of functions[2].

The growth of the port that followed in the first half of the 20th century was dramatic. The reasons for this were threefold. Firstly, the construction of the Nieuwe Waterweg in 1872 linked Rotterdam directly with the North Sea and enabled access to the port of Rotterdam for larger ships. Secondly, innovations in water and

A panorama of the Erasmus Bridge and the River Maas in Rotterdam © Massimo Catarinella / Wikimedia Commons

land transportation, were suited to the city's geography or resulted in the city adapting itself to the new technology. Finally, Rotterdam rose in the wake of Germany's late 19th and early 20th century industrial euphoria. The port grew from 200 Hectares in 1880 to 1,880 forty years later.[3] In parallel, Rotterdam grew linearly along the river, flowing westwards following the growth of its port[4].

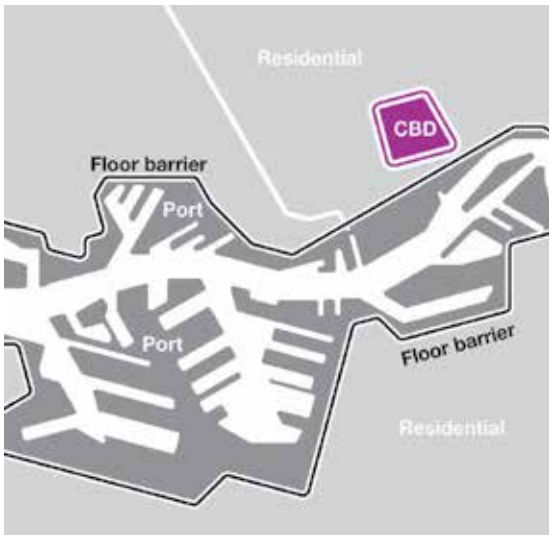
ROTTERDAM, FUNCTIONALIST PORTCITY

Second World War and subsequent reconstruction were a turning point in the port and city dynamics. The city saw some 2.6 km^2 of its medieval centre and other areas levelled by German bombs while the port suffered the destruction of seven kilometers of quay walls and a loss of 40 percent of its warehouse area[5]. By 1950, the port had receded to 1,400 Hectares[6].

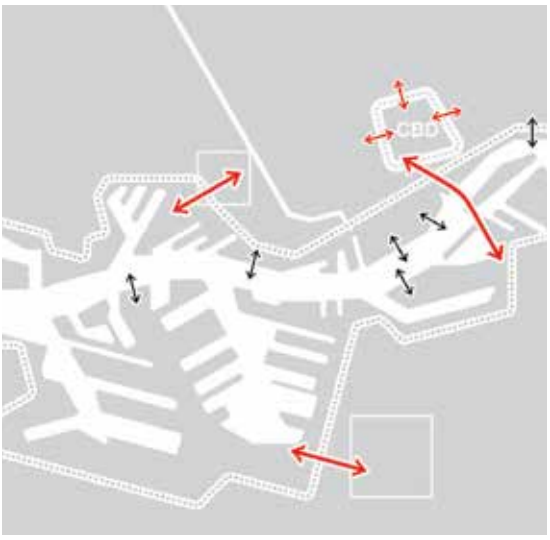
Guided by the Basis Plan of 1946, reconstruction was based on the modernist principle of functional separation[7]. "First the port, then the city" became the motto behind Rotterdam's economic revival[8]. Following on the modernist logics, what happened in the port had its own logic. Obviously, given the scale of the port, and the focus on water based traffic, that had huge effects in the city's economic profile and in its notably less diversified industrial development[9]. Historically, the port has behaved as a 'landlord' port, which leases sections of its premises and supplies with infrastructure to those companies that align with the Port Authority's strategy; the emphasis on throughput of cargo has therefore limited the type of industries that could settle by the River Maas.[10]

In the postwar, the port continued focusing on being a hub for transit and distribution. Investments in waterways and wharfs made room for larger vessels and newly invented containers[11]. Before 1940, 70 to 75 percent of goods were merely in transit. The realisation in the 1980s that

The embankment, Rotterdam, between ca. 1890 and ca. 1900.



Rotterdam 20th Century: (1) Strong functional separation; (2) strong physical segregation between river landscape and urban fabrics.
© Cities of Making team TU Delft



Rotterdam 21st Century: (1) Functional interweaving and flexibility; (2) physical interweaving of river landscape and the city.
© Cities of Making team TU Delft

"barely anything was done with the goods [that came in the port] in Rotterdam" led to define strategies to diversify its economy and focus on developing added value[12], making it less dependent on cargo and taking advantage of the port's location while creating new employment[13]. Initially oil refineries and chemical industries were built[14], followed by an emphasis on supply chain management and intermodal platforms which regionalised the port's economy.

URBAN RENEWAL IN ROTTERDAM[15]

If the dominance of the port in spatial politics was hampering the development of a diversified economy in the large, regional scale, policies of urban renewal in the 1970s and 1980s razed the remaining productive urban ecologies in the inner city. Housing shortage in the 1960s and early 1970s was aggravated by businesses competing for central land. In the period between 1970 and 1974, some 1200 dwellings were occupied by businesses due to the lack of available space.

The urban renewal projects substantially reduced the available space for making via regulation and urban design. Firstly houses were prevented from being transformed into office space. Secondly retail structure was pushed onto high streets to avoiding scattered shops in residential areas. Finally industrial spaces causing nuisance were moved out of the neighbourhoods.

The consequence was a sharp reduction of local jobs and working environments: - 11 percent reduction of local jobs compared to -0.7 percent in overall Rotterdam. Urban renewal resulted in a surprising paradox in Rotterdam's business landscape: while the supply of business space was twice as the demand, there was a shortage of smaller business premises; large companies had left, smaller ones remained, and new, smaller companies could not afford the new rents.

CHALLENGES AND TRANSITIONS

The port has continued its voracious growth in the past 40 years: from 7,600 Hectares in 1979[16], to 12,600 in 2017[17]. This growth exacerbated the inherent conflict between the spatial logic of the port versus that of the city[18]. As the port kept its position as global actor and distanced itself spatially from Rotterdam, the inner

Rotterdam after bombing of World War 2 in the Netherlands Source unknown.

city was neglected: it was, and remains, a relatively poor city, with lower incomes, higher unemployment, lacking good public space, containing fractured communities and cultural life[19]. As the city has extended along the banks of Rotterdam's waterways to the North sea, it has split the whole region in two parts[20] and has hindered the creation of a shared identity[21] while creating social divisions.

In the 1990s, the politics of "if the port is successful, Rotterdam is successful as well" continued[22], the sums didn't add up. Indeed, the economy of the city is dominated by the port, and the income of the municipality is tightly linked to the number of ships docking there and the volume of goods handled. It is the biggest job provider in the city: 85,000 in 2016 with about 250,000 people employed within the maritime economy.[23] In short, the economic spillover of the port in the city is in doubt due to further automation and reduced demand for low skilled jobs.

The most recent strategy focuses on creating a 'knowledge port' by fostering knowledge and innovation-related industries, attracting well-off creative and knowledge workers[24], while being oriented towards the city rather than the sea. The port is now seen as a source of innovation, where multinational firms and knowledge and innovation clusters interact, with a strong accent on maritime industry[25], steered by the Port Authority to transition to sustainable transport, clean energy, and, most of all, the greening of its activities[26]. This strategy is seen to attract partners, investors, and high skill labour[27]. Furthermore, the strategy includes waterfront redevelopment linked to the economic diversification and mix with other uses - particularly development of housing and public space[28].

The region's knowledge economy is quite sizeable and therefore an opportunity, including two large universities (Erasmus University in Rotterdam and TU Delft), three hogescholen (schools of applied sciences), and other academies, enrolling more than 100,000 students. An array of additional knowledge institutions such as the academic hospitals, TNO (Netherlands Organisation for Applied Scientific Research) and Deltares (a large technology institute focused on delta engineering). Workers in this knowledge network live across four cities - Delft,

Leiden, Rotterdam, and The Hague. Greater spatial coherence, more interaction and better conditions for supported facilities, could be important ingredients of future spatial policy in the region.[29]

Today, the pressure to build more housing, and the focus on very specific industrial sectors in the industrial agendas of both port and governments, limit the possibility of achieving a diverse economic system, specially urban manufacturing. The port is redeveloping waterside areas into business sites aligned to its innovation agenda, mainly belonging to the maritime sector and sets out a strict set of requirements for businesses to settle in available land. Furthermore, on these portside redevelopment areas controlled by the municipality, the pressure for building new housing - the city needs to build 40,000 new homes - is putting in risk very young productive ecologies that had settled in marginal, underused industrial areas. As Paul Stouten has noted, urban regeneration and housing construction is moved by the political aim of attracting creative or higher income groups, and gentrifying the inner city of Rotterdam to make it attractive for investors[30] therefore increasing prices per square metre and making it less accessible for small making and manufacturing businesses.

Port of Rotterdam
© Jan Voets / Anefo. Nationaal Archief

THE ADAPTED DELTA FOR THE FUTURE INDUSTRIAL LANDSCAPE

The rise of an industrial economy in the Rotterdam-The Hague region is a result of the ability to adapt and exploit the landscape to the technical demands of the time - this interdependency is unique and is vulnerable to the adaptability of the port to climate change and requires a brief summary to show some of the variables at play.

Rotterdam grew out of its favorable position at the estuary ‘Nieuwe Maas’, atf the river-mouths of the Meuse and Rhine. The landscape was the product of the processes of sediment-transport by rivers and sea, resulting in an alluvial landscape of soft clay and peat. Urbanization of these deltaic marshlands was possible by applying a centuries-old land-making technology: draining the highest parts of the alluvial territory, and surrounding the drained territory with dikes for protection against high water events in the river and/or sea. This combination of drainage and dike-construction resulted in the typically Dutch polder-landscape and polder-cities. Ongoing sediment-transported by rivers and the sea resulted in new land outside the dikes, which could be reclaimed by repeating the same process: draining the new silted-up territory and constructing new dikes around it. This type of colonisation of the land took maximum profit of the ‘ecosystem services’[31] of the estuary landscape, using the natural processes of currents, transportation of sediment, siltation and the role of vegetation.

This dynamic process changed radically from the 19th century, as a result of the introduction of new technologies of land-making and river-management and

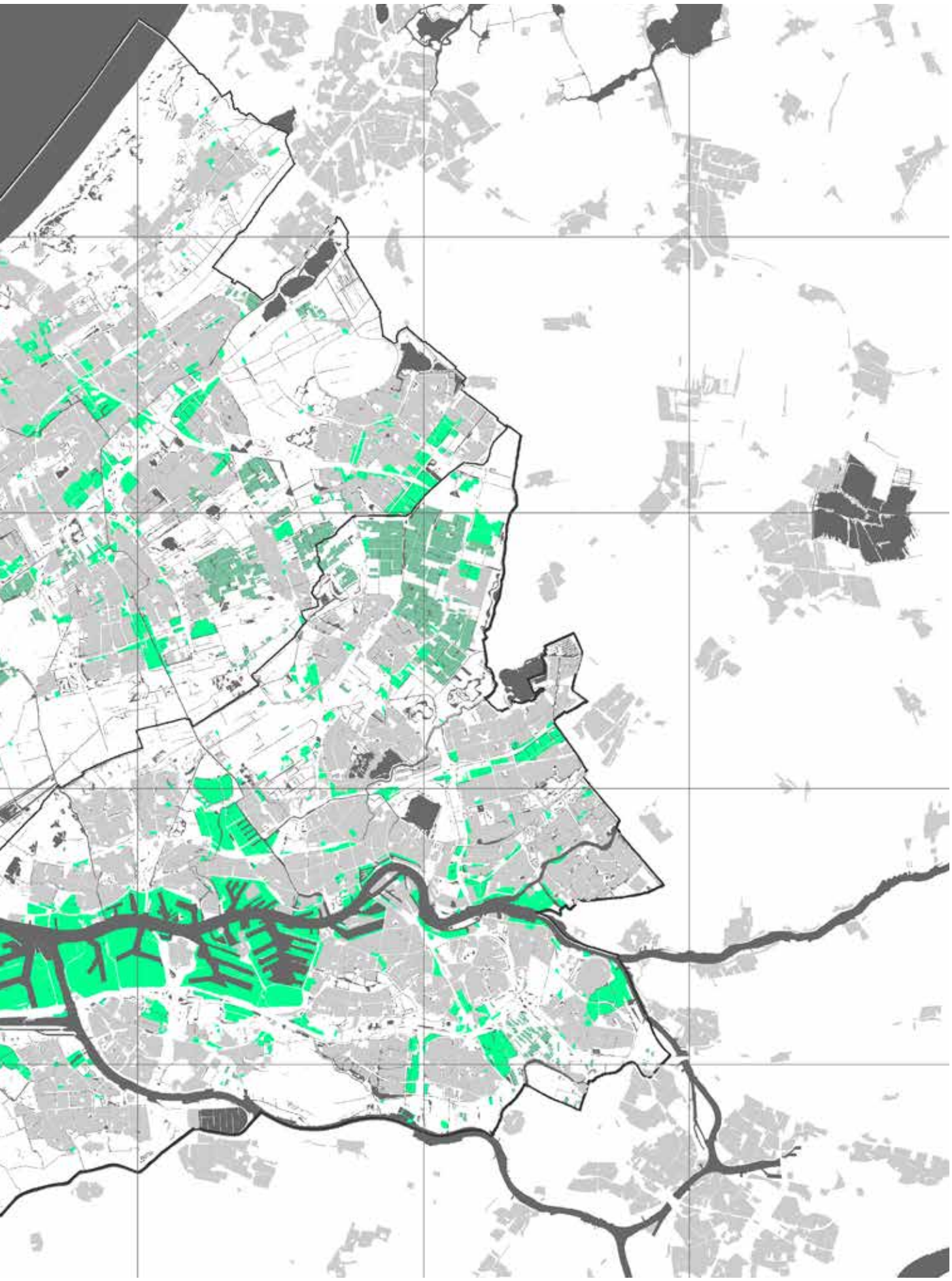
the rise of the industrial economy[32]. The Nieuwe Waterweg and, later, the construction of the large scale port areas of Botlek, Europoort and Maasvlakte resulted in a radical transformation of the existing polder- and river landscape to a completely new, artificial port-landscape of 12,000 hectares. Villages and farms were evacuated and demolished, polders and dikes were excavated, harbor-basins dug out, new land constructed artificially, a new river mouth (Nieuwe Waterweg) deepened by dredging from 6 meters (1880) to 16 meters currently. Ecosystem services were not used anymore; instead, they were denied and ruined.

The making of this new landscape influenced the physical conditions of the city dramatically. Dredging, narrowing and deepening the river mouth resulted in an increased influence of the sea in the urban areas: stronger tidal dynamics, increased impact of storm surges and increased salinisation of river- and groundwater. Consequently Rotterdam had to adapt the flood protection system, including higher dikes and building a series of new storm surge barriers (Maeslant Barrier, Hartel barrier and Hollandse IJssel barrier), and developing special systems for fresh water supply.

Now a large part of the landscape sits somewhere below or just above sea-level, rendering a vast area of the productive landscape exposed climate change. How will it face climate change and deal with rising sea levels and increasing peak discharges of rivers? The region needs a radical spatial reorganisation. In the national Delta program, launched in 2015, two main options are presented: 1) raising the current dike system, and changing the fresh water supply system or 2) closing the New Waterway with a new barrier, and directing the river to discharge completely into the Haringvliet (south of Rotterdam). An alternative 3rd option of totally reorganising the river-mouth area into a more 'natural' tidal river landscape. It has been considered too radical and too damaging for the established economic interests.

All options will have tremendous consequences, giving either more or less space to manufacturing in the harbour areas or changing accessibility to a large part of the port which will relocate the deep sea port to outside the new sluice. All three options should be considered seriously as they will play an important role in the transformation of the industrial economy to the 'Next Economy', as will be discussed later in the chapter.


MAP 1: INDUSTRIAL ZONES
REGIONAL BOUNDARY
ZONED INDUSTRIAL LAND
GREENHOUSES
BUILT AREAS
10km
This map shows land zoned for industrial use, compared with the overall built area. It provides an indication of traditional locations of manufacturing. The map does not show the full extent of manufacturing sites as many are embedded within land zoned for mixed or other uses. Source - see Appendix 2.



4.2 Manufacturing sectors and trends

The Rotterdam-The Hague region supports a vast range of manufacturers from very large-scale chemical refinaries, to food producers, machine manufacturers to smaller scale furniture makers and carpentry workshops. A bulk of these manufacturers are dependent on or have spun out of two activities: firstly Europe's largest port and secondly intensive greenhouse agriculture. Newer manufacturers are emerging through regional knowledge networks.

THE DUTCH ´MAAKINDUSTRIE´

In the Dutch manufacturing industry, maakindustrie, the actual making or production of stuff is just a small part of the process. In fact, design, development, and sales at least of the same importance. Industry is the largest exporter (62 %) and largest buyer (60 million Euro annually) of all economic sectors in the country. Despite uncertainties abroad, such as Brexit, the exports have continued strong, as has domestic demand. After a strong 2017 (production growth + 3.5%), the sector has expected a further 3% increase in 2018. Nonetheless, the rise in industrial productivity may account for greater output yet with fewer employees; as unit labour costs fall, competitiveness improves, but there is a concern about employment growth lagging behind. Irrespective, at a national scale the maakindustrie is proving to be healthy.

Manufacturing, together with health, and financial service form the top three economic sectors in the country. The Dutch GDP topped €540 billion in 2012, and manufacturing contributed €68 billion to the total. Ten percent of the workforce – 825,000 people – works in the manufacturing industry. The Dutch manufacturing sector enjoys high productivity among EU nations, contributing €51.90 of additional value added per additional hour worked. Still, the Netherlands ranks in the second of four tiers in the European Commission Innovation scoreboard for 2015. Denmark, Finland, Germany, and Sweden rank in the top tier as "innovation leaders," while the Netherlands, Austria, Belgium, France, Ireland, and Luxembourg are listed as "innovation followers."

A smaller yet significant player is the Dutch agriculture and food industry, accounting for approximately 200,000

Rotterdam hosts a number of large processing plants, thanks to its connection to the port.
© LyondellBasell

employees. There are 70,000 agricultural holdings in the country attending to 1.9 million hectares or 45% of Dutch land.[33]

The driving force behind the growth of the manufacturing industry is technology industry and engineering. Its share in industry is about 40 percent and, as a result supplying sectors such as metal and plastic benefit. Growth expectations for the chemical sector (15% of the industry) remain positive even after 2018 (+ 2%) after a reasonable growth in 2017 (+ 2%). Although profitability is slightly under pressure due to the oil price that has risen.

Another important pillar in industry, the food industry (20% of industry), growth is expected to start again in 2018 (+ 2%). The shrinkage in the dairy industry seems to end and in 2018 the sector will benefit from rising consumer spending in Europe.

A more detailed account of the most important industrial manufacturing sectors in the Netherlands, as derived from recent reports, and their presence in the Rotterdam region, in maps, will follow. Opportunities and threats to manufacturing industry add to those that come as consequence of the aforementioned trends, issues external to production itself, as well as new customer trends. First, the implementation of new technologies is seen as an opportunity to further increase

Box 1:

Nationwide Trends, Threats and Opportunities for the Dutch Manufacturing Industry

As described throughout this chapter, the Rotterdam The Hague region is highly embedded within the larger national ecosystem, making it hard to distinguish local level issues from national level programmes. Sectors described later in the document will therefore point to both regional and national statistics.

Trends defining the manufacturing sector in the Netherlands mainly deal with internationalisation and innovation[34]. Whereas Europe remains as main destination for exports, companies want to expand to new markets (15% of them), especially in Asia, Latin America (23%), and Africa (22%). Also, outsourcing of production offshore continues: one quarter of the companies willing to internationalize include in their plans taking production abroad, at the expense of jobs in the country. Regarding innovation, emphasis is set in new forms of collaboration between sectors, both for chain optimization (linking product development and production), and connecting to existing knowledge clusters and networks to support R&D (60% of OEMs want to increase their expenses on this). Besides, smart industry concepts (such as additive manufacturing and automation) as well as cleantech production processes are on agendas across all sectors of industrial production: 30 percent of companies want to increase their investment in robots further highlighting movement away from low-skilled jobs. Opportunities and threats to manufacturing industry add to those that come as consequence of the aforementioned trends, issues external to production itself, as well as new customer trends. First, the implementation of new technologies is seen as an opportunity to further increase productivity and cost control, through innovation and automation. Besides the side effect of a decoupling between growth of productivity and employment, there is a persistent shortage of skilled workers; despite an increase of graduates in technical education, concerns about secondary and vocational technical education (VMBO / MBO). Second, customer-oriented development and production brings new opportunities, but puts more pressure on production, and specially to smaller and medium business, as it asks for short delivery times, specialization and flexibility. However, the collaboration with customers, as well as with suppliers and other sectors offers a chance to increase innovation capacity. Finally, an external threat to production is the volatility of cost of raw materials and energy. All in all, its worth noting that only 44 percent of manufacturing companies have a strategic plan.

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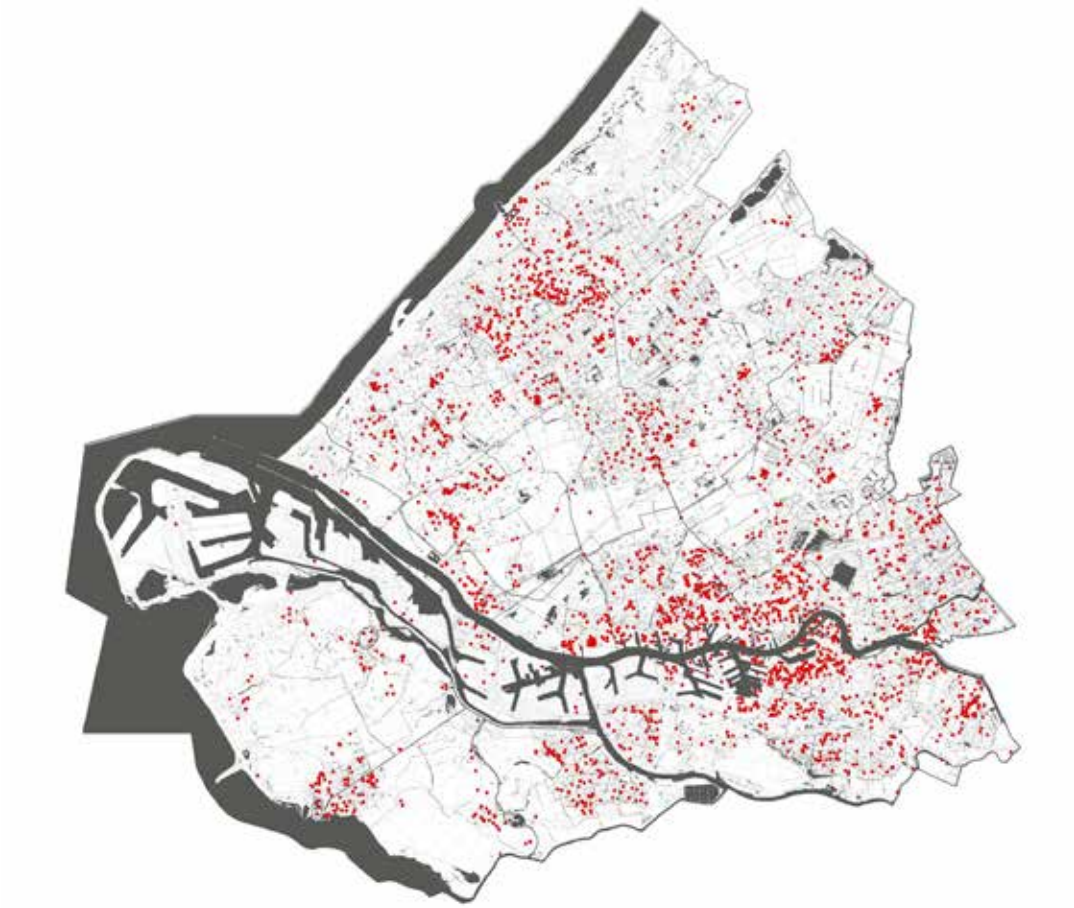


Map 2
Technology industries

Source:
see Appendix 2

Technology Industry[35]

Technology Industry is composed of the following subsectors: rubber and plastics, machine-making, metal industries, high tech, and automotive industry. It accounts for a production of approximately € 122 billion and a share of around 40%. The sector has a number of major challenges. The energy transition, for example, affects a number of important sales markets for the technology industry, especially the automotive (fuel engines) and energy sectors. Another big challenge is finding skilled staff. In order to structurally sustain the higher growth, around 120,000 new people will be needed by 2030.

Lely Astronaut milk robot © Anoek2012 / Wikimedia Commons

Electrotechnical industry[36]

This is a heterogeneous sector, which integrates ICT, software, telecom, and machine building. It ranges from the production medium tech products, such as electric motors, generators, and transformers, to high tech elements, as robots, sensors, artificial vision technologies, microchips, and advanced electronic components in general. Demand for such products comes mainly from other industrial companies in electrical and mechanical engineering, the healthcare sector, the non-residential building sector, OEM's that demand smarter machines, and large manufacturers of electronics which outsource production of components to suppliers.

In the Netherlands, there are around 1,500 companies operating in this sector. Mostly they are small companies: 80 percent of them have fewer than 10 employees. The annual sector turnover is 20 million Euros. However, its big companies that are responsible for a great part of the turnover and export - for example, Phillips. Growth is expected due to increasing automation and sensor technology, but at the same time selling prices are under pressure due to competition.

Changing customer requirements (demand for know-how and flexibility) ask for more flexible processes,

product development in networks with knowledge institutions and customers, the adoption of smart factory concepts (electronics + ICT + machine building). Customers also demand for cleantech and high tech solutions. Internationalization is seen as the way to grow.

Remaining competitive demands innovation, combining specializations through collaboration, supply chain integration, linking engineering services to sale and the provision of complete platforms. Contract research in collaboration with customers and institutions and focus on technologies that ensure shorter product life cycles (mechatronics, nanotech, photonics) are of particular importance. Employees with creative, communication, and resolution skills are scarce, and very much needed in a context of increasing automation.

Plastic processing[37]

This sector encompasses a wide variety of production methods, materials, market segments and sale areas, and deals with the manufacture of semi-finished and finished products result of processing of polymers. It is an industry with potential, as demand is high.

About one third of the production of plastic products goes to the automotive industry, machine, and equipment construction, and 20 percent goes to the packaging sector (fueled by food industry). Innovations in production are growing, in particular composites and bioplastics (with a growth of 10 percent yearly). It is an industry to which customers demand more quality, and faster delivery.

Plastic is becoming to be seen as an alternative raw material, with an increasing use and reuse of plastic in Europe. Those reuse processes, higher customer demands, and the increase use of bioplastics demand complex production processes, requiring automation and ICT solutions. Internationalization and scale up are key for competitiveness. Innovation is seen as source of new product applications, and for that, collaboration with innovation institutions, R&D and sustainable products development, as well as new manufacturing technologies, automation and robotization, are needed. Threats for this industry are the volatility of prices of raw materials and energy and the dependence on raw material suppliers from Asia and Middle East. SMEs tend to have a weaker position in the chain, between large chemical companies and large companies.

Machine-making[38]

This is also a very diverse sector, which makes parts and devices that in a large majority serve as supply for other production companies. There is a strong segmentation by products and sales markets, and has a in international orientation. Some of the companies are niche producers. Demand for this kind of industries is cyclical and dependent on the demand of other industries; it is a sector that is sensitive to shifts in economic cycles. Therefore, it is a sector that has to adapt to rapid changes in demand and provide customized solutions. Evidently, demands for efficiency and productivity require investment in capital (AM, automation, sensors, nanotechnology).

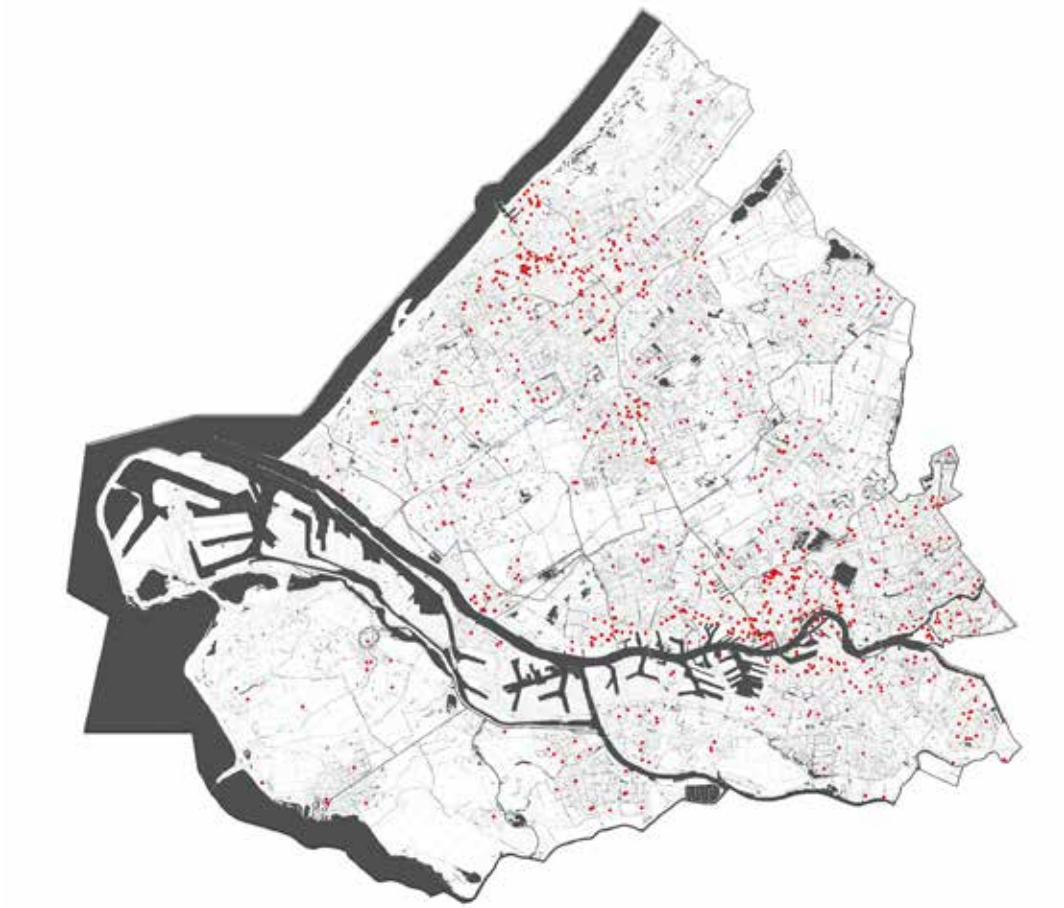
The sector amounts for 2,800 companies, of which 1.800 employ less than ten people. In contrast, 175 companies have more than 100 employees, and account for 50 percent of the total turnover of the sector. In total, all companies employ 80,000 people.

Shorter production cycles (changing needs by customers) demand an increase focus on R&D and strategic parts of production, marketing and final assembly, whereas standard production is outsourced. Delivery of customer specific total concepts, or platforms, including maintenance and service, quick response manufacturing, clean-tech, and collaboration with partners and intelligent software to implement automation are trends that new customer needs bring.

More integration of emerging technologies, such as modular machine concepts or intelligent software, industrial IoT, smart industry are an opportunity to address the need for flexibility, customization, increased speed of response: end customers require research and development capacity. Increasing competition and copying

Chemical processing
© LyondellBasell

P151
Workshop of Quooker, Ridderkerk
© Quooker



Map 3 - Furniture industries

Source: see Appendix 2

from machine makers in low wage countries is a threat to sustained innovation. Circular economy and reuse of machines is to be taken into account

The Metal Industry[39]

Again, it is a very diverse sector, in which companies are suppliers of machine parts and other metallic, semi-finished products. Sub-sectors include: construction and welding, machines supplies, surface treatments, metal ware, sheet processing, and maintenance and service. This industry works mainly as a supplier, and therefore is vulnerable to trends in other industrial sectors, and to economic fluctuations.

In the Netherlands, there are 10,600 companies. Smaller companies by far dominate the landscape: 9,000 employ less than 10 employees. In turn, 120 companies employing more than 100 people each account for 50% of turnover.

Metallic 3D printed components at RDM © Víctor Muñoz Sanz

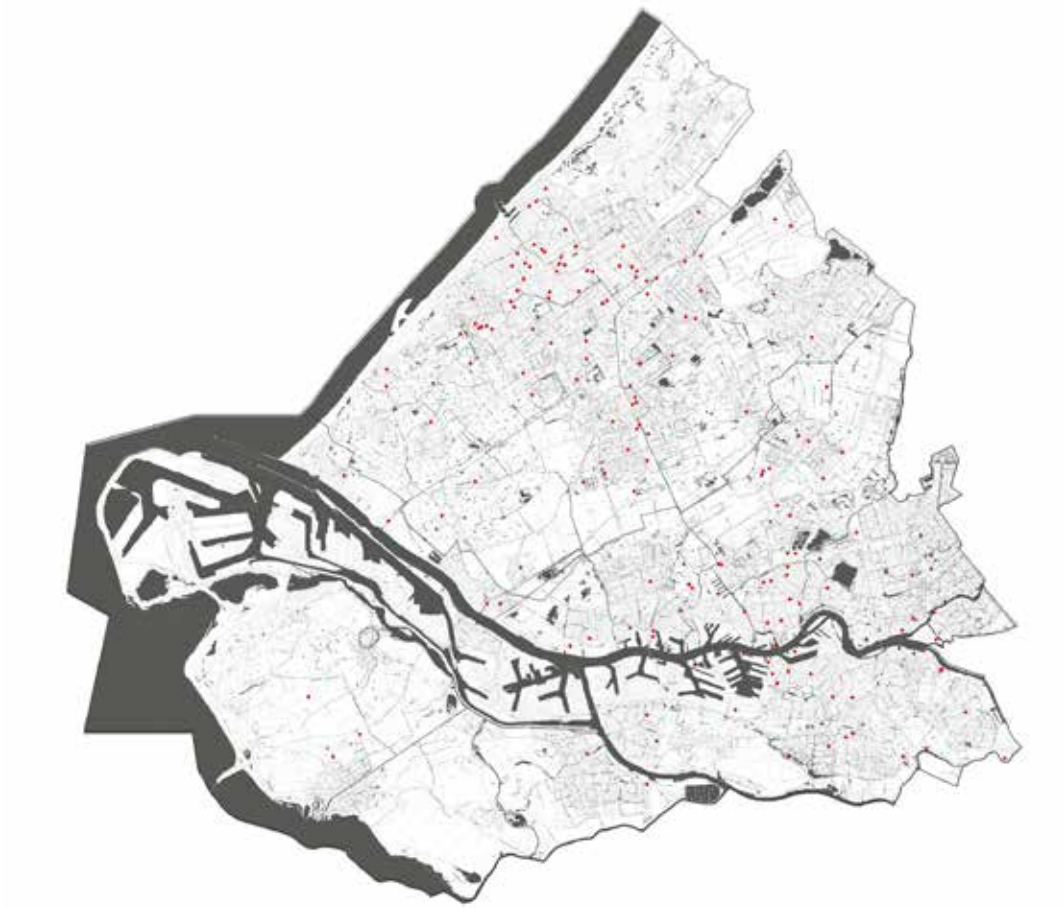
Smaller of order sizes and shorter lead times ask for lean management, use of innovative production techniques (additive manufacturing specially), and smart factory systems. This is linked to an increased demand for development capacity from customers, who also require high quality, composite products.

Opportunities against the vulnerabilities of this sector are the specialization in smaller niches, cost reduction and optimization, achieving higher productivity by speed, flexibility, and automation, shifting orientation to exports, and attracting and retaining competences. Competition from cheaper countries is a threat.

Furniture-making[40]

This sector includes the sub-sectors of home furniture, office furniture, kitchen furniture, and interior design. It is highly dependant on consumer spending and likes. It is predominantly a small salle sector, including crafts: 95 percent of 3,600 companies employ less than 5 employees.

Dutch furniture making



Map 4:
Carpentry industries

Source:
see Appendix 2

is positioned in the middle to high segment of the market, and international competition is high: 70 percent of what is sold is manufactured abroad. The improvement of the housing market and consumer spending is helping this sector.

Consumers increasingly ask for value for money, shorter product life-cycles, and have rapidly changing needs. Such customer oriented production means small production.

Internet as platform for sales, circular economy and reuse of furniture, and the consolidation of businesses are trends that could counterbalance the import of cheap furniture. Innovation in design, manufacturing, sales, and marketing, new materials, reuse, engaging with well-known designers, automation and quick response manufacturing, and exports to emerging markets are big opportunities for this sector.

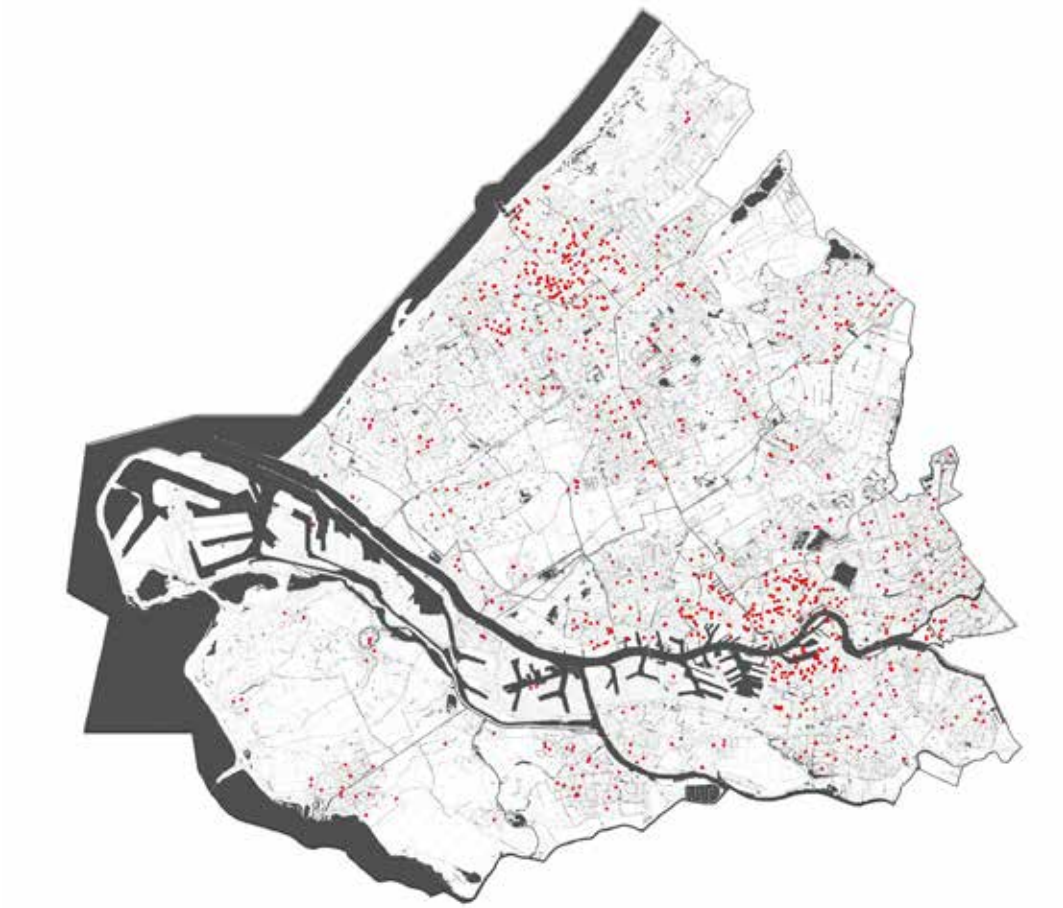
The increasing power of retail platforms at the expense of manufacturer's position, price pressure, volatile price of raw materials, and shortage of qualified personnel in turn threat its sustainability.

V-Table, by Elok
© Elok

Carpentry[4.1]

About 1,300 companies operate within the carpentry industry, manufacturing doors, stairs, timber frames, window frames, etc. These are small companies, only 15 of them employ more than 50 employees. In turn, 800 of them are craft businesses, with just one employee. It is mainly a supplier of the construction industry, so it is certainly dependant on its developments, and seasonal patterns. It is in competition with plastic and aluminum products.

Automation to save labor costs and materials, Chain optimization, speed-up delivery and production, prefabrication, new low-maintenance wood concepts, and giving added value to products (service and maintenance) are ways to adapt the industry to a changing landscape of customer demands, and to



Map 5:
Food industries

Source:
see Appendix 2

Buurman construction market
© Buurman

position it through innovation against the competition of plastic and aluminium.

Dependence on decision makers, for example architects (in choice of material), the scarcity of timber due to emerging markets and use for biomass, competition by other materials, and the increasing demand for high-quality are threats that well channelled become an opportunity to differentiate in price and quality with the competition. The use of FSC certified timber, investment of knowledge in sales, and quick response manufacturing are additional ways of finding niches in the market. The aging of workforce asks for new models of training.

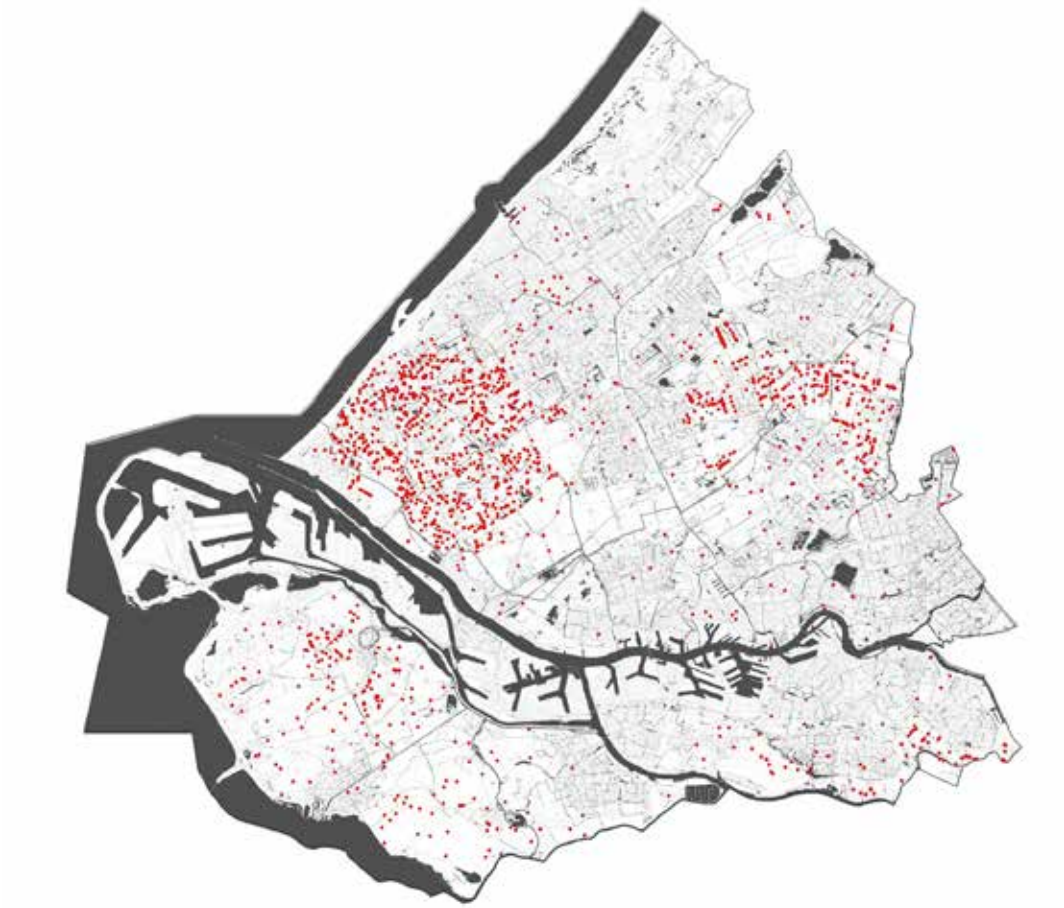
Food[42]

Dutch food industry encompasses many sub-branches, namely:bread processing industry, meat processing and slaughterhouses, dairy industry, oils and fats, derivatives of fruit and vegetables, animal food, drinks, cocoa, chocolate and sugar, tobacco, flour and starch products, and fish. The turnover in the food industry increased by 0.4% in the third quarter of 2017 . In this sector domestic sales decreased by 3.8%, foreign sales increased by 4.2%. In the tobacco industry, sales fell by 19.1% the last quarter of 2017 compared to a year earlier. The turnover in the beverage industry has remained virtually unchanged.

Selling prices have risen again after almost three years. An increase in prices had not occurred since the third quarter of 2013.

The Dutch food industry includes 5,275 companies, employing 135,000 people. The food industry accounts for 22% of the total industrial production in the Netherlands. Total production value is approximately 65 billion euros.

Bakkerij Voordijk
© Bakkerij Voordijk



Map 6:
Horticulture

Source:
see Appendix 2

Horticulture[43]

Between 10,000 and 10,500 Hectares of land in The Netherlands are occupied by glasshouses for horticultural production - around 4,000 in the Westland. While this area has remained unchanged, its productivity has increased. This is a very capital intensive and innovative industry, strongly oriented to exports. Since sales remain constant, and productivity improvements due to automation and digitization, it is expected that the glasshouse area will be reduced. Scaling up is not expected.

The overall trend is that leading to not scaling up production, but achieving higher productivity per square meter by means of technology: increasing automation and mechanization of operations; semi-closed cultivation and geothermal energy, new long-term preservation techniques, and intensification cultivation through increased use of LED lighting. Growing sales but increasing consumer demand call for more intensive cooperation in the chain of breeders, growers, exporters, and customers, and certification of business processes. Reaching a wide range of consumers asks for more diversity in sales methods, and a new focus on local-for-local production.

Scarcity of qualified personnel, emergence of foreign production areas, the growth of the EU, strong mutual price competition, or the strong position of retail organizations are a threat to the sustainability of the Dutch horticultural sector. Division in sales channels, restoring exports, digitization and improving efficiency by automation and robotisation, clusterations and regional distribution centers, and the use of sustainable energy sources (including geothermal energy) and closed cultivation systems are opportunities to remain competitive. Know-how and product innovation, and collaborations in the chain could address the demands for added value and exclusivity by customers.

Westland glasshouse
© Goldlocki /
Wikimedia Commons

PROFILE OF INDUSTRY IN THE ROTTERDAM THE HAGUE REGION

The city of Rotterdam has a mixed economic profile, with lower GDP per capita, growth rates and employment rates than the national average. Rotterdam The Hague Region has an economic structure with a significant share of business services, a harbor activity associated with it (such as shipping, hoisting-lifting-hauling, constructions and food and food stuffs), a capital intensive industry and a sizeable public service sector. Rotterdam is the location of numerous companies, notably: Unilever, Mittal Steel, Nationale Nederlanden, Flora Holland, and Robeco. The declining economic sectors in the region – including traditional industry, logistics and public services – are still dominant[44].

The main three sectors in the country, manufacturing, health, and financial services, are underrepresented in Rotterdam due to its specialisation[45] Energy, water, and the waste sector are overrepresented when compared to the Dutch economy[46]. ICT and financial services are also underrepresented. This affects the diversification of Rotterdam's economy[47]. In contrast, horticultural business, export of products, knowledge and technology are well represented.

In Rotterdam, jobs in the manufacturing sector account for 32.3%, versus a 67.7% of jobs in the service sector. In contrast, in the larger region of Rotterdam, manufacturing accounts for 53.8% percent. Within the high-tech production sector, metal products and machinery, and equipment industries are the most important manufacturing areas. Main employment industries in Rotterdam, from larger to smaller are: IT Services, Architects, Engineers and Technical Design Metal Products Industry, Other Machinery and Equipment Industry, Repair / Installation Machinery and Equipment, Electrical Equipment Industry, Computer and Semiconductor Industry, Research and Development, Automotive Rubber and Plastics Industry, Basic Metal Industry[48]. There is a strong specialisation in transport, storage and wholesale, due to the presence of the port of Rotterdam[49].

The city of Rotterdam set in particular three priority clusters:

- The energy-intensive chemical and refining industrial cluster in Rotterdam and Moerdijk is under pressure. On the one hand, the competitive position of these companies has significantly deteriorated in relation to the United States due to the development of shale gas in that country. The cluster is challenged by having to drastically reduce CO2. Without further action, the cluster will be faced with stagnation and contraction. As a result, Clean-Tech and Water related industries are emerging. Rotterdam is a city with an efficient and clean port complex, making it the European centre of the biobased and circular economy. On a global scale, Rotterdam is at the forefront in the field of water management and delta technology. This places the economic Clean-Tech cluster in a solid position as one of the pillars of the Rotterdam economy. ;
- The medical and health cluster is relevant due to its high-tech and innovative character, new entrepreneurship, but also its employment potentials in the future. Rotterdam aims to increase the economic spin-off of the Rotterdam and healthcare institutions in medical research and education. 3) The Creative Industry is limited in size but certainly promising for the future and a key, innovative part to broaden the Rotterdam economy while the city aims to expand locations for creative industries[50].

EMPLOYMENT TRENDS AND CHALLENGES IN THE METRO REGION ROTTERDAM THE HAGUE

The city of Rotterdam contains some 474,000 residents and employs 284.598 people[51]. The Metropolitan Region Rotterdam-The Hague reaches 1.2 million (2016)[52]. The workforce in the Netherlands increased by 4.5 percent in the period 2006-2016 since the 2008 financial crisis.

Strategy and vision reports for the Rotterdam-The Hague region

Although the economy is recovering, the labor market is lagging behind; unemployment remains relatively high with an 7.8% (2016) - as compared to a 6% in overall Netherlands, or 6.9% in the Province of Zuid-Holland[53]. In the agglomeration of 's-Gravenhage (The Hague) unemployment was barely below the region's average with a 7.7%, while in Rijnmond (Rotterdam region), the figure was the highest among subregions within the Metropolitan Region Rotterdam-The Hague, 8.1%.

The general employment market in the metropolitan region is currently undergoing a series of important transitions that can offer an insight into conditions for manufacturing. Firstly, there is the trend from industrial to post-industrial employment. Between 1996 and 2012, the Netherlands has overall experienced that shift, nonetheless, in Rotterdam there is still a relatively large share of manual labor - 16 percent as compared to 7 percent in Amsterdam. Secondly, from employed to self-employed; the 2009 to 2012 recession period scratched 16,000 jobs in Rotterdam, while 17,000 self-employed activities began, a growth of self-employment from 8 to 10 percent. To clarify this statistic: self-employment does not necessarily mean entrepreneurship but often concerns precarious forms of work. Third, from full-time contracts to part time: the share of part-time jobs went from 47 to 49 percent in the aforementioned period[54].

Fourth, a trend of polarisation and displacement of jobs with a decrease in 10,000 jobs low skilled jobs (primary and secondary level education) ; vanished during the crisis. It is worth saying that the proportion of people with a higher education in the working population of South Holland / Metropoolregio Rotterdam The Hague (36%) is below the average of

Box 1:

What is urban manufacturing in the Next Economy paradigm?

While the Next Economy appears to be a catch-all term, let's unpack what it means for urban manufacturing.

Firstly, it is characterised by blurring boundaries: 1) between sectors, clusters, and scales of operation - local or multinational; 2) between production and services; 3) between public and private initiative; and 4) between living, working, and leisure (having as downside the rise of the 'gig-economy' and other kinds of flexible jobs)[60].

Secondly, it is driven by technological and social innovations, being its pillars digitisation, the internet of things and sustainable, distributed energy[61]. It represents a shift from "centralized, vertically organized and linear economy towards a distributed, collaborative and circular economy"[62] however it is based on the "The... renewal and development of the economic sectors already present in the region..."[63].

Thirdly, it calls for inclusive economic growth, promoting social innovations and new organizational modes that invest in people and their skills[64]. Finally, it is "the transition from mass-production to mass-specialization and from stable to flexible"[65] andbased on customisation[66] .

"Nothing illustrates the Next Economy more than the so-called makers movement" , as "the new economy is, among other things, based on small scale, locally organised networks of manufacturers and consumers, and offers space for technological innovation.... The new makers are fully at home in the new economy:... based on honest, clean circulation"[67].

Urban manufacturing [1] develops radical new technologies, collaborative models and skills; [2] brings to urban ecosystems "scalable and open business cases"; [3] crossover opportunities; and [4] bridges between "entrepreneurial region and society"[68].

metropolitan regions in Europe (2015): London tops the list with 49% followed by Brussels with 48%. This rate lags below the average of other European city regions (4.4% growth between 2008 and 2015)[55]. Vacancies for low skilled workers decreased by 23 percent between 2011-2014. In turn, vacancies for high skilled staff grew 8% in the same period, and 22% just in 2014. Between 2008 and 2016, the labour force with a higher education level increased relatively quickly, by 6 percent[56]. Unskilled staff remains mostly in the trade, business services, and hospitality services. In the non-working population, the proportion of those aged 55 to 64 and belonging to non-Western groups is higher.[57]

Furthermore, companies under the management area of the Rotterdam Port Authority accounted for 26 percent of the regional employment in 2016, by far the largest employer. The Port and Industrial Complex of Rotterdam include economic activities which are directly or indirectly related to the port, and are located in the area managed by the Port Authority. This includes activities such as transport and logistics, manufacturing and maintenance and maritime services[58]. In the Rotterdam port area the expectations for the labor market for the short and medium term are positive. The higher demand for labor resulting from increased spending exceeded the loss of jobs is followed by trends linked to technological developments and increasing labor productivity (automation and digitisation). However, this raises concern. Firstly, the requested level of education in vacancies is increasing, beyond regional supply. Secondly, it is very likely that people who have been been in long term unemployment will remain so

as they cannot catch up with new employment opportunities. Therefore, programs linked to the acquisition of technical skills and support for those long away from the labor market are needed[59].

THE NEXT ECONOMY

The 'Next Economy' is the paradigm dominating the urban and economic development in the Rotterdam since 2014. Founded by economist and social theorist Jeremy Rifkin, 'Next Economy' is the broad umbrella under which new forms of urban economy can be explained including the framework for a new 'third' industrial revolution, refer to Box below.

The Next Economy founded on connectivity, open source and high-tech, which does not sit neatly into the adaptation of more traditional industries. In contrast to the idea of a technologically-driven productive future, more traditional ways of making, such as craft, are present in the mind the City Development Department of Rotterdam when defining manufacturing resulting in different visions for the future. Friction is emerging between the camp focused on a high-tech future and the camp that sees manufacturing as a socially oriented profession oriented towards development of jobs and skills.

Conflict in future land use

With the large portions of the older portland closer to the city, opening up to new development, the question is now what will replace it? The main obstacle in the development of a strong urban manufacturing sector is the availability of space, which could be an ideal candidate. However there is another agenda. The primary conflict comes from 1) the demand for developing more housing targeted at middle to high income groups, 2) the environmental regulations that limit the possibilities of mixed-use housing-manufacturing, 3) the dominance in the economic agenda and sectors of the port, and, in general, 4) the lack of a vision or policy for urban manufacturing.

Key Sectors of the Next Economy

The Next Economy entails "the renewal and development of the economic sectors already present in the region"[69] . Which are the key sectors that the policies are actually addressing? As it becomes apparent, "the generic themes that characterize the Next Economy (communication, energy, and mobility internet, circularity and education and labor market) are confronted with the sectors established in the region"[70] Three key sectors emerge as the ones dominating the future economy of Rotterdam:

1) Agro-Food: The presence of the port of Rotterdam makes the city a hub for the transhipment of fruit, vegetables, juices, soya beans, maize, edible oils, grains and seeds. Rotterdam boasts cold storage facilities with 1.8million m3 for climatised storage and 750,000m3 for cold storage, and 580 horticulture companies receive CO2 from the industries in the port complex Rotterdam. The Netherlands accounts for 7% of worldwide agricultural exports, mostly moving via the port: agro-food accounts for 10% of Dutch GDP and 20% of industrial export. The Greenport Westland-Oostland, in the vicinity of Rotterdam is the largest agro-industrial complex in the country.

The city is also close to Greenport of Barendrecht. Food production and logistics processes are concentrated in the Rotterdam, Westland, Oostland, Ridderkerk and the Barendrecht region. Key players in the Agro-Food business include: producers such as Refresco, Verstegen and Provimi; logistic services companies as Eurofrigo and Fyffes; traders such as Verstegen and Nidera; suppliers such as Akzo Nobel, Emerald, Kalama and DSM; and R&D companies such as Unilever and Rijk Zwaan.

Related knowledge institutes such as Erasmus Medical Centre, NIZO food, TNO, WUR, Top institute Food & Nutrition (TIFN) are all in close proximity of Rotterdam.[71]

2) Life Sciences and Health: with the Erasmus MC as the spearhead for technol-

ogy and health research and development, innovation in medical world, domotics, robotics, medical instrument, and pharmaceutical industry. Also in connection to Agro-Food, the Erasmus Medical Centre is leading in research on the role of food in the prevention and treatment of disease. Near the M4H area, the Rotterdam Science Tower aims to become the location where spin-offs from Erasmus MC can thrive, with a mix of laboratory and office space and facilities for medical education

3) Cleantech: Circular business principles are foundational for Rotterdam's Cleantech/Maritime sector. The sector includes the following subsectors: Sustainable building, sustainable mobility, sustainable energy, maritime and delta technology. These businesses could potentially benefit from flows of waste, for example: plastic wastes (~30 kton p.a. from households), green waste from trimmings & pruning etc (~20 - 40 kton p.a.), E-waste from households (~1 kton) and SME's. Waste water (~58 Mton p.a.). Companies that are in the cleantech business are: Umincorp, Sita, VGG, Circularity centre, Wecycle, Topsurf, Evides, Marconia, Akzo/Enerkem. These three sectors account already for 146.000 jobs in Rotterdam.

Researchers, students and designers partnered up with business to develop one of the most efficient petrol vehicles at RDM Rotterdam. © Adrian Hill

ROTTERDAM THE HAGUE AS TESTBED OF TRENDS TOWARDS THE NEXT ECONOMY

Technology

Visions and strategies of urban economic development in Rotterdam are founded on the adoption of new technologies in services and production[72] . These are mainly digitisation, robotisation, circularity. Most certainly, these will guide the way urban manufacturing will unfold in the Rotterdam region in the coming years. Rotterdam aims to be at the forefront of a long list of innovative technologies starting from smart applications of ICT technology, artificial intelligence (AI), Virtual Reality (VR), Internet of Things (IoT), blockchain, robotics, automation, sensors (all these applied to the logistics or medical sectors, e.g.), to those directly linked to the material world, such as additive manufacturing, 3D printing, and the development and use of new materials.

3D printing is hailed for its potential as a driver for an urban making economy: it is suits low-volume production, allows for mass-customisation, and it frees production from the spatial and economic requirements of traditional factories: "just as digitization has freed some people from working in an office, the same will happen in manufacturing."[73] . It is also expected to simplify the process of making and enable attracting the power of the crowd to production. Both 3D printing and robotics have the potential of making factories smarter and flexible: "The days of huge factories full of lots of people are not there anymore. Advanced robotisation also means factories can run 24 hours a day, 7 days a week without heating or lighting, saving costs to the point of making manufacturing cost effective in higher-wage countries" [74] .

The sector in which this shift towards smart industry will be more visible in Rotterdam is that of the maritime industry, as seen in the projects, existing and planned, for the Stadshavens[75], or in the maritime delta of the Drechtsteden, where shipbuilding and offshore industry is gaining momentum with 3D printing and robotisation[76]. This is the best example of the aim of renewing existing industrial sectors under the umbrella of the Next Economy.

Energy

Rotterdam, the region and country at large, have the target of transitioning to sustainable energies in the coming decades, leaving fossil fuel economies behind. The deployment of smart grids in the region to be more energy efficient and self-sufficient has its prime example in the Westland, the agro-food cluster, where plans for a smart grid of geothermal energy and reuse of CO2 are underway[77].

Labour

The Next Economy is that of the 'prosumers': customers become part of the production process or provide services, with the potential emergence of cooperative models, or ideas of a self-sufficient city[78]. It is also related to the sharing economy, which entails the risk of bringing gig-economy and unstable, temporary jobs[79] .

Digital manufacturing will decrease costs and make it less labor intensive, making it possible to reshore industries from developing countries with the possibility of non-human factories and displacement of labor[80] . However, "In some cases a "manufacture locally" revival could take root, as companies cluster their design, production and customer service unites regionally to enable faster responses to new trends, demands and preferences of end-users.

As production and design become increasingly integrated, it is foreseen that off-shoring of the production process will become more difficult and lose its advantage of cost per unit for those products that rely on high customisation and new technologies"[81].

4.3 Governance and Decision Making in Rotterdam-The Hague

Holland has grown out of rigid territorial planning that clearly described what was to occur where. This generated almost a century of top-down segregation of manufacturing from other land uses such as housing and leisure. However with a radical change in planning policy based on performance criteria, the manufacturing landscape may undergo radical change.

SPACE: PLANNING CONDITIONS

Dutch Planning System in a Nutshell[82]

In the Netherlands the Spatial Planning Act (WRO), national level, defines how the spatial plans of the state, provinces and municipalities are to be put into effect. A municipal land-use plan (bestemmingsplan) is an example of a spatial plan. This section will summarise the main instruments in Dutch planning, but one must be aware that all this will change with the passing of the new Environmental Law (Omgevingswet), which will profoundly change how planning is made in the Netherlands: for example Zoning Plans and other plans will be replaced by one single plan, called Environmental plan (Omgevingsplan).

Spatial planning decisions are made at the national, regional and local levels, therefore is characterized by decentralization. The spatial visions of the government, provinces and municipalities describe the spatial developments they expect as well as how these developments will be directed or implemented. Spatial visions are policy papers that have replaced the key planning decisions (of the national government), the regional plans (of the provinces) and the structure plans (of the municipalities).

Spatial planning policy and its implementation are, in so far as possible, shaped at the municipal level; municipalities hold the most important powers in planning. The municipalities are able to set appropriate regulations based on their knowledge of the local situation. The state focuses on subjects that are of importance to the entire country, such as improving accessibility; these national interests are set down in the Spatial Vision

on Infrastructure & Spatial Planning (SVIR). In turn, the provinces focus on provincial interests, for example, landscape management, urbanisation and the preservation of green spaces; provincial interests are set out in the provincial spatial visions.

Land-use Plans

Land-use plans, or bestemmingsplannen, are the most important tool in Dutch spatial planning, defining thelegally binding form of spatial designs. Such plans set down where construction may take place, what may be built, the size of the structure and what it may be used for. The fixed components of a land-use plan are: the rules and regulations for the area concerned; an illustration (planning map / bestemmingen) that indicates and explains the various zones, land-use objectives (residential area, industrial area, agricultural use). The plan contains rules about building lines (rooijlijnen), vistas (zichtassen), as well as development regulations (bebouwingsvoorschriften) on, e.g, building height or mass.

Building Permits

The key governmental power in planning law is that of requiring permits to a project initiator. These affect planning of building work, for execution of the work, and for use of the work. It has to comply to different levels of regulation, and can be rejected if it is in conflict with, a.o: Building decree (Bouwbesluit), Municipal building ordinance (bouwverordening), Municipal Land-use Plan (Bestemmingsplan), Requirements of external appearance (Redelijke eisen van welstand); Rules of provincial order or national order. These orders must be incorporated in the affected Bestemmingsplannen by municipalities.

Another plan at municipal level is the Visual Quality Plan (Beeldkwaliteitplan) which offers notions on the desired form and structure of an urban area. It is not ground for refusal of a building permit, but in fact, it is used for that, as it can be used as reference by the External Appearance Committee in its decisions.

Rotterdam: Compatibility with urban form and systems

In the economic and urban planning and policy discourse in Rotterdam, there is a case made for urban manufacturing and mixed uses as the most clear manifestation of the Next Economy in the city. “As young makers prefer to live and work in the city, the makers movement brings back production to the city. They tend to locate in underutilised areas, given the availability of space and the ‘raw’ atmosphere that they seek-after.

As the Next Economy is about human interaction, creation of denser urban spaces and enabling social interaction”[83] . Because it is often about clean and often small-scale industry (3D printing), the new manufacturing industry can also settle in the urban areas near their employees, clients and other partners[84] holding the potential of “moving small scale industry back into city centers, using the city as an incubator by taking over disused office and retail space and breathing new life into the city centre”[85]. In short, urban making is desirable and compatible, at least in theory, with the city of the Next Economy, but urban making requires mixed, vibrant urbanities to thrive.

Such realisation is present in the municipal visions: “Strengthening interaction-friendly is one of the most important tasks in the Next Economy. It’s not just a nice appearance of public space, workplaces and buildings, but also to create the right mix of features....[however] in Rotterdam, [despite] all ingredients are present for a successful mix,... there is still lack of cohesion, cooperation, spatial connections, meeting places, etc.”[86]. The plan for an ‘Makers District’ at the former city harbours, Stadshavens, is the project with which the city wants to push forward this idea of a mixed urban district that has space for both production and living.

URBAN PLANNING CONDITIONS

There are numerous national and local planning conditions embracing and restricting urban manufacturing and new urban economies, ranging from very practical 'work at home' regulations to a development prejudice towards housing.

Environmental Categories

The Association of Dutch Municipalities (Vereniging van Nederlandse Gemeenten; VNG) provides a guideline advising municipalities on zoning locations of different types of businesses in relation to dwellings and vice versa, in terms of possible nuisance such as smells, dust, and potential danger (of explosion or fire e.g.). The guideline classifies activities in 6 environmental categories, and establishes a recommended distance between those economic activities and dwellings.[87]

Housing shortage

The city of Rotterdam has set a target to build 50.000 new homes by 2040. City expansion is not desirable to satisfy the demand for housing. Instead, the use of old port areas in now central locations, and the densification of the city center is the preferred option. Added to the restrictions in mixed use housing-manufacturing imposed by environmental laws, the emergence of interactive spaces for living, innovation, working and making seems unlikely, unless more flexible frameworks were put in place. The first structural vision of the Stadshavens[88] already discussed the possibility of adapting environmental contours, using all legal possibilities, to combine companies with housing.

30% rule for work at home

A rule, 'Werken aan Huis' (working at home) or 'Aan huis gebonden beroep/ bedrijf' (home based business), present in most of the current zoning plans in Rotterdam allows to use up to 30% of living space for work purposes; depending on the specific zoning category of the location, different types of businesses are allowed. These are usually those of category 1 according to the VNG, except retail activities and car repair.

Restructuring of Horticultural Cluster in Westland

In the case of the Westland, the situation is the opposite to Rotterdam. The priority is to serve primarily the needs of the greenhouse horticultural industry. Other uses are subordinate to this

Implications of the New Environmental Act

This new Environmental Act is a real shift in Dutch spatial planning policy that was renown for rigorous detail, is now focusing on performance based criteria. Zoning as it's now known will disappear, and land use could become, in general, more flexible--in the so-called areas in transition for example. When it comes to manufacturing uses, It would be up to a municipal organ to decide whether the use is appropriate or not for a given area. Flexibility means that, if well argued, a clean, high tech, nuisance-less manufacturing business could settle in an urban environment, in spite of belonging to one of the environmental categories that were not supposed to mix with housing before. It also means that, in the absence of a mediating figure or a strong urban manufacturing lobby, decisions will be made in a business as usual mode[91].

The Environment Act requires the government, provinces and municipalities to make an environmental vision (this replaces spatial visions). In the environmental vision they have to take into account the different interests in an area. Then environment plans are done for specific areas substituting the current bestemmingsplannen. In practice, applicants require 1 license (digitally) at either the municipality or province (either of them) makes a decision.

An abandonned former wharf offers obvious potential for public space and housing.
© Adrian Hill

industry[89]. The solution proposed by the Province of Zuid Holland and Westland municipality is to restructure the glasshouses, being more efficient in the use of space in order to free up land for uses that would increase the liveability of the area.

New Environmental Act

To be in effect in 2021, the new Environment Act, the Omgevingswet, the Dutch government wants to simplify and merge the rules for spatial development. Making it easier, for example, to start construction projects. This law brings together 26 existing laws, dealing with, among other construction, the environment, water, spatial planning and nature.

The goals of the government with the new Environment Act are threefold: to better coordinate and integrate the various plans for spatial planning, the environment and nature, encouraging sustainable projects (such as wind farms); further decentralize decision-making, so that municipalities, provinces and water boards can adapt their environmental policy to their own needs and objectives. The law wants to encourage the private sector. Permits are simplified and rules will be more general. The “attitude in assessing plans is ‘yes if’ instead of ‘no unless’”[90].

Over the last decade, a number of examples of urban manufacturing and Next Economy have emerged across the region. Interestingly voices in the municipality claim that “the necessary ‘next city’ is already in progress in the existing and concentrated physical and functional structure of the city. This applies especially to the northern Maas river, the city center and surrounding areas such as Kralingen, Delfshaven, the Old West, the Middle and the South of the South. The attractive housing market, together with the presence of strong companies and facilities for the next economy of consumers and producers, lends itself to capitalizing on innovative economic dynamics”[92]. However, some areas in transition, being transformed from their mono-functional use to interactive environments are of particular importance in the region.

4.4 Ongoing projects and Activity

Rotterdam's pioneering DNA is projecting ambitious moves in development projects within abandoned inner-city port sites - however under the surface both vision and compatibility with house are in question. Within the inner-city, grass roots projects are emerging based on more 'informal' spaces for making. While in the greenhouse district, a mechanised agricultural future looms awaits.

STADSHAVENS: M4H AREA + RDM, "THE MAKERS DISTRICT"

Early on 2018, the city of Rotterdam and the Port of Rotterdam Authority decided to rebrand the RDM and M4H areas as the "Rotterdam Makers District", "the place in the region for the innovative manufacturing industry."[93] For these authorities, innovative manufacturing industries (focused on new technologies such as additive manufacturing, robotics, and material science) requires small and medium-sized spaces, labs, cleanrooms, data centers, and flexible, open environments. With these facilities co-developers and co-producers can quickly react to the changing nature of technology and economics.

RDM Rotterdam

RDM is a collaboration between the Port of Rotterdam Authority and Rotterdam University of Applied Sciences and brings together port-related manufacturing industry and related education and R&D. The 23,000m2 site is located in Heijplaat (Rotterdam Zuid), in a former submarine and shipbuilding facility, a 20 minute ferry ride away from the city centre. The area is the lighthouse of the port's transition towards innovation. There are three educational institutions with 1200 students, the Hogeschool Rotterdam (HBO), the Albeda College (MBO) and the Zadkine College (MBO). Start-ups, SMEs and big names in the maritime sector can take advantage of the space, the technology and also the knowledge and skills attached to the education facilities. Vacancies at the RDM are limited and demand continues to increase despite voices claiming it to play a minor role in " innovative business dynamics", isolated nature, and lack of amenities"[94].

Merwe Vierhavens area
© Stadshavens Rotterdam

M4H Rotterdam

Located opposite to the RDM, M4H was in use for fruit transfer for many years. The juice cluster in Vierhavens is still functioning, but fruit transshipment has largely disappeared from the Merwehaven as a result of containerization, leaving behind many vacant buildings. Pioneering and craft manufacturing companies have found space on their own in the Keilewerf or use the facilities at Fair Design Square. Creative entrepreneurs such as Studio Roosegaarde and Atelier Van Lieshout were offered a space there. Other companies in the circular manufacturing industry such as Rainmaker Holland, and Buurman are located there.

The area is divided in two parts, a central one, on land of the Port Authority, and the peripheral, belonging to the City of Rotterdam. The port is renovating the premises and infrastructure and leasing properties to companies exclusively. Businesses willing to settle in the port's land have their candidacy assessed by a board on the basis of the adherence with the following values[95]:

- Social value: if entrepreneurs can offer work experience places to people from surrounding neighbourhoods or if they are going to make use of the student population of RDM and its faculty.
- Economic value: Innovative, technological companies that add to Rotterdam's manufacturing economy especially in the maritime sector.
- Physical value: Businesses wanting to invest in the area or that have a background in sustainability.

The larger the contribution to the three forms of value creation, the more possibili-

Bird's eye view of Rotterdam centre © Debot / Wikimedia Commons

ties there are for attractive contract conditions and duration.

The site under control of the City of Rotterdam falls under a very different paradigm. Plans are to develop a mix of living and working environments and a clear system of public spaces. Here the city will offer the land to residents and companies with an erfpacht (long-term lease), but without any other contractual requirement with regard to the way land will be used. In principle, there will not be land zoned as 'industrial' or 'manufacturing' but as 'flexible use' (which includes retail and hospitality uses). Some of the current industrial or retail uses present on municipal land, for example Continental Chocolade, a chocolate factory, are considered undesirable for the new character of area and negotiations are being made for their relocation. In cases where redevelopment is affecting and effectively pushing out companies that the city wants to keep on site, like Buurman (a woodworking company), relocation within the area will be the desirable outcome.[96]

CITY CENTER (BINNENSTAD)

The city centre of Rotterdam has seen interesting manufacturing locations popping up in the recent years, providing workspaces for collaborative, high tech and creative businesses, including making activities. There are two types of urban location that enable these activities: first, the area or urban block and second, the high streets. Examples for area or urban block developments are hubs such as the Schieblock[97], ZoHo Rotterdam[98], or BlueCity[99], and social enterprises as Het Lab, among others.[100] Examples for the high streets, called stadstraten in Rotterdam that are part of the old structures of the city are the Beukelsdijk, Kruiskade, Oude and Nieuwe Binnenweg, Meent, and Hoogstraat among others. Whereas the first category takes advantage of vacant areas in the city centre and focuses more on collaborative innovation environments, the second category provides more spaces for individual smaller companies, which find their place in smaller buildings, being part of the high street. The location of the high street allows businesses to produce and sell to the end user at the same place.

Buildings in this environment become more and more interesting as locations for small scale manufacturing, since many cities experience a decline in retail businesses that have been dominating high streets in the last decades. Most of these activities play a pioneering role in urban regeneration; high streets are, for example, the first space where (small scale) manufacturing usually comes back (due to real estate prices). Nonetheless, as real estate pressure increases, small manufacturing activities in these locations are at risk of being pushed out. According to Emiel Arendts[101], spatial advisor at the Department of City Development, regeneration and densification would be desirable in central locations, as it is more sustainable and would create synergies[102]. This would mean, however, the addition of more public infrastructure, schools, doctors, green spaces, and an increased competition for commercial space. Due to this, it is very relevant to develop planning and design rules that enable integration of manufacturing as a central function in urban life.

ROTTERDAM ZUID

While modest in productive scale, several initiatives focused on crafts and manual labour are emerging in Rotterdam south, creating synergies between creative industries in the north of the city with a mainly immigrant population that has traditional making skills. These activities mainly take two forms: home-based crafts (see 30% for work at home, section 4.3), and collaborative workspaces and enterprises specialized in high-quality, local food products. An example of the first is the initiative Wijkatelier op Zuid (neighbourhood Atelier), which connects among others Dutch fashion designers and related industries with residents who have access to knowledge of craftsmanship in textile making[103]in the Afrikaanderwijk. Examples of the second are 'The Rotterdam Mint', a herb garden where fresh herbs for Rotterdam-based catering companies are grown and sold[104], and Rotterdamsche Confituur, a social enterprise manufacturing fruit preserves.[105] For the city, these are noteworthy initiatives because they not only provide excellent urban manufacturing products, but also create community and bring people together in deprived areas, [106] addressing high unemployment in neighbourhoods in the south of Rotterdam.

WESTLAND

The regions of Westland-Oostland are home of the largest horticultural production glasshouse area in the world. The Westland alone contains more than 700 companies, involving 2,400 hectares of production and accounts for about 60,000 direct and indirect jobs. This cluster is in constant transition in order to retain its strategic importance, renovating its production systems and spaces to become more economic, resilient, efficient, and smart. However, increasingly the greenhouses are involving high-tech solutions resulting in automation of labor, production and logistics, which holds the potential of rethinking productive spaces, urban typologies, and its entire territory. In this sense, mechanisation and automation of the sector is turning it increasingly more industrial in nature, pushing the limits between agriculture and manufacturing.

Texile making workshop at Wijkatelier op Zuid

4.5 Driving Rotterdam's next economy

While no shortage of ambitions, finance and ideas, Rotterdam's 'New Economy' oriented future is not so clear. Jobs are shifting away from low skilled-manual labour which is available in abundance to high-skilled knowledge workers which is in shortage. Development pressure on available former port land is favouring housing over more strategic land uses for jobs or climate resilience.

1. CHANNELING THE NEXT ECONOMY

The transition to the so-called Next Economy attracts great confusion regarding which sectors to stimulate, the priorities, the new economic profile of the city and region and its basic industry in the future. Nonetheless, some sectors are named as strategic - and therefore absorb all the focus by institutions (particularly the port with regard to maritime manufacturing) and investors including: clean tech, maritime industry, health and agro-food. The opportunity lies in understanding the meaning of the Next Economy, in terms of the renewal of all productive cycles, innovation in manufacturing processes, products, logistics and knowledge transfer. The strong institutional support to for the Next Economy agenda, knowledge institutions and the availability of space in areas on transition (post industrial settings such as the port), in regeneration such as Rotterdam Zuid or being restructured including Westland) and several large waste streams mean there are conditions for a diverse and sustainable manufacturing landscape to emerge. How can the Next Economy and its resources be channelled into constructive urban manufacturing?

Manufacturing Smart Technologies

The Next Economy will force manufacturing to adapt. Clients will demand manufacturers to provide more flexibility, greater customization, smaller batch orders, quicker responses, more extensive level of service, possibility for R&D, require internal marketing, while scaling up demands internationalisation. All of that requires a new whole set of skills and higher capital investments. Dutch manufacturing companies, mostly small and medium companies across all sub sectors suffer from increased pressure to adapt to

these conditions. The consequence is likely to require higher collaboration between parts of the chain, which could lead to mergers, consolidations and acquisitions, ironically making the manufacturing ecology less diverse and resilient.

Another answer to the new demands is investment in Smart Factory concepts involving automation, additive manufacturing, sensors, digital platforms. This potentially will result in a shift in the character of manufacturing employment. Industrial platforms might also increase the dependence of companies in larger, multinational actors developing technology or software.

The question remains: how can a strong local network of knowledge institutions and entrepreneurs collaborate to develop innovative smart industrial concepts? Could sensors, robots, and other systems be designed, developed, and manufactured locally, creating in turn new jobs that replace those that will be lost by digitisation?

Manufacturing as Potential Source of Local Livelihoods in the Next Economy

Recovery since the 2008 financial crisis has manifested in higher productivity, but employment growth is lagging behind, and it is generally in form of precarious conditions as self- or part-time employment. Jobs for those which didn't pursue higher education, or have not updated their skills, a profile that defines a large pool of the region's population, have fewer options. In turn, vacancies for those highly educated or with skills linked to the Next Economy are in high demand. How to keep the large lower skilled segment of the workforce active and valuable in the Next Economy? How could urban manufacturing become a source of both traditional and groundbreaking modes of labor intensive, local jobs based on local knowledge and skills?

2. ENGAGING WITH THE PORT OF ROTTERDAM

The Port of Rotterdam has historically, and to this date, defined the economic profile of the city and region and its narrow focus on a few industries such as logistics and fossil fuels. Beside employment, there is limited local added value actually from all the materials and goods that flow through the region. Furthermore in the context of economic transitions and a European move away from fossil fuels, the region's dependence on employment from this large single actor remains a serious weakness.

The Port Authority certainly is adapting its profile and developing former port areas to introduce new, innovative manufacturing opportunities that support directly and indirectly its business towards the transition to the Next Economy. However, the focus on certain, specialised kinds of making, namely those linked to maritime industry, may limit the growth of a diverse manufacturing scene.

New urban manufacturing economies could benefit from being situated by the most important port in Europe, building on available resources and skills while turning its focus to Europe's most important agricultural cluster. World class logistics infrastructure and expertise, in addition to a growing network to capture wasted resources from port activities (such as CO2 or heat) could hold a huge potential. Furthermore, as the port modernises and moves westwards, it is leaving vacant, now more central areas that could become interactive spaces for a highly competitive ecosystem of urban manufacturing ecology.

The port authority is a strong actor, able to 'make things happen' when it comes to stirring urban and industrial development in the region. A fundamental question remains, how can the port be engaged in a conversation dealing with a broader understanding of urban manufacturing?

RDM Rotterdam - a place for R&D and startups
© Adrian Hill

3. NEW URBAN DESIGN PARADIGMS FOR A RESILIENT URBAN ECONOMY

If something defines Rotterdam's approach to planning it is "Rotterdam Make it Happen." This is evident in the city's ambitious plans of becoming circular, resilient and in offering more attractive housing, urban spaces and conditions for investment.

While this makes planning flexible and dynamic, it also means that planning officials can easily change priorities to meet certain urgencies. Some plans with great long-term potential, such as urban manufacturing, can benefit from this flexible planning environment. However, with medium to higher income housing considered the most urgent priority, this way of flexibility instead of rethinking the space and technologies for urban productive activities and their combination with living and territorial strategies against climate change could mean a missed opportunity.

The foreseen land price rise due to housing projects affects urban manufacturing as other higher paying commercial functions (such as logistics and large retail) push out the productive activities. In short, despite the plentiful amount available space in the city for making, it may be curtailed by short-term development opportunities.

In the absence of medium to long term certainty in zoning, or subsidies to improve insulation and technology to make it possible to mix making with residential, new initiatives and investments could be discouraged in favour of generic gentrified neighbourhoods.

With the region in very much in need of climate adaptation solutions and strategies to support the Next Economy, how can a case be made for environmental compatibility of urban manufacturing with other functions, including residential within the context of serious climate change challenges?

Mediating for Urban Manufacturing in Future Environmental Plans

With the new Environmental Act, traditional zoning will change. It will allow for even more flexibility to introduce new uses - in so-called zones in transition for example. Regulation will be looser, and the municipalities will have more power in deciding what and how things could happen. It would be up to a municipal commission to decide whether a clean, high tech, nuisance-less manufacturing business could settle in an urban environment, despite belonging to an environmental category which did not allow for mix with housing until now. It could also mean that without the proper expertise in municipalities, decisions will fall into a focus on low risk and predictable solutions addressing tangible issues such as housing.

Is a bridging actor necessary to mediate between decision makers, local residents and manufacturers in order to facilitate informed decisions at municipal levels on where and how industry can be integrated in an urban setting?

APPENDIX 1: KEY ACTORS

Gemeente Rotterdam. Department of Urban Development of the City of Rotterdam
This department starts and supervises spatial and economic investments in the city, and its initiatives are driven by the motto 'Make it Happen'. It is divided in four main areas: Spatial and Economic Development (Ruimtelijke Economische Ontwikkeling, REO), Urban Design (Stedelijke Inrichting, SI), Engineering Office (Ingenieursbureau, IB), and Project management office (Projectmanagementbureau, PMB).[107]

Spatial and Economic Development (REO)[108]
REO's goal is to stimulate spatial developments and investments in the city, together with other governments and market parties. It aims to make the city more attractive for private investors by working on the residential, living and business climate, with an special focus in the city center of Rotterdam.

Urban Design (SI)[109]
SI is the area in charge of defining the use and layout of the urban and regional space. It elaborates one of the main urban strategy documents, the 'Kaart van de Stad'. The Urban Planning department comprises the departments Space & Housing, Traffic and Transport, and Building and Housing Supervision. The Space & Housing department works on the spatial planning of the city, and it elaborates both the bestemmingsplannen (zoning plans) as specific, project-based interventions. Its core competencies are: urban development, planning, landscape, zoning plans, and the environment. The Building and house supervision department was created in 2015 from the merger of the Permits and Supervision Buildings departments. It focuses on building regulations and related procedures.

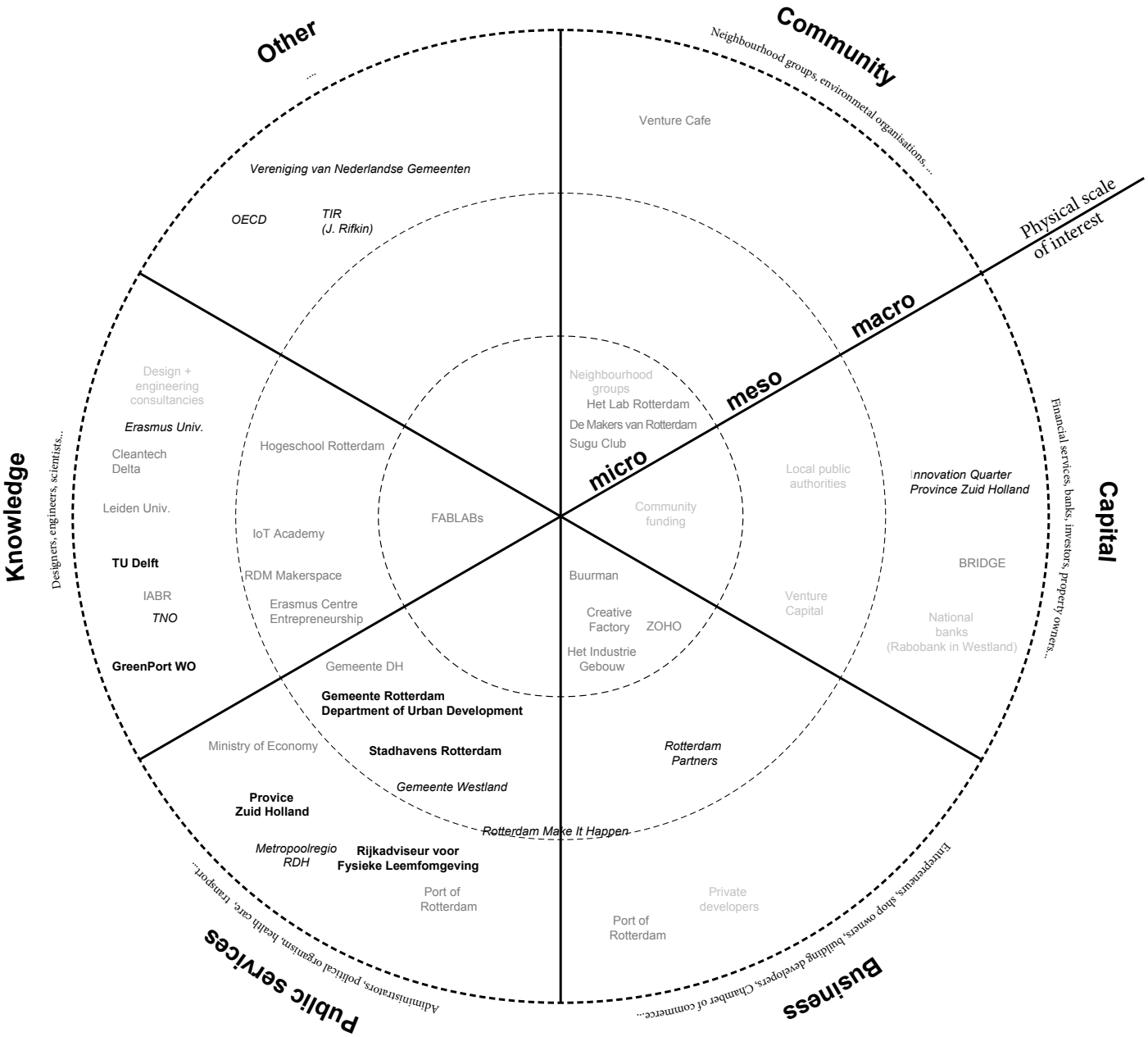
Port Authority of Rotterdam
As explained in the introductory text in this report, the Port Authority holds enormous influence on urban and economic planning and development in the city and region. As a 'landlord port', that leases areas to companies and provides them with infrastructure, it has great power in deciding what happens where and how, according to its long term strategy (Port Compass) towards becoming a greener and more efficient port. The Port Authority partnered with the municipality in the Stadshavens organization.

Stadshavens Rotterdam[110]
In 2007, the Port of Rotterdam Authority and the Municipality of Rotterdam entered into a special partnership for the redevelopment of the port areas located adjacent to urban areas in Rotterdam. The Stadshavens Rotterdam program office has done work to connect the city and port in the Rhine-Maashaven, Waal-Eemhaven, Merwe-Vierhavens (M4H) and RDM Heijplaat districts.

Province of Zuid-Holland
The provincial government is an intermediate entity in Dutch governance and policy; is is an important link in the government chain, between the national government and local authorities. The province has the position and the network to translate European and national policy into the region. The province is responsible of developing and implementing the Visie Ruimte en Mobiliteit (Vision for Space and Mobility). The Vision Space and Mobility do not offer a well-defined spatial final picture, but a perspective for the desired development of South Holland as a whole.

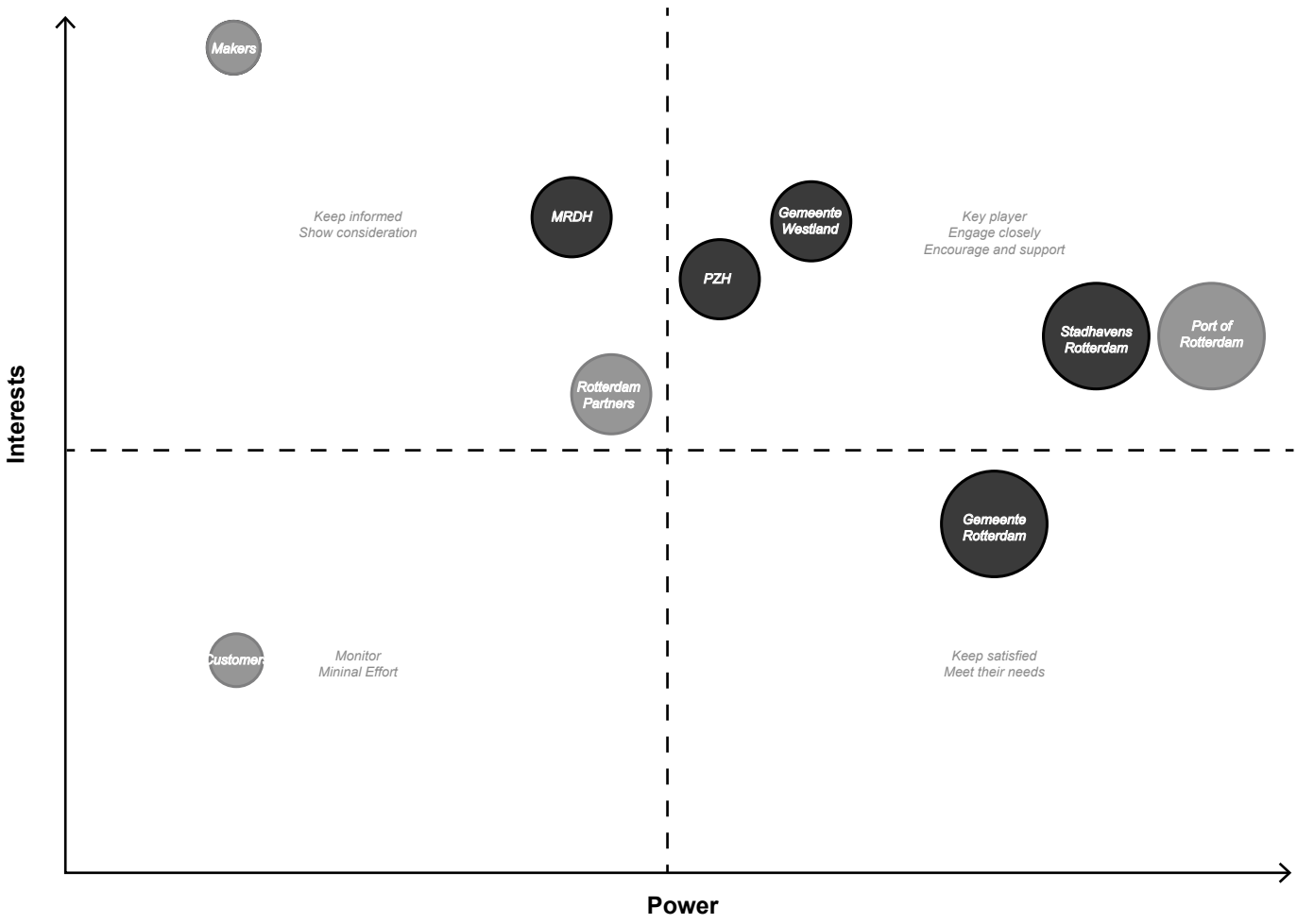
In order to implement the provincial spatial policy, the province has various instruments, of which the Regulation for Space 2014 (Verordening ruimte 2014) is the most important. This regulation is developed in collaboration with the different local governments. It sets rules for municipal zoning plans; zoning plans have to comply these rules, or alternatively, make a case for exceptions. Not all subjects are suitable for inclusion in a regulation. The province can use several instruments if there is a provincial interest, and impose changes on zoning plans to municipalities.[111]

Metropolitan Region Rotterdam-The Hague
This is the result of a joint initiative by 23 local authorities. The local authorities work together to improve accessibility and strengthen the economic business climate; as such, it has been formed to counterbalance the role of the province in regional decision making in those issues, and give more power to the large cities of Rotterdam and The Hague. Municipalities part of this metropolitan region are: Albrandswaard, Barendrecht, Bernisse, Brielle, Capelle aan den IJssel, Delft, The Hague, Hellevoetsluis, Krimpen aan den IJssel, Lansingerland, Leidschendam-Voorburg, Maassluis, Midden-Delfland, Pijnacker-Nootdorp, Ridderkerk, Rotterdam, Rijswijk, Schiedam, Spijkenisse, Vlaardingen, Wassenaar, Westland, Westvoorne and Zoetermeer.



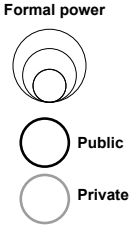
Actor map

This scheme show the constallation of main actors opperating in Rotterdam and their interests in terms of urban manufacturing.



Power / interest map

An synthesis of how actors have been positioned in terms of power and interest related to the theme of urban manufacturing.



The Metropoolregio Rotterdam
The Hague has an approved policy framework for European cooperation, and is working on a Roadmap for the implementation of the set-up goals. Metropoolregio Rotterdam The Hague has internal working group for preparing policy documents and screening opportunities, and a regional knowledge exchange platform with the 23 municipalities. Its main document so far is the Roadmap to the Next Economy, which presents a vision for a transition of the region to the so-called Third Industrial Revolution.

Rotterdam Partners[112]
Rotterdam Partners is an entity that emerged from a merger of Rotterdam organizations linked with city marketing, investing, and urban economic development. Its main activities are the programs on: Networks, Marketing & Communication; International Trade & Investment, offering information and services for international entrepreneurs and employees (expats) on choice of location, fact finding missions, introductions to relevant networks and assistance in areas such as taxes, healthcare, permits and laws and regulations; Convention Bureau & Tourism and hospitality. It is a network organization of which several initiatives stem, being the most relevant:
The International Advisory Board (IAB) is formed of international leaders from science, industry and the public sector.
Rotterdam Economic Partners (formerly the Rotterdam Economic Council), which contribute to economic policy, in alignment with the Board of Mayor and Aldermen and the management of the municipality.
R'damse Nieuwe is a network of young professionals has been set up to stimulate the active involvement of young people in the development of the Rotterdam economy.

Gemeente Westland / HOT Coalition
In close collaboration with the Province of Zuid Holland, the municipality of Westland is developing visions and strategies to improve the liveability of the glasshouse area while maintaining its large, productive horticultural cluster. Here an important actor is the HOT Coalition. This organization includes The Federation of Fruit and Vegetable Organizations (FVO), Royal Flora Holland, the Provinces of Noord and Zuid Holland, the Gemeente Westland, the Ministry of Economic Affairs, and Rabobank. This coalition emphasizes: a revolving fund for energy transition, adjustments to space-for-space regulation, design (and adjustments) of possible transport subsidies, a cluster-friendly way of economic expropriation, improvement of enforcement policy for the purposes of restructuring glasshouses, forms of equalization, development rights and possibly tax measures, a new way of dealing with planning rights, and raising capital from EU Green Funds or other unlikely sources of financing.[113]

APPENDIX 2: MAPPING DATA

Separate Industry Maps
Each dot represents an individual business registered with the NACE code related to the described industry
Source: ORBIS database [web]

Manufacturing Maps Urban Regions
The maps give an overview over industrial land use in each urban region.
Source: Land use data BBG2012; accessed via "Data Archiving and Networked Services – DANS" in April 2018. [web]

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Foundries of the future

5

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Photo, previous page: Quooker workshop, in Ridderkerk, a company manufacturing boiling water taps.

Despite the differences in size, history and economy, there are commonalities to be drawn from the landscape of urban manufacturing in Brussels, London and Rotterdam. These insights help to better understand the influences affecting the sector, and identify paths for future investigation. Insights are set within the European context and therefore present relevance for the wider European context. This chapter highlights key points of information from the report, and describes three areas which particular warrant more detailed investigation.

MAKING IT LOCAL: THE IMPORTANCE OF PLACE

The challenge of defining urban manufacturing

Complexities arise from the term 'urban manufacturing'. Across all cities the term meant different things to different people; some considered arts and crafts to fit, others thought that repair should be included. In many cases 'industry' and 'manufacturing' were interchangeable. In non-English speaking contexts, the language became even more challenging: in French the term 'manufacture' is associated with artisanal work. The Dutch term 'maakindustrie' (directly translated as the 'making industry') is a term that has apparently surfaced over the last decade. The notion of 'maker' and 'making' also questions the scale of manufacturing, which is also culturally sensitive. Likewise 'industry', in Belgium and The Netherlands, can include power plants and logistics.

Resource management, has a very urban and public pressence in Brussels
© Diogo Pirez

The term 'productive city' ('productieve stad' in Dutch or 'la ville productive' in French) is an even broader term that could include urban agriculture. In many cases, industrial land is also occupied by waste management, recycling and construction activities. One may argue that within the Circular Economy framework, waste management activities which transform waste into energy or resources should be part of the manufacturing activity, or at least their linkages acknowledged.

Part of the challenge in defining the value of urban manufacturing is in finding reliable statistics that can represent its role in the the larger economy. While industrial and economic classifications, such as NACE, do ring fence the sector for data collection, these do not capture the nuances within the urban manufacturing space. For example many repair activities fall outside the classification, the construction sector could involve manufacturing, some food and beverage can be merely logistics while informal or freelance labour is unaccounted for. It is these subtleties which are of interest to this research.

Confusions were anticipated and the scope of the research was guided by defining principles, explained in the first chapter, rather than by a strict definition. This approach proved helpful. Attempting to construct a definition which strictly delineates activities between manufacturing and non-manufacturing,

urban and non-urban, does not appear to be either possible or accurate. It is however important to point out the issues which may arise from this intangibility. Without a clear definition, some policy makers and other stakeholders use words such as 'manufacturing', 'industry' and 'productive' interchangeably and as catch-all terms. This risks a lack of clarity about what exactly is being discussed and makes differentiating between similar sectors challenging. In turn, this may lead to the subject being neglected in relation to other, more tangible issues, such as provision of housing.

City as a brand - Savonneries Bruxelloises produce high end soaps. © Adrian Hill

Rising interest in local production

Often equated with 'well-made' and intrinsically connected with the nature of the urban sphere (for and from the city), a rising interest in buying local products is an opportunity for businesses in the three cities. Here, the 'place' of production is equally important as a marketing tool as it is for other practical considerations. The prestige associated that comes with a London-made Brompton bike is an example of this, where the brand share the spirit of a city and becomes part of the city function beyond the product (e.g. new mobility model for healthier, more sustainable cities). This 'local' label is important in the food and drink sector too; in Rotterdam the Fenix Food Factory is a collection of local eateries built around a micro-brewery.

There are practical reasons for wanting local production too. In Brussels another folding bike manufacturer, Ahooga, has founded their business on the promise of quality service, of 'dissolving obstacles to happy cities'. Being close to their customers allows them to build that relationship. However, it should be recognised that public facing manufacturing, such as Brompton and Ahooga, can distract attention from other areas of the sector with less glossy veneers such as sandwich makers, metal works, electronics producers and chemical refineries that keep cities running.

Technology at our finger-tips. The Maker's Faire in Rotterdam © Victor Sanz

Initiatives have emerged in all three cities which provide access to advanced technology (e.g. 3D printing, Laser cutters, etc), usually in the format of a makerspace or open access workshop. London's Machines Room, Buurman in Rotterdam and the Microfactory in Brussels allow both amateurs and businesses to access support and new technology.

Networks of manufacturers have also appeared. In London, the East End Trades Guild acts as a collective voice for small firms including manufacturers, and the Open Workshop Network connects some forty makerspaces across the city. These developments show the importance of social connections and collective action for supporting businesses and may offer an insight into more socially oriented urban manufacturing.

Finally there is the link between research, design, testing, prototyping and education that are focused around urban areas

Increasingly, while universities and technical colleges provide training, there is a lack of flexible space and technology to bring these elements together to form an innovation driven manufacturing cluster. With exception to the RDM facility, rarely are spaces available that are conducive to entrepreneurship and support the shift from product development to communication and production.

Skills, jobs and knowledge

In all three cities, irrespective of the size of their existing manufacturing sector, there exists a pool of available talent based on existing functioning businesses. In Brussels, the skill-sets are diverse but the size of the available workforce is relatively small. In London, the workforce is greater and the sector encompasses a wide range of activities. However, accessing the right skills is a critical challenge faced by businesses, particularly when technology is changing rapidly and demands for staff now may be very different than in five years time. One manufacturer in Brussels noted that the lack of available staff has led them to introduce greater automation - a narrative is most often heard the other way around. Despite large labour markets, the right skills and training programmes are hard to come by. This has also led to 'training on the job' type of initiatives, where manufacturers set their own programmes to train their staff.

Rapid changes in technology are also changing the expectations of the competencies for staff. RVB.
© Adrian Hill

Manufacturing is often seen as being a provider of a large number of low-skilled jobs. It is easy, therefore, to assume that simple and repetitive manufacturing jobs could be the panacea for low-skilled unemployment. However, some trends indicate that lower skilled jobs in manufacturing are reducing while there is an increasing demand for highly educated knowledge based workers. In Rotterdam since the 2008 financial crisis this has been the case while in Brussels the sector has more than halved since 2000 from 6% to 2.7% of the workforce in 2014. Regardless, lower skilled jobs are still in demand, if affordable, and entrepreneurial actors such as the Brussels-based Travie provide an interesting example, using its social enterprise model to provide advantageous rates for high-labour repetitive tasks while providing reliable employment for some 450 people that may otherwise be jobless.

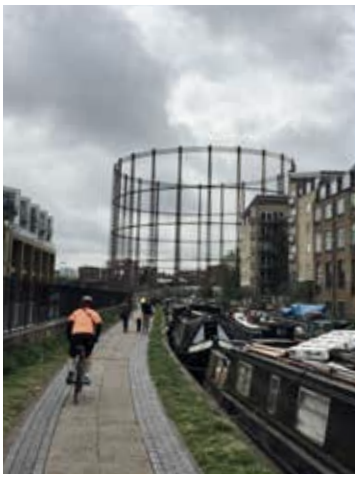
The relationship between manufacturing and low-skilled work is a complex one and varies across sectors, cities and businesses. A few low skilled workers can support high-tech machinary. Contemporary urban manufacturing should be careful not to repeat the industrial scale servitude of the late 19th century and find ways to support quality and security of the work available. Furthermore, the future of work remains very much in question as Artificial Intelligence and more complex technology replace jobs.

Finally, education, skills training and research is a detail easily overlooked. Disconnecting knowledge, skills and produc-

tion means losing the valuable feedback loop between learning and doing. Cities that depend on technical skills - either for foundational jobs (such as building or food production) or for innovation (such as aerospace engineering and bio-tech) need a certain level of manufacturing work to retain demand for the training and research.

Embedded in the 21st century city

European cities have changed radically over the last century, with the shift from manufacturing based economies to services. Cities are now undergoing yet a new wave of change driven by shifts towards quality of life, greater levels of citizen action, the pick-up of the access economy (hiring rather than owning things), larger commitments to climate adaptation, stricter pollution regulation (such as low emissions zones) and more sustainable forms of transport.

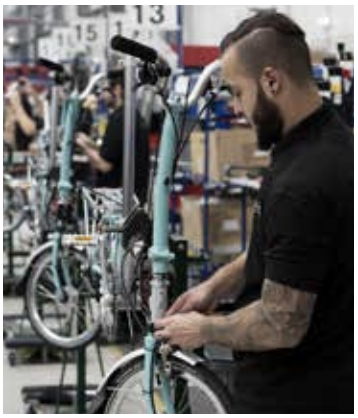


The busy canalside area in London
© Adrian Hill

It is worth observing how industry traditionally developed in all three cities along waterways for various reasons, may it be access to transport, water, energy or simply due to cheap land. Industry in Brussels was largely concentrated along the Senne Valley and the canal. In London industry follows various tributaries to the Thames - notably the Lea Valley. In Rotterdam, industry followed the Maas River. In all cities, 'nature' is also becoming a competitor to adapt cities for new climate related challenges. More severe rainfall and sea-rise is putting these zones under threat. Industry often sites on land that cities can relatively easily 're-claim' without displacing residential populations. Manufacturers operating on larger sites will need to learn how to adapt or accommodate these pressing environmental issues.

Secondly, cities are beginning to focus much more on the human scale. With greater social action driven through social media, communities are demanding better quality public space, more parks and community spaces. Some highly mixed neighbourhoods have very little or very poor quality public space and industrial spaces are thus the target for 'urban renewal'. While this certainly can improve the quality of life for residents and users, a gentrification knock-on effect could destabilise manufacturing networks.

Furthermore, urban industrial zones are becoming attractive places to visit, offering exciting places for local tourism. For example, small breweries are building a public facade such as a bar that forms part of their brand and charm. Other manufacturing spaces are attractive for public events, such as the Abattoir in Brussels. Joggers and cyclists also find industrial zones part of their fitness routine, London's canals are a case in point. Manufacturers need to find a way to embrace this shared space and build a public facade that may not only improve their revenue streams but also offer increased value for the larger community.



Bompton bike factory London
© Brompton Bicycle Ltd.

FOCUS FOR FURTHER INVESTIGATION

The research focuses on three critical levers for urban manufacturing : governance and actor networks; spatial conditions; technology and resources. This analytical research into the social, economic, political and physical landscape of the three cities has helped to narrow the focus of issues and opportunities for urban manufacturing.

Building governance and network models which recognise and support urban manufacturing

In both Brussels and London manufacturing forms a very small part of the economy, much smaller in scale than that which once existed in the cities. It is not surprising, then, that manufacturing does not play a significant role in economic development policies in either city. Rotterdam is the exception and still retains a large manufacturing base.

This is sometimes due to a lack of clarity about accountability or responsibility for the sector. In Brussels, for example, there is a general will at the operational level within regional agencies to protect existing manufacturers however the work falls outside of the scope of any one agency and therefore businesses can find themselves lost in bureaucracy without a solution to their problems. Manufacturing firms are focused on their business activities and may never be engaged in policy discussions. This can leave them vulnerable to losing other essential services around them. RVB, the Brussels luxury tap producer, once depended on local skills for molds and parts, without that local capacity they are now sourced from Portugal and Germany and dependent on low shipping costs.

While interest in manufacturing has been clearly expressed, policy focus and commitments do not appear to follow. This is despite manufacturing's potential to play a role in supporting other policy ambitions in each of the cities: capitalising on the 'Next Economy' in Rotterdam and moving towards the circular economy in Brussels and London. The links between manufacturing and these visions are little recognised.

Manufacturers are part of wider value chains both within the city and extending beyond. These networks act across public authority areas and cooperation is sometimes required to set policies which support rather than disrupt them. Brussels is an interesting case as public agencies acting within the small 160km2 region are not well integrated with the Flemish and Walloon regions beyond the boundary. In the Netherlands, the national spatial and environmental planning are shifting, replacing the traditional zoning plan with a new environmental plan. Dutch public authorities on the regional and municipal level develop visions, but there is incongruence in their implementation and priorities, particularly regarding the alignment between regional and municipal levels.

If urban manufacturing is to flourish then cities require

networks and governance models which acknowledge and support it. How are manufacturers are connected? How do they depend on supporting services - from training to suppliers, logistics, childcare and recycling services? How are businesses affected by planning policy and taxation? How do they use their space? What is their impact on the neighbourhood beyond? Finally, which actors should or are able to take responsibility for putting this governance into place, connecting business and public interests?

Harnessing technology and resources for resilient cities and competitive urban manufacturing

Each of the three cities recognise the need to become more environmentally sustainable. All of them have ambitions to change the way resources are managed within the jurisdiction, and see circular economy principles as a route to achieving this. Brussels was an early adopter of this framework through the installation of a regional circular economy plan (known as the PREC). Also London recently launched its Circular Economy Route Map with commitments to promote circular economy and new business models. Rotterdam has a strong programme for exploring ways of embedding it within practice.

RDM Innovation dock Rotterdam
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Manufacturing has a significant role to play in the circular economy and contribute to closing the material and energy cycles in cities. Its skills and processes can contribute to developing new ways of producing goods and managing resource and transform waste streams into productive resources. While perhaps not the most charismatic dimension of manufacturing, the repair and repurposing of materials and technology is an essential part in this shift, and can improve resilience. London employs some 12,000 people in this sector. Meanwhile in Brussels, the small neighbourhood of Heyvaert lives off a largely informal second-hand car industry that involves a large number of low-skilled repair based jobs - jobs that could be shifted to other types of repairs if a market existed.

Emerging technologies including additive manufacturing and artificial intelligence could disrupt manufacturing in the coming years. In fact, distributed manufacturing has already significantly changed the landscape of manufacturing in cities with the emergence and consolidation of the ‘makers’ movement. Exactly how the three cities will be affected remains to be seen and no doubt the results will be very different in every city. Some large volume, repetitive production could see significant amounts of automation, which may introduce relevant changes to the skills required but also a potential demand for manufacturing of automated technologies and equipment.

The impact of automation could be much less relevant in industries focusing on bespoke products, like jewellery production, which are likely to embrace technology in other ways (e.g. customisation). New digital technologies are likely to promote

Bompton bike factory London
© Brompton Bicycle Ltd.

local production of small scale, highly customised products. Further exploration of the role and impacts of technology within cities including manufacturing, is required, including discussions about ways to provide support for businesses to adopt advanced technologies. This is especially relevant as in all three cities, the majority of manufacturing firms are Small and Medium Enterprises (SME). SMEs are less likely to have the resources to invest significantly in new technologies which may constitute a key obstacle for the grow of sustainable forms of manufacturing at the urban scale. If the sector is to flourish in the future it will be important to consider how smaller manufacturers have access to new technology. Sharing technology and production space, which is more common in makerspaces, may offer new opportunities. Public partnerships with banks to underwrite loans is another possibility.

Research and development is one particular niche for European manufacturers. At one end of the scale,makerspaces are a low-barrier environment for exploring these new opportunities. However, in all three cities makerspaces remain focused on hobbyists, amateur professionals and education facilities while struggling to define their long-term place in the city and stable financing. RDM in Rotterdam is one exception where an education facility (Hogeschool Rotterdam) shares machines and technical knowledge in a 23,000 m2 space, with about half of the space dedicated to manufacturing oriented startups and SMEs. At the other end of the spectrum is the university and research community that could support manufacturers in both the domains of technology and sustainability. In the Netherlands there is a strong focus on ‘linked-up innovation’ which connects researchers, knowledge institutes (like TNO and Deltares) and businesses. And in the UK UCL’s CircEL initiative brings different disciplines and actors together to investigate circular economy opportunities. Formal links between academic research and commercialisation are less evident in Brussels which may highlight a missed opportunity to better connect theory, innovation and practice.

3D Printing at RDM Innovation Rotterdam
© Victor Munoz Sanz

If the cities are to improve their sustainability then it is important to explore ways of harnessing available resources and new technology. Firstly, what new forms of manufacturing could be introduced into urban areas to take better advantage of existing resources within the framework of the circular economy? Secondly, what types of infrastructures and technologies could promote the transition to the circular economy in cities including technologies for companies such as 3D printing and repairing, recycling/ recovering technologies? Finally, what kind of policies would help to shape framework conditions to encourage circular urban manufacturing and encourage better connection between different actors (such as research, manufacturing, technology providers)?

Creating and retaining suitable space for urban manufacturing

Like all urban areas, the three cities face the challenge of adapting to socio-economic demands for space. All three cities are seeing a period of increased demand for housing. Today London population growth is having direct impact on former industrial land. In Rotterdam land abandoned by the port signal a new future for large swathes of river-side land and an opportunity to attract new highly educated residents. Manufacturers concerns for long-term rent are rarely being heard while housing is high up on the political agenda.

Suitable long-term access to space is essential. Exactly what 'suitable' means varies between businesses and over time, but cost, location and security of tenure are key. In both London and Brussels the availability of industrial space is currently not meeting businesses needs. Brussels' regional developer, Citydev has an extensive waiting list from businesses for their smaller industrial sites (200-1000 m2). This looks likely to be stymying potential growth and development as small businesses struggle to find the space to grow. By contrast in Rotterdam, large areas of industrial land are accessible since port based functions are moving out.

Conflict with gentrification - Hackney Wick in London.
© Teresa Domenech

Private and public development, particularly for housing, threatens space for industry. This is felt most in Brussels and London. Brussels saw a reduction of 100 hectares of industrial land between 1997-2011 while London saw 1300 hectares transferred between 2001 and 2015 - more than double the benchmark set out in policy. Until now, new changes to Rotterdam's (the Dutch) rather rigid planning system may result in developers becoming more aggressive in their approach. There are interesting examples of policy which offer support for industrial space. In London the Significant Industrial Location designation (SIL) provides additional protection for the largest reservoirs of industrial land and in Rotterdam a regulation stating that up to 30% of domestic space can be used for work could provide opportunity for micro enterprises in mixed use buildings. These figures though have been insufficient to secure industrial space in the past in the context of pressures from the residential and commercial sectors.

Manufacturing activities have always been part of the life of these cities. As a result, interesting urban networks have developed which mix industry with other aspects of city life. This is evident in the spread of manufacturing businesses across the cities - even though strong clusters also exist. It is important that newer developments and architectural projects also manage this balance. In all three cities there is interest in the creation of mixed function spatial arrangements in order to fulfil housing and employment requirements. However, developing these functional mixes in practice is not simple. In London a challenge lies in evidencing the financial viability of schemes, given that housing commands higher returns than industrial

space in the short term. In Rotterdam, environmental regulations restrict the flexibility of such developments in established neighbourhoods with exceptions such as the future M4H neighbourhood. Mixed-use zoning associated with the ZEMU zones in Brussels is becoming problematic as developers and public agencies involved lack technical and financial experience in development and long-term management of such schemes. Developers too are finding that new business models are required in mixed use blocks, as they seek to fill industrial space. If this space comes at unaffordable rates then the risk is that they remain empty or are filled solely by retail, meaning that manufacturing businesses do not benefit.

Spatial development needs also to consider changes to manufacturing activities - the requirements of manufacturers today may not meet those of tomorrow. There is evidence that manufacturing firms present in the cities are smaller than those of the past, and that this is an ongoing trend. As technology changes manufacturing and the capacity for smaller scale and redistributed manufacturing becomes greater, this is a trend which is likely to continue.

Urban design can deal with a lot of the inconveniences of manufacturing - from noise and dust to the quality of public space and sustainable transport. What urban typologies can accommodate 21st century manufacturing? How can manufacturing be accommodated with other functions, while keeping environmental quality and liveability of the areas? What planning and/or design instruments can provide space for manufacturing in a more structural way?

HARNESSING URBAN MANUFACTURING: THE NEXT PHASE

This report marks the end of the analysis phase of the Cities of Making programme. It has mapped the landscape of manufacturing in three European cities and identifies pain points for the sector as well as potential opportunities for development and growth. The next phase of the programme will focus on these pathways for renewal through three dimensions: governance, spatial planning, and technologies and resources. Partners in each of the cities will explore ways in which the levers of policy, practice and narratives - the stories which frame manufacturing in public perception - can be harnessed in order to better understand and support making.

There are two potential futures for urban manufacturing: one in which ‘business as usual’ continues and manufacturers and making in the city slowly declines, pushed out by a lack of space and support. And another where cities - policy makers, citizens, businesses - proactively seek to understand the changing nature of urban manufacturing and its added value as a fundamental piece in the city ecosystem. In creating this vision they carve out a space for modern manufacturing and its role in meeting the needs of the 21st century city.

View over Brussels' canal zone, one of the most dynamic mixed use areas in the city.
© Diogo Pires

About

BRUSSELS

Latitude

Latitude is a strongly engaged in context-based research and design platform, gathering scholars and professionals from different domains. We aim to understand space in its multiple dimensions focusing on well-established urban conditions and territories, as well as liminal physical and social contexts, experimenting with a wide range of tools for investigation and dissemination at the intersection between urban design and anthropology.

Team: Adrian Vickery Hill, Federico Gobatto, Alessandra Macron, Marco Ranzato

ULB - LoUISe

The research of LoUIsE - Laboratory on Urbanism, Infrastructures and Ecologies - is oriented towards the knowledge, understanding and comparison of the dynamics of transformation of metropolitan areas starting from the region of Brussels-Capital. The knowledge and understanding of dynamics are mainly based on observation, critical analysis and the fabrication of urban projects. Research is organised according to the three axes - urbanism, infrastructure and ecology.

Team: Geoffrey Grulois, Fabio Vanin

VUB - Cosmopolis

The Cosmopolis Centre for Urban Research, based in the Department of Geography of the Vrije Universiteit Brussel, is dedicated to research and teaching in geography, spatial planning and urban design. Committed to pursuing both academic and practice relevant research, Cosmopolis actively engages policy makers, governments, citizen networks and other urban partners to transform knowledge into action.

Team: Fabio Vanin and Alexandre Orban

BECI

The Chamber of Commerce & Business Union of Brussels (BECI) connects the interests of some 35,000 individuals and businesses while providing support in managing 21st century business challenges. We support our members through interpretation of legislation, legal issues, support with funding and

financing, to best practice and transitions to innovation. We also reach out to public authorities to ensure that their voice is being heard and reflected in public policy.

Team: Lise Nakhlé and Laura Rebreanu

LONDON

The RSA

The RSA (Royal Society for the encouragement of Arts, Manufactures and Commerce) believes that everyone should have the freedom and power to turn their ideas into reality – we call this the Power to Create. Through our ideas, research and 29,000-strong Fellowship, we seek to realise a society where creative power is distributed, where concentrations of power are confronted, and where creative values are nurtured. The RSA Action and Research Centre combines practical experimentation with rigorous research to achieve these goals.

Team: Josie Warden, Ben Dellot, Fabian Wallace-Stephens

UCL CircEL

The UCL's Circular Economy Lab is an exciting cross-faculty, cross-discipline initiative, aiming to use UCL's expertise to improve the design of buildings and products, their re-use and recycling, and the return of their constituent materials back to the economy. Since founding the Lab in 2015, Circular Economy has become a far more mainstream topic and interest has continued to grow in and around our activities. See below for more information. We are aiming to develop the scientific and socio-economic understanding and technological basis for design and implementation of systems, processes and policy that will support the transition to a Circular Economy. With access to the full width and depth of UCL expertise, CircEL will be capable of tackling Circular Economy related problems of any size or stage of development. It is essential that CircEL research and technology development is driven by the needs of the industrial/business community. We envision support of, and guidance by, an industrial ecosystem composed of one or two compatible large companies and several well-matched small/medium-sized enterprises (SMEs), each with its own symbiotic ecological niche.

Team: Dr Teresa Domenech and Dr Ben Croxford.

ROTTERDAM

TU Delft

The Chair of Urban Design - Urban Compositions - is concerned with the design of the physical form of urban areas and the complex relationships between urban form and social processes. We have an expertise in spatial analysis, with a focus on evaluating the built form including architecture and open space, public as well as private space and its different uses. We are developing innovative concepts and approaches for urban analysis and design, acknowledging contextual changes that call for a rethinking of theory and method in urban design. The object of urban design – the city – is changing rapidly: in the Netherlands and across the globe, complex urban regions are emerging. A whole range of systemic changes in relation to, for example, transport, water management, energy production and consumption but also the social composition of cities and urban regions means that the assumptions about the relations between urban form and social activity are becoming outdated. We understand cities as 'complex adaptive systems' that comprise a multitude of dynamic interconnections and flows that adjust to each other irrespective of plans or designs.

Team: Prof. dr. ir. Han Meyer, DI. Birgit Hausleitner, Dr. Víctor Muñoz Sanz, Ir. Anouk Klapwijk (research assistant)

Urban manufacturing, interpreted simply as the production in cities of tradable goods at scale, is a poorly understood aspect of urban life that is often taken for granted or overlooked in urban planning. Following years of decline and offshoring, European cities may now be at a turning point. Firstly, manufacturing jobs have shifted quickly to services and have created large gaps in the employment market. Secondly, concepts such as circular economy are being taken seriously by cities. Finally new technology is emerging allowing industry to be quieter and more discrete. Should 21st century cities continue to manufacture? If so, then what should be made, where?

Cities of Making is a two and half year European research project, looks into manufacturing through the lense of three European cities: Brussels, London and Rotterdam. Each city has had a significant manufacturing past and a very different future lies ahead. Regardless of differences, each city is at a crossroads where manufacturing could form a stronger place in the urban economy or simply fade away, replaced by more contemporary demands for urban space and jobs.

This first analysis stage has found that manufacturing has both a fond and important place in urban areas, yet remains poorly defined and understood within the urban economy. Over the last decade grass-roots maker initiatives have been emerging that have revived an interest in the locally made, associated with quality and value. At the other end of the spectrum, never has there been a time where technology has been so accessible. Likewise, within a globalised market with almost negligible freight costs, never has there been a time where public authorities must be more strategic in attracting and supporting the industries that serve their local economies while investing in the necessary infrastructure to support it. This may have a positive turn for cities - with urban manufacturing helping to customise goods and technology to suit their markets and needs while managing waste and resources. Now is the time to decide whether to continue a decades long trend of expelling manufacturing from cities or embrace it within the local economy.

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of making